Driving Rural Governance Modernization through New Quality Productive Forces: A Theoretical Framework and Empirical Evidence from China

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Abstract

In the grand historical process of comprehensively promoting Chinese modernization, the modernization of rural governance serves not only as a crucial cornerstone of the national governance system and governance capacity modernization but also as a key support for realizing the rural revitalization strategy. Currently, with the deepening development of the new round of scientific and technological revolution and industrial transformation, New Quality Productive Forces (NQPF)—characterized by high technology, high efficiency, and high quality—are profoundly reshaping traditional modes of production and social structures. This paper aims to construct a theoretical analysis framework based on the three-dimensional synergy of technology-industry-institution to deeply analyze the internal mechanism by which NQPF drives the modernization of rural governance. The paper first reviews the evolution of productivity theory, pointing out that NQPF overcomes the dilemmas of information asymmetry, resource fragmentation, and subject atomization in traditional rural governance through the three dimensions of technological penetration, industrial upgrading, and institutional reshaping. Subsequently, based on panel data from 38 districts and counties in Chongqing, China (2021-2023) and in-depth field research cases, this paper empirically tests the governance effectiveness of NQPF using fixed effects models, mediation effect models, and heterogeneity analysis methods. The study finds that: first, NQPF significantly improves rural governance efficiency, and this conclusion remains valid after various robustness tests; second, the degree of information openness and the degree of multi-subject synergy are key mediating mechanisms; third, there is significant heterogeneity between the main urban metropolitan area and the mountainous areas of northeast/southeast Chongqing, where differences in industrial foundation and digital infrastructure determine the boundaries of the enabling effect. This study not only enriches the micro-application of Marxist productivity theory in the digital age but also provides empirical evidence and policy implications for various regions to utilize NQPF to solve governance problems according to local conditions.

Keywords

New Quality Productive Forces; Rural Governance Modernization; Technology-Industry-Institution Synergy; Chongqing Experience; Fixed Effects Model.

1. Introduction

1.1 Research Background and Problem Statement

1.1.1 Historical Background: Challenges of Rural Governance under the Vision of Chinese Modernization

Chinese modernization involves a massive population and aims for common prosperity for all. Within this grand narrative, rural areas have always remained the weak link in modernization and the locus of governance difficulties. With the acceleration of urbanization, China's rural social structure has undergone profound changes. On the one hand, the outflow of a large

number of young and middle-aged laborers has led to the hollowing out phenomenon in rural areas, where traditional clan authority and acquaintance society governance mechanisms have gradually disintegrated, and the demand of the left-behind population for public services has become increasingly diversified and complex. On the other hand, as national resources continue to flow into the countryside, grassroots political power faces the enormous challenge of effectively allocating resources and providing precise public services within an atomized social structure. Existing research has profoundly pointed out that without the modernization of agriculture and rural areas, there is no modernization of the entire country [1]. Currently, rural governance faces the dual dilemma of involution and suspension. The continuous input of governance resources has not always brought about a synchronous improvement in effectiveness but has sometimes fallen into a cumbersome cycle of formalism. Meanwhile, grassroots political power, in the early stages of digital transformation, occasionally detaches governance behavior from the actual needs of rural society due to a lack of effective data connections and mass basis. The No. 1 Central Document of 2024 explicitly lists improving the level of rural governance as a key task for promoting comprehensive rural revitalization, emphasizing the need to improve grid management, refined services, and information-supported grassroots governance platforms. This indicates that finding new dynamic mechanisms to break the governance deadlock has become an urgent topic of common concern in academia and political circles.

1.1.2 Realistic Opportunity: The Rise and Empowerment of New Quality Productive Forces

While governance dilemmas urgently need to be broken through, a qualitative leap is taking place at the level of productivity. The concept of New Quality Productive Forces provides a brand-new theoretical guideline for understanding the new momentum of current economic and social development. NQPF represents contemporary advanced productivity generated by revolutionary technological breakthroughs, innovative allocation of production factors, and deep industrial transformation and upgrading. It sheds traditional economic growth modes and productivity development paths and features high technology, high efficiency, and high quality. In the rural field, the manifestations of NQPF are becoming increasingly rich, ranging from the application of hard technologies such as drone patrols and satellite remote sensing monitoring to the penetration of soft technologies such as big data decision-making and algorithmic governance, and to the rise of new industries such as rural e-commerce and smart agriculture. These elements are not only innovations in production tools but have also profoundly changed the connection methods between people, between people and organizations, and between organizations. For example, Chongqing, as an important strategic fulcrum for China's Western Development, has vigorously implemented the construction of the 33618 modern manufacturing cluster system in recent years and introduced this industrial thinking into the agricultural and rural fields, exploring a path of governance modernization with mountainous characteristics through the collaborative innovation of technology-industry-institution [2].

