



Blockchain Adoption by Farmers in Agricultural Product Supply Chains from the Perspective of Government Subsidies: A Literature Review and Research Outlook

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Abstract. In response to the practical dilemma faced by farmers in agricultural supply chains—where high adoption costs and spillover benefits from adoption hinder their willingness to adopt new technologies—the government subsidy has emerged as a crucial policy instrument for alleviating their adoption pressures. This paper, through a systematic literature review, aims to explore the central question: "How do government subsidies dynamically and precisely influence the adoption decisions of heterogeneous farmers?" Our analysis reveals that while existing studies, grounded in tools such as game theory, have confirmed the positive role of subsidies in coordinating supply chains, incentivizing adoption, and overcoming the free-rider problem, their theoretical exploration suffers from significant paradigmatic limitations. Most models rely on static, homogeneous, and simplified assumptions, neglecting the dynamic nature of technology diffusion, the heterogeneity among farmer actors, and the potential for long-term policy dependency induced by sustained subsidies. These limitations render current theories inadequate for guiding the design of complex and ever-changing real-world policies. To address these gaps, this paper proposes that future research should achieve a paradigmatic breakthrough: methodologically, by developing a dual-agent dynamic evolutionary model that incorporates both "time" and "path"; scenically, by focusing on specific agricultural product categories and introducing parameters that reflect agent heterogeneity; and policy-wise, by exploring dynamic instruments such as tiered subsidies based on quality and scientifically designed phase-out mechanisms. The arguments presented in this paper seek to provide a clear theoretical critique and innovative research foundation for constructing a blockchain adoption policy analysis framework that can adapt to dynamic environments, deliver precise incentives, and promote sustainable adoption.

Keywords: Blockchain Adoption, Government Subsidies, Evolutionary Game, Agricultural Product Supply Chain.

1 Introduction

Thanks to its decentralized, tamper-proof, and traceable features, blockchain technology offers a promising technical pathway for building a trustworthy agricultural

product traceability system. The academic community has already conducted extensive research—from technical frameworks to smart contracts—on its application in agricultural supply chains, confirming its technical feasibility. However, there remains a significant gap between technical feasibility and large-scale adoption. Take, for example, a geographically indicated agricultural product: its green certification coverage is less than 3%. This means that a large number of small- and medium-sized farmers remain outside the official traceability system, making it difficult to fully implement brand protection and quality supervision for this product. This paradox raises a fundamental question: Why is a technology that has been proven feasible so hard to promote and popularize at the actual production level—especially among smallholder farmers?

For smallholder farmers with limited financial resources and low risk tolerance, the primary barrier to adopting blockchain is not a lack of technical understanding but rather a practical economic trade-off. Deploying a blockchain system requires substantial upfront investments—including IoT devices, platform integration, and staff training—which often far exceed the annual net income of individual smallholder farmers, thereby creating an economic threshold for blockchain adoption among them. Even more critical is that the long-term benefits—such as brand premiums and enhanced consumer trust—that blockchain can bring are, by their very nature, delayed and uncertain.

There exists a structural contradiction in which costs are incurred immediately, yet the benefits are realized in the future and widely spill over to downstream distributors. This misalignment of costs and benefits—in terms of both timing and actors—severely undermines the intrinsic motivation for adoption on the production side, trapping it in a collective dilemma: "wanting to adopt blockchain but being unable to afford it."

Against this backdrop, government subsidies naturally emerge as the core policy tool for bridging this gap and overcoming the "cold-start" challenge. Existing research has also confirmed from various perspectives that well-designed subsidies can reduce adoption costs, align supply-chain interests, and guide market equilibrium. However, a more fundamental and critical theoretical question remains insufficiently addressed: In a complex real-world environment characterized by dynamically declining technology costs, evolving market perceptions, and significant heterogeneity within farmer groups, how should government subsidy policies be systematically designed to dynamically, precisely, and sustainably incentivize farmers to adopt blockchain technology? Most existing literature simplifies subsidies as static, homogeneous exogenous parameters, making it difficult for such studies to tackle the core challenges of dynamic adaptation and targeted intervention.

