Management application and effectiveness evaluation of digital Inclusive Finance in rural economic development

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Abstract: This paper focuses on the management dilemma and optimization path of digital Inclusive Finance in the rural scene, and finds that the current management application faces three core challenges: the structural weakness of digital infrastructure, the lagging contradiction of risk prevention and control, and the institutional obstacles of policy coordination, which are specifically manifested in the problems of insufficient rural network coverage, credit risk agglomeration, and regulatory vacuum. In order to solve the dilemma, we need to build a three-dimensional solution through such measures as the sinking of 5g+Beidou technology, the interconnection of agricultural big data and credit reporting system, and the formulation of the list of central and local regulatory responsibilities. The study emphasized the need to narrow the digital divide with technology empowerment, balance risk prevention and control and inclusive targets with institutional innovation, and break down sectoral barriers with policy coordination, so as to finally form a governance framework of "technology system ecology" Trinity, and promote the high-quality service of digital Inclusive Finance to rural revitalization.

Introduction

Digital Inclusive Finance is the key engine of rural revitalization, and management efficiency is directly related to the precise allocation of financial resources to rural areas. The current management practice has exposed structural contradictions, such as the coverage gap of digital infrastructure in remote rural areas, the lack of digital skills of the elderly, the credit risk caused by the weakness of agriculture, and the lag in the adaptation between the traditional regulatory framework and digital financial innovation, which restrict the depth and sustainability of services. At the same time, the regulatory vacuum and the deviation between local legislation and national strategy caused by the cross function of departments further aggravate the fragmentation of governance. Based on the perspective of management, this paper systematically analyzes the practical difficulties in the three dimensions of digital infrastructure, risk prevention and control, and policy coordination, and puts forward targeted optimization paths, providing theoretical reference and practical solutions for the construction of digital financial governance system suitable for rural scenes.

1 Core characteristics of digital Inclusive Finance in rural economic development

1.1 The dual characteristics of wide coverage and strong permeability

Digital Inclusive Finance has built a rural service network of "wide coverage+deep penetration" through technological empowerment and model innovation[1]. In the absence of physical outlets, digital channels are effectively replaced by mobile terminals and Internet infrastructure. Financial institutions integrate payment, credit, insurance and other basic functions by developing lightweight applications and cloud service platforms, so that farmers can obtain full process financial services without relying on physical outlets. In line with the grid layout of agricultural withdrawal service points and intelligent terminals, the service radius extends from towns to administrative villages. For the long tail customer touch, we will innovate and build a three-level service system of "County Center Village Service Station peasant households". By setting up rural digital financial counselors, configuring mobile service vehicles and other ways, we will refine the service tentacle from "the last kilometer" to "the last hundred meters", and develop an aging friendly interactive interface and dialect voice

system to eliminate barriers to the use of vulnerable groups. The multi-level penetration mechanism has significantly improved the availability of financial services, significantly shortened the response cycle of farmers' financing needs in remote areas, shifted the frequency of services from annual periodic contact to quarterly normalized interaction, and formed a closed loop of "immediate demand response - precise product push - dynamic risk monitoring", fundamentally reshaping the allocation efficiency and fairness of rural financial resources.

1.2 Deep integration of service mode innovation and scenario application

The deep integration of service mode innovation and scenario based applications is promoting the embedding of digital inclusive finance into the whole chain of rural industries[2]. In the production process, the real-time monitoring of farmland environment and intelligent irrigation are realized through the Internet of things equipment, and the quality traceability system of agricultural products is constructed by combining the blockchain technology; In the field of circulation, build an e-commerce platform and a warehouse logistics data center, and open up the direct sales link of origin; In the consumption scenario, digital wallet and supply chain financial instruments are used to connect farmers with the end market. The intelligent risk control system is localized according to the cyclical characteristics of agriculture, introduces satellite remote sensing data to evaluate crop growth, integrates meteorological indexes and e-commerce transaction records to build a dynamic credit model, and breaks through the traditional mortgage dependence. For example, the "digital agriculture cloud platform" in a province has established a mapping mechanism of "production data - Credit Score - credit line" by integrating data such as land ownership confirmation and agricultural materials procurement, realizing the whole process of financial embedding from planting and breeding planning to sales collection, shortening the credit approval cycle, significantly improving the financing availability of farmers, and forming a virtuous cycle of "industry digitization - Financial precision - service inclusiveness".