1.1.3 Research Question

Although intuitively it is believed that technological progress helps to improve governance, exactly what specific mechanisms does NQPF use to drive the modernization of rural governance? Are there boundary conditions for its impact? What heterogeneity does this driving effect show in regions with different resource endowments? Existing literature mostly focuses on a single perspective of digital technology empowerment and lacks a systematic interpretation from a macro political economy perspective regarding the interaction between productivity and production relations. Based on this, this paper proposes the core research question: How does NQPF reshape the rural governance system through the three-dimensional

synergy of technology, industry, and institution, thereby promoting the modernization of governance capabilities?

1.2 Research Significance

1.2.1 Theoretical Significance

This study possesses profound theoretical significance and practical value. At the theoretical level, this paper expands the micro-application field of Marxist productivity theory. Traditional productivity theory mostly focuses on macro-economic growth and social form changes, whereas this paper sinks it to the micro-field of rural governance, exploring how advanced productivity specifically changes the power structure and operating mechanism of grassroots society, responding to the specific manifestation of productivity determines production relations in the digital age. In addition, this paper constructs an analytical framework of technology-industry-institution three-dimensional synergy, breaking through the limitations of focusing solely on technological instrumental rationality in the past. By incorporating industrial upgrading as the economic basis and institutional innovation as the superstructure into a unified framework, it reveals the comprehensive reshaping logic of NQPF as a systemic force on governance modernization.

1.2.2 Practical Significance

At the practical level, this paper provides new ideas for solving the fragmentation problem of rural governance. Through empirical analysis of Chongqing's experience, this paper reveals how data elements break through departmental barriers and achieve precise allocation of governance resources, providing operational solutions for various regions to solve the problems of heavy grassroots burdens and low efficiency. At the same time, this paper provides a basis for the formulation of differentiated rural revitalization policies. Heterogeneity analysis shows that different regions should have different focuses on developing NQPF, which helps local governments avoid the policy misunderstanding of one size fits all and formulate digital transformation and industrial development strategies according to local conditions, thereby more effectively promoting comprehensive rural revitalization.

1.3 Definition of Core Concepts

1.3.1 New Quality Productive Forces (NQPF)

New Quality Productive Forces are relative to traditional productivity characterized by large resource consumption and low technological content. In the research context of this paper, it includes three core dimensions. First is the technological dimension, referring to the application of disruptive technologies represented by artificial intelligence, big data, the Internet of Things, and biotechnology in the agricultural and rural fields. Second is the factor dimension, referring to data becoming a new key factor of production, deeply integrated with traditional factors such as land, labor, and capital to produce a multiplier effect. Finally, the industrial dimension refers to the transformation of traditional agriculture to smart agriculture and ecological agriculture, as well as the deep integration of primary, secondary, and tertiary industries in rural areas.

1.3.2 Rural Governance Modernization

Rural governance modernization refers to the dual modernization of the governance system and governance capacity. The modernization of the governance system means that under the leadership of the party organization, the governance pattern combining autonomy, rule of law, and rule of virtue is increasingly improved, and the governance subject shifts from single government dominance to multi-subject collaborative governance, including the participation of villagers, social organizations, and enterprises. The modernization of governance capacity refers to the shift of governance means from empirical and extensive to scientific, refined, and

intelligent, capable of efficiently responding to public crises and accurately providing public services, thereby achieving good governance in rural society.

1.4 Review of Domestic and International Research Status

1.4.1 International Research Status: Technological Governance and Rural Change

Western academic research on technology and rural governance started relatively early, mainly concentrating on the two fields of Technological Governance and Smart Villages. Early research mostly focused on the reconstruction of rural community social capital by Information and Communication Technologies (ICTs). For example, some scholars pointed out that the use of the Internet has broadened farmers' social networks, helping to form network communities that transcend geographical limitations, thereby enhancing the capacity for collective action. However, with the popularization of algorithmic decision-making, recent literature has begun to pay attention to the exclusion effects of the digital divide and algorithmic bias on marginalized rural groups. Some scholars warn that over-reliance on technology may lead to technological bureaucracy and weaken villagers' democratic participation rights. From the perspective of productivity, foreign scholars tend to use concepts such as the Fourth Industrial Revolution or Industry 4.0 to describe current changes, exploring how precision agriculture technology changes agricultural production relations and thereby affects rural social structures.

1.4.2 Domestic Research Status: Digital Empowerment and Governance Transformation

Domestic research closely follows the strategies of Rural Revitalization and Digital China, showing an explosive growth trend. Regarding research on digital technology empowerment, literature [6] analyzed the application potential of Generative Artificial Intelligence (AIGC) in rural governance from a prospective perspective, arguing that it helps achieve source governance and refined services. Relevant studies [7] emphasize the role of digital technology in reducing information asymmetry and enhancing the effectiveness of villager autonomy. Regarding research on governance dilemmas, some scholars [9] have deeply analyzed the phenomena of suspension and involution that appear in the process of embedding digital technology into rural governance, pointing out that technology itself cannot automatically bring about good governance and must be accompanied by corresponding institutional reforms. Regarding research on NQPF, with the proposal of this concept, some scholars [2][3] have begun to combine practices in specific regions such as Chongqing to explore the generation logic of NQPF in industrial transformation, but empirical studies directly linking NQPF to rural governance efficiency are still rare.