Therefore, this paper does not aim to provide an exhaustive review of the literature on "government subsidies and blockchain adoption." Rather, it seeks to play the role of a "paradigm critic" and an "agenda setter." Focusing on the core issues mentioned above, this paper conducts a systematic review and critical examination of existing research with the goal of achieving two objectives: First, to deeply reveal the three major limitations of current research—namely, its failure to adequately account for dynamics, heterogeneity, and side effects—and to highlight the disconnect between its theoretical contributions and actual policy needs. Second, building on this critique, to propose a clear future research framework that combines theoretical innovation with practical

policy implications, guiding subsequent studies to shift from "static equilibrium analysis" to "complex dynamic system simulation," from "homogeneity assumptions" to "heterogeneous agent modeling," and from "the debate over whether or not to provide subsidies" to "dynamic policy instrument design."

The structure of this paper is as follows: Chapter 2 systematically reviews the influencing factors behind farmers' adoption, the mechanism of government subsidies, and the application and contributions of evolutionary game theory, while precisely identifying the shortcomings of the current research paradigm. Building on this critique, Chapter 3 proposes future research directions that focus on "dynamic evolutionary thresholds" and "dynamic simulation of subsidy policies." Chapter 4 summarizes the entire paper and provides specific methodological, scenario-based, and policy-design recommendations for subsequent researchers.

2 Government Subsidies and Farmers' Adoption of Blockchain —Contributions and Gaps in Existing Research Introduction

2.1 Factors Influencing Farmers' Adoption of Blockchain

Although the application potential of blockchain technology in agricultural supply chains has been widely recognized, its actual adoption continues to be constrained by multiple factors. Scholars both domestically and internationally have conducted studies on the determinants of blockchain technology adoption in various contexts, based on the TOE (Technology-Organization-Environment) framework (Mbadlisa and Jokonya, 2024; Li Ying and Zhou Jianqin, 2025)^[1-2]. This paper, however, combines the specific context of agricultural supply chains and summarizes the factors influencing farmers' adoption of blockchain as follows.

From a technological perspective, the primary barrier is the high cost of technology. The main actors in agricultural production—small and medium-sized farmers and cooperatives—have limited financial resources and are highly sensitive to the costs of adopting blockchain technology, leading to the dilemma of "wanting to adopt but being unable to afford it." Furthermore, the supply of agricultural products...

The supply chain involves multiple links, including planting, procurement and storage, processing, logistics, and distribution. The information systems of various stakeholders differ significantly, and the compatibility issues between blockchain and existing systems are equally prominent.

From an organizational perspective, enterprise size and management support are key factors. Large agricultural enterprises or leading cooperatives, with their abundant resources, find it easier to implement blockchain technology, whereas small, scattered farmers often hesitate due to cost pressures and a lack of awareness. Meanwhile, the fragmented nature of agricultural supply chains and their low degree of organizational integration make cross-entity collaboration particularly challenging—yet the successful adoption of blockchain hinges precisely on multi-party consensus and a willingness to collaborate.

In terms of environmental factors, consumer trust and willingness to pay are the core driving forces. Unlike the B2B model, agricultural products are directly sold to end consumers, who place great emphasis on "authentic origin" and "food safety and quality," demonstrating a clear willingness to pay a premium. Moreover, government policies and regulations are equally important: policies such as subsidies and certification support can, to some extent, reduce farmers' wait-and-see attitude.

Overall, costs and incentives constitute the core factors driving the adoption of blockchain technology in agricultural products. Smallholder farmers are highly sensitive to costs; the initial investment required for blockchain implementation far exceeds their annual net income, creating a clear "scale-threshold effect." At the same time, the short-term benefits of blockchain are not readily apparent, and most of the brand premium is captured by downstream distributors, leaving limited benefits for producers themselves. This structural pattern—where costs are incurred immediately while benefits are realized only in the future and tend to spill over to others—severely undermines producers' motivation to adopt blockchain technology, thereby highlighting their need for external incentives such as government subsidies.

2.2 The Role of Government Subsidies in Blockchain Adoption—Contributions from Existing Research

Government subsidies are regarded as a key policy tool for promoting the adoption of blockchain technology. Existing research has confirmed the positive effects of subsidies in various contexts and identified the critical conditions under which these effects are realized.

The Positive Role of Subsidies: Coordination, Motivation, and Goal Orientation.