1.3 Precision service and risk control driven by technology

Technology driven is reshaping the service paradigm and risk control logic of rural digital Inclusive Finance. At the precise service level, financial institutions have built a dynamic farmer credit portrait system by integrating satellite remote sensing data, agricultural machinery operation trajectory, e-commerce platform transaction records and other multiple information. Based on the federal learning technology, cross platform data fusion can be realized without disclosing the original data, so that the approval of credit line breaks through the dependence on traditional financial statements and turns to the quantitative evaluation of "soft information" such as production capacity and market performance records. The embedding of blockchain technology in rural property rights transactions enables the confirmation, registration and transfer traceability of land management rights, forest rights and other assets through distributed ledgers, and the automatic execution of transaction terms with smart contracts, significantly reducing the risk of property rights disputes and intermediary costs. From the perspective of risk control, the production data such as temperature and humidity, crop growth, etc. collected in real time by IOT devices are cross verified with futures market prices and regional meteorological early warning information, forming a full process risk early warning network covering pre loan review, in loan monitoring and post loan disposal. The localized decision engine based on edge computing technology can achieve millisecond response to abnormal trading behavior, promote the fundamental change of risk control mode from "post accountability" to "real-time blocking", and build an intelligent risk firewall for agricultural business entities in the digital era.

2 Realistic dilemma in current management application

2.1 Structural weakness of digital infrastructure construction

Digital inclusive finance faces the structural constraints of digital infrastructure in the rural scene. In view of the network coverage gap, the "LEO satellite networking+5g micro base station" collaborative scheme can be used to fill the signal blind spot in remote mountainous areas, and the mixed investment mode of "operator investment - government subsidies - villagers' co construction" can be explored to reduce the cost of station construction. At the level of equipment popularization, it is necessary to build a "basic terminal supply+aging adaptation" system, cooperate with manufacturers to develop a minimalist smart machine with dialect interaction function, and support the subsidy mechanism of "trade in+lease

by stages". In order to break the barriers of intergenerational use, a normalized training system of "village level counseling Station+scenario simulation course" should be established, and digital skills should be included in the assessment index of village cadres. In terms of operation and maintenance mechanism, the PPP mode of "government authorization - enterprise operation and maintenance - villagers' supervision" is introduced, the boundary of maintenance responsibility is clarified through the franchise agreement, and a service availability oriented performance payment mechanism is built to form a closed-loop governance framework of "construction, management and maintenance" integration.

2.2 Lagging contradiction of risk prevention and control system

The risk prevention and control of digital Inclusive Finance in the rural scene faces multiple lag contradictions, and it is urgent to build an intelligent prevention and control system suitable for the characteristics of the agricultural industry[3]. Aiming at the credit risk agglomeration caused by the weakness of agriculture, a dynamic credit evaluation model of "Internet of things+satellite remote sensing+futures market" can be established. Through the real-time collection of soil moisture, crop growth and other production data, combined with the regional meteorological index and the futures price of bulk agricultural products, a multi-dimensional risk early warning index can be constructed to break through the traditional mortgage dependence. In the field of data security, it is necessary to build a privacy protection framework of "blockchain encryption+federated learning" to prevent the risk of information abuse through distributed storage and hierarchical management of access rights while ensuring the availability of farmers' transaction data. In view of the transfer trend of new financial fraud to rural areas, we should build a three-dimensional prevention and control network of "Ai behavior monitoring+grid member sinking", use machine learning algorithm to identify abnormal transaction patterns, establish village level financial security propaganda and education points, improve the elderly's fraud awareness ability through scenario simulation exercises, and form a closed-loop prevention and control mechanism of "technical interception - manual intervention - awareness enhancement".

2.3 Institutional obstacles of policy coordination mechanism

The institutional obstacles of the policy coordination mechanism need to be broken through the three-dimensional path of "central local coordination - legal technology integration - tool innovation". In view of the regulatory vacuum derived from the cross function of departments, it is necessary to build a governance structure of "central coordination - territorial linkage". At the provincial level, a joint conference on digital financial regulation was set up to clarify the list of rights and responsibilities of agricultural and rural, financial regulation, Internet information office and other departments, establish a cross departmental information sharing platform, and use blockchain technology to realize real-time uplink and penetration monitoring of regulatory data, so as to solve the dilemma of "water control in Kowloon". At the adaptation level of central and local laws and regulations, it is necessary to establish a two-way transmission mechanism of "national strategy - local legislation", absorb the demands of farmers and financial institutions through grass-roots legislative contact points, translate the requirements of upper laws such as the Rural Revitalization promotion law into local implementation rules, and establish a dynamic evaluation and revision system of laws and regulations to avoid policy dislocation caused by "one size fits all" legislation. In view of the digital lag of the traditional regulatory framework, we should introduce the "regtech" toolbox, develop a risk early warning index system based on big data, bring new risk points such as algorithm transparency and cross-border data flow into the scope of off-site regulation, synchronously promote the transformation of regulatory rules into code, realize the automatic implementation of compliance requirements through smart contracts, and build a technology neutral regulatory environment.