1.4.3 Literature Review and Research Space

In summary, existing research has been quite profound in the micro-mechanisms of technological empowerment and the description of governance dilemmas, but there are still problems such as limited perspectives, lack of frameworks, and insufficient empirical evidence. Most studies view technology as an exogenous variable, lacking investigation into it as an endogenous element of the productivity system, and ignoring the fundamental supporting role of industrial upgrading for governance modernization. At the same time, there is a lack of a systematic analytical framework integrating technological change-industrial reconstruction-institutional change, making it difficult to explain why the same technology produces distinctly different governance effects in different institutional environments. In addition, existing research is mostly based on qualitative case analysis, lacking quantitative empirical testing based on large-sample data, especially quantitative assessment of the non-linear relationship between NQPF and governance efficiency. This paper attempts to fill the above gaps by constructing a grand theoretical framework and combining rich practical data from Chongqing to provide a more explanatory analytical paradigm.

2. Theoretical Framework: The Logic Mechanism of New Quality Productive Forces Driving Rural Governance Modernization

2.1 Modern Interpretation of Marxist Productivity Theory

Marxism believes that productivity is the ultimate determining force of social development; productivity determines production relations, which in turn determines the superstructure. The rural governance system belongs to the category of superstructure, and its reform must be based on the development of productivity. The emergence of NQPF marks a leap in humanity's ability to transform nature to a new level. This leap is not just the replacement of production tools, such as intelligent agricultural machinery replacing manual tools, but also the improvement of laborers' quality and the expansion of the scope of labor objects. As a new labor object, data resources are revolutionizing the production process comprehensively. According to the principles of historical materialism, when a qualitative change occurs in productivity, the old governance system based on the small-peasant economy and traditional administrative orders will inevitably fail to adapt to the development needs of new productivity, thus generating internal tension for change. This tension drives the governance structure to evolve in a more flattened, networked, and intelligent direction, requiring the establishment of new production relations and superstructure compatible with NQPF.

2.2 Technology-Industry-Institution Three-Dimensional Synergy Analytical Framework

To specifically dissect this driving process, this paper constructs a technology-industry-institution three-dimensional synergy analytical framework.

2.2.1 Technological Dimension: Revolutionary Upgrade of Governance Tools (Penetration Effect)

Technology is the leading element of NQPF, and its penetration effect in rural governance is reflected in the comprehensive improvement of perception, connection, and decision-making capabilities. Technologies such as the Internet of Things, satellite remote sensing, and video surveillance have built an all-weather rural perception network, making governance objects such as the ecological environment, security status, and disaster warnings visible and quantifiable, solving the post-event remedy problem caused by information lag in traditional governance and achieving pre-event warning. The mobile Internet and social platforms have broken time and space barriers, establishing real-time connections between the government and villagers, and among villagers themselves, reducing negotiation costs and making democracy at fingertips possible. Big data and cloud computing technologies can clean, analyze, and mine massive heterogeneous data, providing decision-makers with accurate user profiles and trend predictions, thereby avoiding empirical decision-making errors.

#### 2.2.2 Industrial Dimension: Solidification of Governance Foundation (Support Effect)

Industry is the carrier of NQPF, and its supporting effect provides a solid material foundation for governance modernization. NQPF promotes the extension of agriculture to high-value-added links, such as deep processing and rural tourism, strengthening the collective economy of the village. A strong collective economy provides necessary financial guarantees for providing public services such as road construction, elderly care, and environmental protection, reducing the excessive dependence of grassroots political power on transfer payments from higher levels. Industrial modernization has spawned new business entities such as agricultural leading enterprises, professional cooperatives, and family farms. These entities have established close interest linkage mechanisms with farmers through shareholding cooperation and contract farming. Within the industrial community, the contract spirit and rule consciousness have gradually replaced traditional logic of human feelings (Renqing), laying a

social foundation for rule-of-law governance. At the same time, high-tech industries have attracted high-quality talents such as New Farmers and returning entrepreneurial college students to flow back. These talents often become the backbone of rural governance, optimizing the personnel structure of governance subjects.