Studies show that government subsidies primarily promote blockchain adoption by reducing adoption costs and aligning the interests of multiple stakeholders. In competitive multi-channel supply chains, subsidies can reconcile the interests of suppliers, e-commerce platforms, and brick-and-mortar stores, enabling all members to achieve Pareto improvements and fostering supply-chain collaboration (Li et al., 2025) ^[3]. In single-agricultural-product supply chains, subsidies can effectively bridge the gap in adoption attitudes between farms and distribution companies arising from differences in cost-benefit expectations. Liu Suyu's (2023) study further elaborates that subsidy strategies must be aligned with internal coordination mechanisms within the supply chain: when there is no internal cost-sharing mechanism, subsidies should be precisely targeted at farms with conservative attitudes; whereas, in cases where cost-sharing exists, the government can flexibly select subsidy recipients and achieve its objectives at lower costs ^[4]. Particularly crucial is the study's revelation of the special characteristics of small farms: for small farms with limited production capacity, only if the government assumes all R&D costs can they be encouraged to adopt blockchain technology, highlighting the necessity of providing intensive or full subsidies to vulnerable actors. Moreover, subsidies can also influence the power structure of the supply chain. When the subsidy ratio is moderate and technology costs are relatively low, manufacturers or

retailers are more likely to take the lead in blockchain implementation, potentially achieving win-win outcomes for all parties involved (Pu et al., 2025) [5].

The Boundaries of Subsidy Effects: Multiple Constraints Imposed by Costs, Market Conditions, and Supply-Chain Structure.

However, the positive effects of subsidies do not hold unconditionally; their effectiveness is strictly constrained by technological costs, market conditions, and supply-chain structures. First, technological costs represent a hard constraint. Li et al. (2025) explicitly point out that subsidies can yield net positive effects only if the operating costs of blockchain fall below a certain threshold [3]. Pu et al. (2025) also find that subsidies need to interact with cost-sharing arrangements involving technology service providers: when the latter bear a lower proportion of costs, the marginal incentive effect of subsidies becomes more pronounced [5]. Second, market demand serves as an external driving force. The degree to which consumers recognize the value of blockchain-based traceability information—the market-added value potential brought about by the technology—is a key external factor determining whether subsidies can translate into adoption incentives (Liu Suyu, 2023) [4]. This finding echoes Li et al. (2025), who show that when consumers' initial trust in product information is low, the relative improvement brought about by adopting blockchain—coupled with subsidies—becomes even more evident [3]. Finally, the internal power dynamics and coordination structure within the supply chain—such as who takes the lead and who bears the costs—can generate complex interactions with subsidy policies, jointly shaping the ultimate equilibrium of adoption (Pu et al., 2025; Liu Suyu, 2023) [4-5].

In summary, existing research has made certain progress in uncovering the coordinating value, incentive effects, and complex boundary conditions of government subsidies, providing an important foundation for subsequent researchers seeking to understand subsidy policies. However, most of these insights are built upon a framework of comparative static analysis, typically treating key parameters such as subsidy intensity, technology costs, and consumer preferences as exogenously given and fixed. As a result, while current studies can answer whether subsidies are effective under specific conditions, they struggle to guide practical decision-making on how subsidy policies should be dynamically adjusted in response to technological diffusion, declining costs, and shifting market perceptions. Particularly noteworthy is that existing models often treat "farms" or "supply-chain members" as homogeneous, rational decision-makers, failing to fully capture the systematic differences between smallholder farmers and large agricultural enterprises in terms of financial constraints, risk tolerance, and learning capabilities. Consequently, the "one-size-fits-all" subsidy strategies proposed by these models face limitations when it comes to guiding targeted and precise policy interventions. These theoretical simplifications represent the primary gap between current research and practical needs, and they also point to promising directions for future research to bridge this gap.

2.3 Analyzing Government Subsidies and Blockchain Adoption in Agricultural Products Using Evolutionary Game Theory—Contribution of the Existing Research

Existing research has made significant contributions to constructing game-theoretic models for analyzing subsidy mechanisms, primarily by expanding the perspective from micro-level competition to multi-dimensional supply-chain collaboration.