3 Optimization path of improving management efficiency

3.1 Digital infrastructure upgrading and inclusive security

The upgrading of digital infrastructure needs to build a two wheel drive mechanism of "technology empowerment - inclusive sharing". At the layout level of 5g+Beidou system, the collaborative scheme of "satellite networking+base station supplement" should be adopted. Give priority to the deployment of Beidou high-precision positioning base stations in agricultural industrial parks and logistics distribution centers, and rely on 5g network to achieve millisecond level response

in scenarios such as automatic driving of agricultural machinery and traceability of agricultural products; For the construction of micro base stations in remote villages with the implementation of "one village, one policy", the cost of entering the home is reduced through the combination of government subsidies and enterprise profit sharing, and the localized data processing center based on edge computing is built synchronously to relieve the transmission pressure of the core network. The digital integration of silver haired groups needs to establish a three-dimensional training system of "cognitive Remodeling - skill iteration - social support". Develop a digital course package suitable for aging, covering the basic operation of intelligent devices, anti fraud scenario simulation, the use guide of government app and other contents; Relying on the village level activity center, the post of "digital counselor" is set up. Young volunteers provide one-to-one practical guidance, and the training effect is included in the evaluation index of grass-roots cadres. Infrastructure operation and maintenance can explore the PPP innovation mode of "government authorization - enterprise operation - villagers' participation", clarify the maintenance responsibility boundary of the social capital party through the franchise agreement, establish a performance payment mechanism with service availability as the core, and give the village collective the right to supervise the equipment status, forming a sustainable governance framework of "construction, management and maintenance" integration.

3.2 Three dimensional construction of risk prevention and control system

The three-dimensional construction of risk prevention and control system needs to form a closed-loop structure of "data empowerment regulatory innovation identity authentication". At the data level, we should open up the two-way channel between the agricultural big data center and the credit reporting system, cross verify the production information such as crop growth data and agricultural machinery operation trajectory collected by the Internet of things equipment with financial data such as farmers' credit records and transaction behavior, and use federal learning technology to build a dynamic credit evaluation model to solve the information island dilemma. Regulatory innovation can introduce the "regional characteristic sandbox" mechanism, pilot the establishment of access lists and negative lists in large agricultural counties, allow financial institutions to test new agricultural loan products within a limited range, and embed the blockchain certificate deposit module to achieve the traceability of the whole transaction process, forming a regulatory iteration cycle of "trial point feedback optimization". The digital identity authentication system needs to establish a national unified "biometric+digital certificate" two factor authentication standard, connect biological information such as face recognition and fingerprint authentication with the household registration database of the Ministry of public security, develop a lightweight identity verification SDK suitable for rural scenes, realize cross platform mutual recognition through distributed Identity Protocol, curb false identity fraud from the source, and build a credible digital identity infrastructure for digital Inclusive Finance.

3.3 Institutional innovation of policy coordination mechanism

The institutional innovation of policy coordination mechanism needs to build a three-dimensional governance framework of "central local linkage - precise policy implementation - ethical embedding"[4]. At the level of central and local coordination, we should establish a list of regulatory responsibilities of "central rules and local implementation", clarify the power and responsibility boundaries of the Ministry of agriculture and rural areas, the State Administration of financial supervision and the Internet information office through legislation, build a cross departmental information sharing platform based on blockchain technology, realize real-time online and penetration monitoring of regulatory data, and solve the dilemma of "multi dragon water control". Differentiated regulation needs to build an index system of "regional portrait+dynamic calibration", divide the main agricultural production areas, ecological protection areas, e-commerce agglomeration areas and other types based on the characteristics of county economy, set parameters such as differentiated capital adequacy and liquidity coverage, and establish a regional risk heat map by using machine learning algorithm to realize the quarterly iterative optimization of the index library. The ethical governance of financial technology can explore the extension mechanism of "provincial hub County fulcrum". The rural working group of the ethics committee is set up under the provincial financial supervision bureau to formulate the ethical standards of agricultural related financial technology, focusing on regulating the behaviors such as algorithm discrimination and data abuse. At the same time, financial institutions are required to submit an ethical evaluation report before promoting new products in the rural market,

establish a multi-party review mechanism composed of farmers' representatives, scholars and regulatory departments, and incorporate ethical compliance into the preconditions for financial institutions' market access.

4Conclusions

The management optimization of digital Inclusive Finance in the rural scene needs multi-dimensional collaborative promotion[5]. At the technical level, the digital divide is narrowed through 5g+Beidou networking and the popularization of aging equipment, and the information asymmetry is cracked through the interconnection of agricultural big data and credit reporting system; At the institutional level, a list of central and local regulatory responsibilities and differentiated regulatory indicators are established to balance innovation and risk with the regulatory sandbox; At the governance level, build an operation and maintenance mechanism of "government enterprise villagers" co governance, and extend the ethical supervision of financial technology to the county. In the future, we need to further promote the deep integration of technological empowerment and institutional innovation, explore the benign interaction mode between digital finance and rural industrial ecology under the premise of ensuring data security and farmers' rights and interests, and finally realize the leap from "coverage and popularization" to "effective empowerment" of Inclusive Finance.

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