2.2.3 Institutional Dimension: Standardization of Governance Relations (Reshaping Effect)

Institution is the guarantee of NQPF and is also the object reshaped by productivity. Its reshaping effect is reflected in the reform of rules, organizations, and incentive mechanisms. As research [5] pointed out when analyzing the transformation of energy cities, the development of NQPF forces the reform of the rural land system, collective property rights system, and administrative management system, promoting the establishment of new production relations adapted to productivity development. As data becomes a core factor of production, rural governance institutions must innovate around data collection, confirmation of rights, circulation, and protection, for example, establishing data opening and sharing mechanisms to break departmental data silos and establishing privacy protection mechanisms to regulate technology application boundaries. Adapting to the needs of rapid digital response, the bureaucratic governance structure is forced to transform into a flattened one. The implementation of the grid management system allows governance tentacles to reach farmers directly, reducing information loss at intermediate levels. In addition, digital incentive mechanisms such as point system management quantify villagers' daily behaviors into points, stimulating endogenous motivation through material and spiritual rewards, effectively solving the problem of insufficient villager participation.
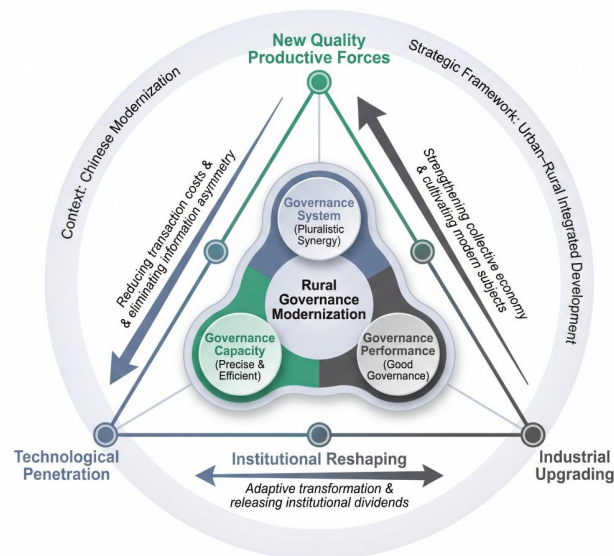
Figure 2.1: Technology-Industry-Institution Three-Dimensional Synergy Driving Mechanism Diagram

2.3 Internal Mechanism of Governance Efficiency Improvement: A Cost and Supply-Demand Perspective

From the perspective of New Institutional Economics, the essence of NQPF improving governance efficiency lies in the reduction of transaction costs and the improvement of supply-demand matching. Traditional governance is constrained by high information collection and supervision costs, often adopting one size fits all extensive management. NQPF, however, minimizes governance costs through data empowerment. For example, using satellite remote sensing to monitor straw burning, compared to manual patrols, has almost negligible costs and achieves 100% coverage. On the supply side, precise profiling technology allows public services to accurately match villager needs, such as smart medical services for the elderly left behind,

solving the long-standing problem of supply-demand mismatch. Table 2.1 details the comparison of rural governance characteristics supported by traditional productivity and empowered by NQPF.

Table 2.1: Comparison of Characteristics of Rural Governance Supported by Traditional Productivity and Empowered by New Quality Productive Forces

Comparison Dimension	Rural Governance Supported by Traditional Productivity	Rural Governance Empowered by New Quality Productive Forces	Transformation Logic
Core Elements	Land, Labor, Physical Capital	**Data**, Technology, Talent, Knowledge Capital	Element Digitalization, Virtualization
Information Structure	Severe asymmetry, decay in hierarchical transmission	**Holographic Transparency**, Flattened real-time sharing	Information disintermediation
Governance Means	Empirical management, Human wave tactics, Campaign-style law enforcement	**Data-driven**, Algorithm-assisted, Long-term mechanism	Governance precision, Automation
Resource Allocation	Static segmentation by administrative division, Supply-demand mismatch	Cross-regional dynamic synergy, **Precise irrigation**	Intelligent allocation
Organizational Structure	Vertical bureaucracy, Fragmentation	**Networked synergy**, Platform + Grid	Organizational flexibility
Mass Participation	Passive mobilization, Narrow participation channels	**Active participation**, Fingertip deliberation	Participation convenience

3. Background and Status Quo: Chongqing's New Quality Productive Forces Practice in Rural Governance

3.1 Representativeness Analysis: Why Choose Chongqing?

As the largest municipality directly under the central government in China, Chongqing has the special municipal condition of big city, big countryside, big mountainous area, and big reservoir area, and its urban-rural structure as a master of integration makes its governance experience highly representative. Chongqing has both highly modernized central urban areas and vast Qinba Mountains and Wuling Mountains areas. This dual structure is a microcosm of China's national conditions. At the same time, Chongqing is the intersection of multiple national strategies such as the construction of the Chengdu-Chongqing Twin City Economic Circle, the New International Land-Sea Trade Corridor, and the development of the Yangtze River Economic Belt, with rich policy resources and strong reform momentum. In addition, Chongqing is a pioneer area for NQPF, proposing to build a 33618 modern manufacturing cluster system, explicitly proposing to drive the development of modern agriculture with advanced manufacturing, and solving the development problems of inland cities through four-chain integration, i.e., the deep integration of the innovation chain, industrial chain, capital chain, and talent chain, which is highly consistent with the theory of NQPF.

## 3.2 Policies and Practices of NQPF Development in Chongqing

According to the Policy Measures of Chongqing Municipality to Support Steady Growth, Transformation and Upgrading of Manufacturing Industry and related documents [1][2], Chongqing has taken systemic measures to promote the movement of NQPF to the countryside, mainly reflected in two aspects: industrial digitalization and governance intelligence.