First, in terms of market competition, the study by Li Zhiwen et al. (2025) is particularly representative. They constructed an evolutionary game model for a duopoly in the agricultural product market, revealing the dynamic evolutionary process of blockchain adoption decisions^[6]. The study found that firms' adoption behavior does not happen overnight; rather, it follows an evolutionary path—from "neither firm adopts" to "one firm swings first," and finally to "both firms adopt"—as the ratio between blockchain's added value and product's added value changes. An important contribution of this study lies in demonstrating that government subsidies are a key variable for breaking the "prisoner's dilemma." When the subsidy amount exceeds a certain threshold, it can guide the two-duopoly firms from a wait-and-see attitude toward collective adoption, thereby resolving the issue of "collective irrationality" that arises solely from market mechanisms. Second, at the supply chain operations level, the studies by Wan Jun (2024) and Sun Xiaoting (2024) further deepen our understanding of this phenomenon^[7-8]. They introduced a tripartite game-theoretic framework involving "government–enterprise–farmers/retailers," with a particular focus on analyzing "free-riding"—the core bottleneck hindering technology diffusion. The study shows that, due to the positive externalities inherent in blockchain technology, supply chain members tend to shirk the high costs of onboarding onto the blockchain while reaping the trust premium generated by others. Existing research confirms that governments can effectively correct this market failure by designing a subsidy-penalty mechanism. In particular, Wan Jun (2024) found through simulation that supply chain participants exhibit greater sensitivity to subsidy policies than to penalty measures, providing quantitative evidence for governments to formulate targeted fiscal incentive policies^[7].

2.4 Main Shortcomings of Existing Research

Although existing research has yielded abundant insights into the necessity of government subsidies and their static equilibrium effects, providing an initial theoretical foundation for policymaking, one issue that cannot be overlooked is this: in reality, the adoption of blockchain technology is a decision-making process embedded in a complex, dynamic system. When we shift our research perspective from "whether subsidies are effective under specific conditions" to "how to design a subsidy policy framework that can adapt to a dynamic environment, precisely incentivize heterogeneous actors, and simultaneously ensure long-term sustainability," the existing research paradigm—based on classical game theory—reveals three significant limitations:

First, there is a lack of consideration for dynamic, time-varying subsidy strategies. Existing literature (e.g., Li Zhiwen et al., 2025; Wan Jun, 2024) often treats government subsidies as static exogenous variables or one-time game parameters^[6-7]. However, in

reality, the adoption of blockchain technology is a long-term, dynamic process. Technology costs tend to decline over time (due to the Moore's Law effect), and market participants' strategies continuously adjust in response to environmental feedback. Current models often overlook the optimal path for dynamically adjusting subsidy intensity according to technological maturity and market penetration levels, and they lack an in-depth exploration of questions such as "when to phase out subsidies" or "how to implement phased adjustments to subsidies."

Second, the heterogeneity of subsidy policies is inadequately addressed in existing models. Current game-theoretic models generally assume that supply-chain actors—such as farms and enterprises—are homogeneous decision-makers and tacitly adopt a "one-size-fits-all" universal subsidy strategy by governments^[9-11]. However, different actors exhibit systematic differences in resource endowments, cost structures, and learning capabilities, which profoundly influence their responses to subsidies. For instance, smallholder farmers with high learning costs are at a disadvantage when making adoption decisions, and their profitability heavily depends on external conditions^[9]; meanwhile, downstream firms with strong bargaining power may capture subsidy benefits that were originally intended to incentivize the production side^[10]. Existing research has failed to adequately capture these actor-specific behavioral differences arising from heterogeneities in costs, benefits, and risks, and has also paid insufficient attention to targeted subsidy designs aimed at groups facing high costs, low returns, or high risks. As a result, the policy recommendations derived from such studies tend to be somewhat crude when it comes to guiding precise policy interventions.

Third, the potential endogenous side effects triggered by subsidies have been overlooked. While most existing literature focuses on the short-term positive incentives provided by subsidies^[9-11], it largely ignores the long-term risks that subsidies might pose—such as weakening firms' intrinsic innovation drive and fostering "policy dependency." In game-theoretic models, few studies incorporate "subsidy dependency costs" or "the degradation of firms' in-house R&D capabilities" into the payoff functions of the actors. Moreover, most existing analyses remain static comparisons, lacking consideration of the timing, pathways, and dynamic welfare effects associated with subsidy phase-outs^[10]. This oversight leads most studies to overestimate the actual net benefits of maintaining fixed subsidy policies over the long term and fails to provide a theoretical basis for designing incentive-compatible mechanisms for subsidy phase-outs or ensuring the long-term sustainability of technology adoption.

3 Future Research Directions

Although existing literature has employed evolutionary game theory to examine the dynamic evolutionary process of firms' strategy adoption, it still suffers from the limitation of static dependence in the design of policy instruments. Current studies typically assume that government subsidies are either exogenous fixed parameters or one-time investments, lacking an in-depth exploration of how governments can dynamically adjust subsidies based on evolving market conditions—such as tiered subsidy schemes or phased reduction mechanisms. Consequently, existing research struggles to answer the

critical question: "How should governments dynamically adjust subsidy intensity at different stages of technology diffusion to minimize costs?"

Direction 1: Research on Thresholds and Path Dependence in Dynamic Evolution.

Current evolutionary game models tend to focus on static equilibrium outcomes. Future research needs to introduce the dimensions of "time" and "path," thereby delving deeper into the dynamic evolution process of adoption rates. Specifically, we should first identify key threshold effects. Research must precisely quantify the "minimum effective subsidy intensity"—the critical point at which the system can transition from a "low adoption rate" to a "high adoption rate." Second, we should pay close attention to the sensitivity of initial conditions. In real-world scenarios, the initial adoption rate—such as the number of early adopters—often determines the ultimate evolutionarily stable strategy. Future studies should construct more sophisticated dynamic equations to simulate how the system converges to different equilibrium points under various initial conditions, thus providing policymakers with actionable guidance on "how to kickstart the market."

After identifying the critical conditions and evolutionary pathways for market launch, a key question that naturally arises is: How can we design a dynamic subsidy policy instrument that is well-suited to these conditions, ensuring both precision and sustainability of incentives? This leads us to our second research direction.

Direction 2: Dynamic Simulation of Subsidy Policies and Design of Exit Mechanisms.

Subsidy policies should not be static and "one-size-fits-all," but rather dynamic and adjustable levers. Future research should focus on simulating the incentive effects of different subsidy approaches and designing scientifically sound exit mechanisms. In terms of subsidy methods, it is important to compare the differences among one-time fixed subsidies, tiered subsidies based on output or transaction volume, and subsidies linked to the quality of on-chain data. Dynamic subsidies can more effectively encourage farmers to continuously and genuinely record their activities on the blockchain, rather than engaging in "blockchain adoption solely for the sake of receiving subsidies." More importantly, research must squarely address the timing and pace of subsidy withdrawal. Once market adoption reaches a certain saturation point (e.g., 60%), how should governments design a "phasing-out mechanism"? Should they adopt a linear reduction approach or a trigger-based termination strategy? By using numerical simulations to model various exit paths, we can evaluate which strategy can minimize fiscal burdens while avoiding market disruptions caused by abrupt policy withdrawal, thereby ensuring the sustainability of technology adoption.

4 Conclusions and Recommendations

4.1 Summary

This paper focuses on the specific issue of "How government subsidies influence farmers' adoption of blockchain," and systematically reviews the contributions and main shortcomings of existing literature. The results indicate that although academia has already confirmed that government subsidies are a key exogenous variable for helping farmers overcome the dilemma of "high costs and slow returns," and although existing studies have largely employed game-theoretic approaches to explore their incentive effects, the theoretical exploration in this area remains incomplete. Specifically, current research mostly treats subsidies as static exogenous parameters, failing to capture the bounded rationality and learning processes of farmers in a long-term, dynamic environment. In terms of policy design, these studies often assume homogeneity among market participants, neglecting the substantial differences between smallholder farmers and leading enterprises in terms of resource endowments and risk tolerance. Moreover, the incentive mechanisms currently rely almost exclusively on financial subsidies, with few studies addressing the synergistic effects of subsidy withdrawal mechanisms and non-monetary incentives. These shortcomings make it difficult for existing theories to provide precise guidance for complex and ever-changing real-world scenarios, underscoring the urgent need for new research perspectives to break through these limitations.

4.2 Recommendations for Researchers

Based on the analysis above, this paper offers the following recommendations for future researchers:

First, in terms of methodology, we recommend constructing a dynamic dual-agent model involving both the government and farmers, embedding the variables of "time" and "path" into the analytical framework. The focus should be on simulating how, under the assumption of bounded rationality, farmer groups gradually converge toward an evolutionarily stable strategy (ESS) through imitation and learning, thereby more accurately reconstructing the dynamic process of technology diffusion.

Second, in terms of the research setting, we should shift from abstract, macro-level assumptions to specific, micro-level contexts. It is recommended to focus on geographically indicated agricultural products or specialized industrial clusters in particular regions, and to calibrate model parameters by integrating field survey data—such as farmers' actual net incomes and the costs of equipment connected to the blockchain. In particular, we should pay close attention to "smallholder farmers," a vulnerable group. By introducing heterogeneity parameters, we can simulate the differentiated responses of operators of various scales when faced with subsidy policies, thereby enhancing the study's explanatory power in real-world scenarios.