3.2.1 Industrial Digitalization: Spillover from Manufacturing to Intelligent Manufacturing

In terms of industrial digitalization, Chongqing relies on its strong automotive and electronic information industry foundation to promote the extension of industrial Internet platforms to agriculture. Literature [3] used Seres Group as an example to verify the feasibility of intelligent transformation of Chongqing's manufacturing industry. This experience was replicated in the field of agricultural machinery manufacturing. Local agricultural machinery enterprises in Chongqing developed small intelligent agricultural machinery adapted to operations in hilly and mountainous areas, solving the problem of no machinery available in mountainous areas and greatly improving agricultural productivity. At the same time, relying on the Western Data Trading Center, Chongqing explored the path of agricultural data assetization, helping agricultural enterprises obtain bank credit using production data, i.e., Smart Manufacturing Loans, effectively solving the financing difficulty problem.

3.2.2 Governance Intelligence: Comprehensive Coverage of Digital Platforms

In terms of governance intelligence, Chongqing has built a digital government service system with Yu Kuai Ban as the general entrance. As shown in Figure 3.1, Chongqing has built a 1+3+N digital rural governance architecture, where 1 is the rural big data center, 3 represents the three major sectors of party building guidance, rule of law guarantee, and rule of virtue education, and N includes multiple application scenarios such as smart emergency response, living environment improvement, and convenience services. In grassroots practice, Banan District, Yubei District, and other places have promoted point system digital management. Villagers upload photos of participating in environmental improvement through mini-programs, and after AI review and manual re-check, they obtain points, which can be exchanged for daily necessities. This measure not only reduces supervision costs but also reshapes the moral ethos of the village.
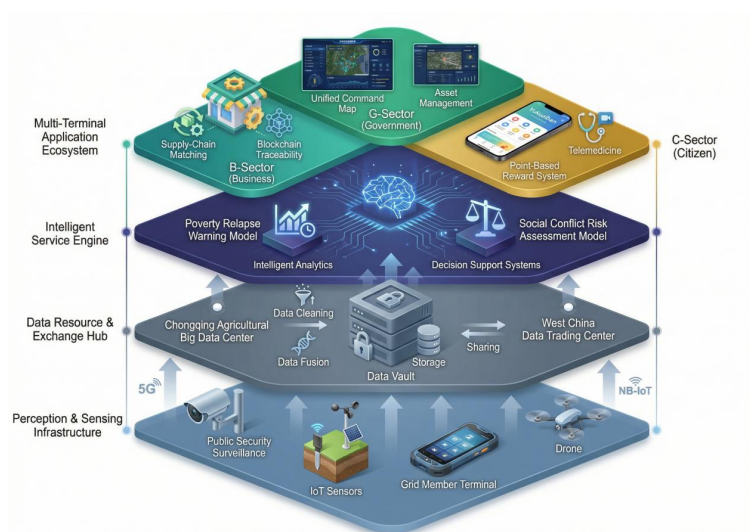
Figure 3.1: Architecture Diagram of Chongqing Rural Digital Governance Platform Operation

3.3 Reality and Data Performance of Rural Governance Modernization in Chongqing

Table 3.1 shows key indicators of agricultural technology and digital governance in Chongqing from 2021 to 2023. The data shows that all indicators show a steady upward trend, especially the coverage rate of rural digital governance platforms, which jumped from 75.2% to 95.8% in three years, indicating that the digital base has been basically consolidated. The average annual growth rate of the development level of county-level digital agriculture and rural areas reached 13.9%, and the digitalization level of productivity has significantly improved. The contribution rate of agricultural scientific and technological progress has steadily increased, and technology has become the primary driving force for agricultural development. The increase in rural Internet penetration rate means that the mass basis for governance is increasingly broad. The rapid growth in the number of newly cultivated professional farmers reflects the optimization of the quality structure of governance subjects. The continuous growth of rural residents' per capita disposable income marks the consolidation of the economic foundation, providing strong support for feeding back governance.

Table 3.1: Key Indicators of Rural NQPF and Governance Development in Chongqing (2021-2023)

Indicator Name	2021	2022	2023	Annual Growth Rate	Data Interpretation
County Digital Agriculture and Rural Development Level (%)	42.5	48.3	55.1	13.9%	Significant improvement in productivity digitalization level
Contribution Rate of Agricultural Scientific and Technological Progress (%)	61.0	62.5	64.2	2.6%	Technology becomes the primary driving force for agricultural development
Rural Internet Penetration Rate (%)	59.8	64.3	68.5	7.0%	Increasingly broad mass basis for governance
Coverage Rate of Rural Digital Governance Platforms (%)	75.2	86.4	95.8	12.9%	Basic universality of digital governance infrastructure
Number of Cultivated New Professional Farmers (10,000 persons)	12.5	15.3	18.6	22.0%	Rapid optimization of governance subject quality structure
Rural Residents' Per Capita Disposable Income (Yuan)	18100	19313	20820	7.2%	Economic foundation consolidated, feeding back governance

Data Source: Estimated based on Chongqing Statistical Yearbook, public reports of Chongqing Municipal Agriculture and Rural Committee, and research group survey data.

3.4 Existing Pain Points and Challenges

Despite remarkable achievements, the survey also found some deep-seated problems. First, the phenomenon of data silos and fragmentation still exists. Agriculture-related data is scattered among different departments such as agriculture, forestry, water conservancy, and land, with inconsistent standards and difficulties in integration, leading to grassroots cadres facing the pressure of multiple reporting. Second is the intergenerational divide in digital literacy. Literature [11] pointed out that the problem of left-behind elderly and children having difficulty

effectively using smart devices still exists, and they may be marginalized in digital services, creating new social unfairness. Finally, there is the problem of two layers of skin between technology and institutions. Research [15] mentioned that some areas emphasize hardware investment over institutional construction, and digital platforms have become display screens, failing to be truly embedded in the governance process, presenting various digital governance risks.

4. Empirical Analysis: The Impact of New Quality Productive Forces on Rural Governance Efficiency

4.1　Research Design

4.1.1　Sample Selection and Data Sources

This paper selects 38 districts and counties (autonomous counties) in Chongqing as research samples, covering the main urban metropolitan area, the northeast Chongqing Three Gorges Reservoir urban agglomeration, and the southeast Chongqing Wuling Mountain urban agglomeration. The time span is from 2021 to 2023. Data are mainly derived from the Chongqing Statistical Yearbook, China County Statistical Yearbook, and the Peking University Digital Financial Inclusion Index. Some subjective indicators of governance efficiency (such as villager satisfaction) come from special questionnaire surveys conducted by the research group in Banan, Yubei, Youyang, and other places.

4.1.2　Variable Definition

In terms of variable definition, the dependent variable is Rural Governance Efficiency (Governance). Referring to existing research [8], this paper constructs a comprehensive indicator system containing four dimensions and calculates the comprehensive score through the entropy weight method. These four dimensions are: public service supply, including rural per capita education, medical care, social security expenditure, and satisfaction; administrative efficiency, including the online availability rate of government service items and average handling time; social conflict resolution, including the number of petition cases per 10,000 people (reverse indicator) and the success rate of conflict dispute mediation; and villager political participation, including village committee election turnout rate and villager council participation frequency. The core independent variable is New Quality Productive Forces Level (NQPF). Based on the previous theory, proxy variables are selected from the three dimensions of technology, industry, and factors, and an index is synthesized through Principal Component Analysis (PCA), specifically including the number of agricultural scientific and technological personnel per 10,000 people and the number of authorized agricultural patents for technological innovation; the proportion of high-tech industry output value in the total output value of industrial enterprises above designated size and agricultural total factor productivity for industrial upgrading; and the county digital financial inclusion index and the number of internet broadband access users for digital foundation. In addition, this paper selects economic development level, urbanization rate, fiscal support for agriculture, and human capital as control variables to eliminate interference from other factors.

4.1.3　Model Specification

To control for individual heterogeneity that does not change with time (such as geographical location, cultural traditions) and macro shocks that change with time, this paper uses a two-way fixed effects model for regression analysis.

4.2 Empirical Result Analysis

4.2.1 Benchmark Regression Results

Table 4.1 reports the benchmark regression results. Column (1) only includes the core independent variable, and the result shows that the coefficient of NQPF is 0.415, significant at the 1% level, indicating a significant positive correlation between NQPF and rural governance efficiency. Column (2) adds all control variables and two-way fixed effects, and the coefficient of NQPF returns to 0.342, but it remains significant at the 1% level. This means that after controlling for factors such as economic development and fiscal input, for every 1 standard deviation increase in NQPF, rural governance efficiency will increase by 0.342 standard deviations. This verifies the core hypothesis of this paper, that is, NQPF is an independent and important force driving the modernization of rural governance. Regarding control variables, the coefficient of fiscal support for agriculture is significantly positive, indicating that government input remains an important guarantee for governance improvement. The coefficient of urbanization rate is negative but not significant, which may reflect that the governance difficulties caused by rural hollowing out during urbanization offset the dividends of resource agglomeration.

Table 4.1: Regression Results of the Impact of New Quality Productive Forces on Rural Governance Efficiency

Variable	(1) Basic Model	(2) With Controls	(3) Robustness Test (Replace Variable)	(4) Robustness Test (IV Method)
New Quality Productive Forces (NQPF)	0.415*** (0.052)	**0.342*** (0.048)	0.331*** (0.050)	0.389*** (0.065)
Per Capita GDP (lnGDP)		0.124** (0.055)	0.118** (0.058)	0.110* (0.060)
Urbanization Rate (Urban)		-0.056 (0.082)	-0.049 (0.085)	-0.062 (0.088)
Fiscal Support for Agriculture (Fin)		0.208*** (0.061)	0.195*** (0.064)	0.215*** (0.068)
Human Capital (Edu)		0.089** (0.040)	0.082** (0.042)	0.091** (0.045)
Constant	1.254***	0.865**	0.912**	1.021**
Observations	114	114	114	108
R-squared	0.385	0.521	0.515	0.508
Region Fixed Effects	YES	YES	YES	YES
Time Fixed Effects	YES	YES	YES	YES

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4.2.2 Robustness Test

To ensure the reliability of the conclusions, this paper conducted multiple robustness tests. First is replacing the independent variable. Column (3) uses a single Digital Village Development Index to replace the synthesized NQPF index, and the result remains significant. Second is the Instrumental Variable method (IV). Considering the possible reverse causality, that is, areas with good governance are more likely to develop NQPF, this paper selects the number of fixed telephones in each district and county in 1984 as an instrumental variable.