Third, in terms of policy, we need to establish a dynamic subsidy mechanism. Research should not stop at simply asking "whether to provide subsidies," but rather delve deeper into "how to provide subsidies" and "when to phase them out." It is recommended to simulate the effectiveness of differentiated tools such as tiered subsidies and

subsidies based on data quality, and to proactively design a phase-out mechanism that will provide scientific theoretical support for the government in formulating low-cost, sustainable subsidy policies for blockchain adoption.

References

1. Mbadlisa, G., Jokonya, O.: Factors affecting the adoption of blockchain technologies in the food supply chain. *Front. Sustain. Food Syst.* 8, 1497599 (2024). doi: 10.3389/fsufs.2024.1497599.
2. Li, Y., Zhou, J.: Factors influencing blockchain technology adoption in port and shipping enterprises: A review and prospect. *Beijing Jiaotong University Journal (Social Sciences Edition)* 24(4), 89–97 (2025). doi: 10.16797/j.cnki.11-5224/c.20251126.001.
3. Li, H., Kannan, D., Xu, Q.: Online operations in a multichannel supply chain under service cost difference: The adoption of blockchain technology. *Transportation Research Part E: Logistics and Transportation Review* 199, 104170 (2025). doi: 10.1016/j.tre.2025.104170.
4. Liu, S.: Research on blockchain technology adoption decisions in agricultural product supply chains. Master Thesis, South China University of Technology, Guangzhou (2023). <https://d.wanfangdata.com.cn/thesis/ChhUaGVzaXNOZXdTmJAyNDA5MjAxNTE3MjUSCUQwMzMzMTEzMhoIZ2p6ZHZyanc%3D>.
5. Pu, X., Jiang, Y., Zhang, W.: An analysis of blockchain adoption strategies in a technology-supported supply chain considering government subsidy. *Systems* 13(11), 931 (2025). <https://doi.org/10.3390/systems13110931>.
6. Li, Z., Xu, X., Guan, X., et al.: Evolutionary game analysis of blockchain adoption decisions in a duopoly agricultural product market. *China Management Science* 33(7), 324–336 (2025). doi: 10.16381/j.cnki.issn1003-207x.2022.1918.
7. Wan, J., Xu, X.: Evolutionary analysis of blockchain technology investment in contract farming supply chains. *Logistics & Technology* 47(15), 122–127 (2024). doi: 10.13714/j.cnki.1002-3100.2024.15.031.
8. Sun, X.: Evolutionary game analysis of adoption decisions for blockchain traceability systems in agricultural products. Master Thesis, Dalian Maritime University (2024). <https://d.wanfangdata.com.cn/thesis/Ch1UaGVzaXNOZXdTb2xyOVMyMDI2MDExNzA4NTkxNhJRDA0MDAx-MjI0Ggh0bjlxcnk4ZA%3D%3D>.
9. Hu, S., Zhou, L., Xie, T.: Research on blockchain technology adoption decisions in agricultural product supply chains. *Science & Technology Progress and Policy* (7), (2023). doi: 10.3969/j.issn.1000-7695.2023.7.023.
10. Zhu, J., Zhang, X., Dan, B., et al.: Government subsidy strategy for fresh agricultural products under demand uncertainty and capital constraints. *China Management Science* 30(8), 231–242 (2022). doi: 10.16381/j.cnki.issn1003-207x.2019.1824.
11. Ni, F., Liu, T., Song, H.: Evolutionary game analysis of blockchain traceability decisions in food supply chains. *China Food Industry* (23), 43–46+50 (2023). https://kns.cnki.net/kcms2/article/abstract?v=y_Sildm5mqvOGE-aNPcu2Hn8FCJvtBIGkYb01Q6VZ4SjeZ_Bd86kS7FQZbYvMjXmBm6s15Odn-YXtxpUrz1VEp39IFLr-L2NHpILT-KkpRT4VF_dQ0syoYSm9dYAmV9cIDhgEA8ecyZo0QfRFGOu_SZ734xbv_YnuKEtVZ6_Iq7aWsgCE3dk9h_w=&uniplatform=NZKPT&language=CHS.

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