Column (4) shows that in the 2SLS regression, the conclusion still holds. In addition, winsorizing all continuous variables at 1% and 99% did not substantively change the results.

4.3   Mechanism Test: Information Disclosure and Subject Synergy

Based on theoretical analysis, we hypothesize that NQPF improves governance efficiency by increasing information openness and enhancing multi-subject synergy. Referring to the mediation effect model, we constructed mediation effect testing steps. Mediating variables include information openness, measured by the update frequency and clicks of information disclosure columns on government websites of each district and county; and subject synergy, measured by the number of projects involving social organizations in rural governance and the amount of enterprise investment in rural governance. Table 4.2 shows the mediation effect test results. In column (2), the coefficient of NQPF on Info is significantly positive, indicating that NQPF significantly improves information transparency. In column (3), when NQPF and Info are put into the regression equation simultaneously, the coefficient of Info is significant, and the coefficient of NQPF decreases but remains significant. This indicates that information openness plays a partial mediating role. The Sobel test Z-value further confirms the significance of the mediation effect. Similarly, subject synergy was also confirmed as an effective mediating path. This verifies that NQPF reconstructs the governance ecology by breaking information barriers and absorbing social forces.

Table 4.2: Mediation Effect Test Results

Variable	(1) Governance Efficiency (Total Effect)	(2) Information Openness (Mediator)	(3) Governance Efficiency (With Mediator)	(4) Subject Synergy (Mediator)	(5) Governance Efficiency (With Mediator)
New Quality Productive Forces (NQPF)	0.342*** (0.048)	0.285*** (0.042)	0.210*** (0.051)	0.315*** (0.055)	0.198*** (0.052)
Information Openness (Info)			0.462*** (0.065)		
Subject Synergy (Synergy)					0.421*** (0.060)
Controls	YES	YES	YES	YES	YES
Constant	0.865**	0.512*	0.628**	0.485**	0.661**
R-squared	0.521	0.488	0.594	0.495	0.588
Sobel Test Z-value			3.85***		3.62***

*Note: *** p<0.01, ** p<0.05, * p<0.1.*

4.4   Heterogeneity Analysis: The Gap between Center and Periphery

Chongqing's special geographical structure provides an excellent sample for heterogeneity analysis. We divide the sample into Main Urban Metropolitan Area (economically developed, flat terrain) and Northeast/Southeast Chongqing Mountainous Area (ecological conservation area, rugged terrain). Figure 4.1 shows the fitting trend of NQPF and rural governance efficiency in different regions. Regression results show that the coefficient of NQPF in the main urban area is significantly higher than that in the mountainous area. This indicates that digital

infrastructure and industrial foundation are prerequisites for NQPF to exert governance efficiency. In mountainous areas with weak infrastructure, pure technological input may face the difficulty of landing the last mile or even produce technological suspension, existing a clear threshold effect, meaning initial input has limited effect and must reach a certain threshold to show results.
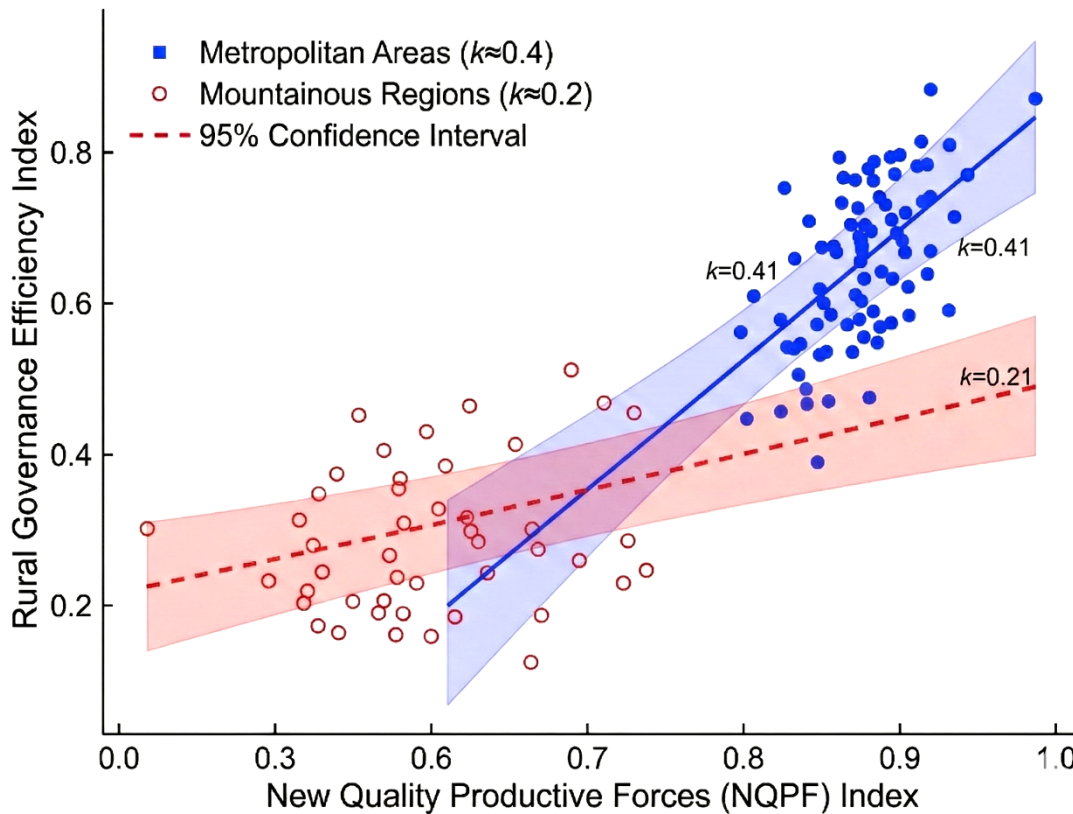
Figure 4.1: Fitted Trend Diagram of New Quality Productive Forces and Rural Governance Efficiency by Region

5. Conclusion, Policy Implications, and Prospects

5.1 Research Conclusions

Based on the background of Chinese modernization, this paper systematically studied the logic and effect of NQPF driving rural governance modernization by constructing a theoretical framework and using empirical data from Chongqing. The main conclusions are as follows. At the theoretical level, NQPF fundamentally changes the cost structure and supply-demand matching mode of rural governance through the three-dimensional synergy mechanism of technological penetration-industrial support-institutional reshaping, serving as a key variable to solve involution and suspension. At the empirical level, evidence from Chongqing shows that NQPF significantly improves rural governance efficiency. This improvement is mainly achieved by increasing information transparency and promoting multi-subject synergy, validating the views of literature [8][12]. At the heterogeneity level, the enabling effect of NQPF has significant regional differences. The enabling effect is stronger in areas with better infrastructure and industrial foundation; in underdeveloped mountainous areas, there is a clear threshold effect, indicating that basic conditions constrain the role of NQPF.

5.2 Policy Implications

Based on the above findings, this paper proposes the following policy recommendations to promote rural governance modernization.

First, the digital base should be consolidated to break data barriers. Continue to promote the extension of 5G and gigabit optical fiber to administrative villages, especially to make up for the shortcomings of IoT facilities in remote mountainous areas. It is recommended to promote low-cost, easy-to-maintain sensor technologies in mountainous areas, such as simple water and fertilizer monitoring equipment for lemon bases. At the same time, establish a cross-departmental agriculture-related data resource pool, formulate unified data standards and interface specifications, promote the one-time collection, multi-party utilization mechanism, and effectively reduce the burden of form filling for grassroots cadres.

Second, industrial synergy should be strengthened to strengthen the foundation of governance. Governance cannot run on empty air; it must rely on industry. It is recommended to connect smart governance platforms with rural e-commerce and smart agriculture platforms. For example, provide deposit-free agricultural machinery leasing services for farmers with good credit through the governance platform to achieve a benign interaction between industry and governance. Utilize NQPF to revitalize rural idle assets, such as idle homesteads and forests, introduce urban capital through digital platforms, increase village collective income, and provide financial guarantees for public services.

Third, attention should be paid to talent cultivation to bridge the digital divide. Implement the Digital New Farmer plan, establish school-local cooperation mechanisms, and targetedly cultivate composite talents who understand agriculture, technology, and management. As suggested by research [14], a shared engineer model can be explored to allow urban technical talents to serve the countryside remotely. At the same time, promote aging-friendly transformation and literacy improvement, and develop care version governance APPs to simplify operation processes. Relying on the New Era Civilization Practice Centers, regularly conduct digital skills training for villagers to ensure that the elderly and vulnerable groups do not fall behind, reducing the threshold for villagers to participate in digital governance.

Finally, institutional supply should be improved to promote integration of technology and governance. Establish new village rules and regulations adapted to digital governance, clarifying data ownership and privacy protection rules. Explore the establishment of a fault tolerance mechanism to encourage grassroots bold innovations in point systems, grid management, etc. Avoid technological determinism and recognize that technology is only a means, and people are the core. Prevent technology from replacing face-to-face mass work, adhere to the combination of key-to-key and face-to-face, and retain the warmth and cohesion of rural society.

5.3   Limitations and Prospects

Although this paper strives for rigor, there are still limitations. Restricted by data availability, some governance efficiency indicators (such as social capital, trust) use proxy variables, which may not be precise enough. The case scope focuses only on one place, Chongqing. Although representative, China has a vast territory with huge differences between the east, middle, and west, and the universality of the conclusion needs to be verified nationwide. In addition, the impact of NQPF is a dynamic and long-term process. This paper only used 3 years of panel data, making it difficult to capture long-term structural changes. Future research can further expand the sample range, conduct cross-provincial comparative studies, and combine anthropological field survey methods to go deep into micro-villages to analyze the subtle changes in rural power structures after technological intervention.

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