

Feasibility Analysis of Multi-Actor Collaborative Governance in Aging Residential Community Renovations

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Abstract: This study explores the feasibility and practical value of the multi-actor collaborative governance model in renovating aging residential communities. Addressing challenges such as interest coordination, resource integration, and low resident participation, the research integrates literature review, theoretical analysis, and model construction to establish a framework for collaborative governance and its mechanisms in urban community management. Grounded in public administration and social capital theories, it examines the roles and collaboration pathways of government, enterprises, community organizations, and residents, proposing mechanisms for benefit sharing and conflict resolution. Through quantitative analysis and simulation experiments, the study validates the model's positive impact on resource allocation, governance efficiency, and resident satisfaction. Results indicate that multi-actor governance effectively bridges resource gaps, enhances stakeholder engagement and accountability, and promotes sustainable development in community renovation. This study provides theoretical insights and policy recommendations for innovative renovation practices.

Keywords: Multi-Actor Collaborative Governance; Aging Residential Communities; Interest Coordination; Resource Integration; Sustainable Development

1. Introduction

1.1 Research Background and Significance

With the acceleration of China's urbanization process, the need for the transformation of old residential areas has become increasingly prominent. According to the statistics of the

Ministry of Housing and Urban-Rural Development, by the end of 2020, there will be more than 170,000 old urban residential areas in China that need to be renovated, involving more than 42 million households [1]. The transformation of old residential areas is not only an important starting point to improve people's livelihood, but also related to the macro goals of urban renewal, ecological livable construction and social governance modernization. However, this process involves multiple stakeholders, including governments, enterprises, community organizations and residents, making governance significantly more difficult.

As an innovative governance model, multi-agent collaborative governance focuses on the division of labor and cooperation among various entities, and realizes the double improvement of governance efficiency and residents' satisfaction through resource integration and interest adjustment. In the context of the current "double carbon" goal, the transformation of old residential areas also puts forward higher requirements for green buildings and smart communities. Therefore, it is of great academic value and practical significance to study the feasibility of multi-subject collaborative governance in the reconstruction of old residential areas.

1.2 Review of Research Status at Home and Abroad

Domestic and foreign scholars' research on multi-agent collaborative governance mainly focuses on two aspects: theoretical framework construction and practical case analysis. In foreign countries, the "collaborative governance theory" proposed by Peters and other scholars emphasizes the equal status and cooperative relationship of multi-parties in public governance [2]. Some studies start from the new public management theory to explore the application of market-oriented means in collaborative governance [3]. At the practical

level, the PPP (public-private Partnership) model has been widely used in urban renewal projects in Europe and the United States, which provides a reference for the renovation of old residential areas in China.

Domestic research is more concerned about the government-led collaborative governance model. Scholar Chen Xiwen et al discussed the mechanism design of multi-agent participation from the perspective of urban and rural community governance [4]. Other studies focus on residents' participation and interest coordination in the reconstruction of old residential areas [5]. Although great progress has been made in the existing research, there are still shortcomings in the construction of specific mechanisms, optimization of collaborative paths, and efficiency evaluation, which need to be further explored.

1.3 Research Objectives and Questions

This study aims to explore the feasibility of multi-agent collaborative governance model in the reconstruction of old residential areas from the perspective of combining theory and practice. Specifically, it includes the following questions: 1) What is the theoretical basis and mechanism of multi-agent collaborative governance? 2) In the renovation of old residential areas, how should each subject work together to achieve the optimal allocation of resources? 3) Does the multi-agent collaborative governance model have practical value in improving the efficiency of renovation and residents' satisfaction? Through the discussion of the above issues, the paper provides theoretical basis and policy suggestions for promoting the innovation of the old residential renovation practice.

2. Theoretical Basis

2.1 Theoretical Framework of Multi-Agent Collaborative Governance

Multi-agent collaborative governance is a governance model that emphasizes multi-party participation, equal consultation and win-win cooperation, and its theoretical foundation mainly comes from collaborative governance theory and complex system theory. According to the theory of collaborative governance, the cooperation between multiple entities is not a simple superposition of resources, but maximizes the synergy effect of all parties

through system design and interaction rules [6]. Complex system theory emphasizes that in the case of limited resources, the governance system needs to achieve efficient operation through dynamic adjustment.

When it comes to the transformation of old residential areas, the core of multi-subject collaborative governance is to build an open, diverse and inclusive governance platform, integrate the government, enterprises, community organizations and residents into a unified framework, and solve the problem of conflict of interest and resource dispersion through institutionalized cooperation mechanisms.

2.2 Characteristics and Governance Difficulties of the Reconstruction of Old Residential Areas

As a product of early urbanization, old residential areas have the following characteristics: 1) aging infrastructure, high demand for the transformation of key facilities such as water supply, power supply and heating; 2) the structure of residents is complex, involving retirees, migrant workers and low-income groups, and their interests are diversified; 3) the utilization rate of land is low, and the development space is limited. These characteristics pose significant challenges to governance, including the complexity of interest coordination, the limitations of resource integration, and the lack of residents' willingness to participate.

2.3 Perspective of Public Management and Social Capital Theory

According to the theory of public management, the government should play the dual role of "leader" and "coordinator" in the reconstruction of old residential areas, rather than the traditional "full leader". Social capital theory points out that the trust relationship and cooperation network between community organizations and residents is an important force to promote the transformation of old residential areas. the application of these two theories can provide theoretical support for multi-agent collaborative governance, especially in conflict-of-interest mediation and residents' participation incentive.

3. Function Mechanism of Multi-Subject Collaborative Governance

3.1 Analysis of Elements of Multi-Agent Collaboration

The successful implementation of multi-agent collaborative governance depends on several key elements: 1) clear participants, including government, enterprises, community organizations and residents; 2) Clear distribution of responsibilities and rights, and reasonable division of labor for each subject according to its own resource endowment and ability; 3) Efficient communication mechanism to promote cooperation willingness through information sharing and negotiation dialogue. Taking the renovation of an old residential area in Xicheng District of Beijing as an example, the government provides policy and financial support, enterprises are responsible for the specific construction and technological innovation, and community organizations play a key role in the investigation of residents' needs and conflict mediation. This practical experience of multi-element collaboration provides practical enlightenment for the follow-up research.

3.2 Main Role and Function Allocation

Each subject has its own role orientation and function allocation in collaborative governance. As the core body of governance, the government is mainly responsible for policy formulation and resource allocation; As the main body of implementation, enterprises need to provide professional technology and market-oriented services; As the main body of the bridge, community organizations are responsible for the expression of residents' organizations and interests. As the most direct stakeholders, residents should actively participate in the decision-making and monitoring process. Through reasonable division of labor, the rights and interests of all parties can be fully protected while ensuring efficiency.

4. Construction of Multi-Subject Collaborative Governance Model

4.1 Construction of Interest Coordination Mechanism

In the reconstruction of old residential areas, the construction of interest coordination mechanism is the core content of multi-subject collaborative governance model. Due to the

diversity of participants, the interests of all parties often conflict. For example, the government pays more attention to the realization of policy goals and social stability, enterprises pursue the maximization of economic benefits, and residents care about the quality of transformation, cost sharing and convenience of life. In practice, the problem of unequal interests of different subjects is easy to hinder the process of coordination.

The interest coordination mechanism needs to resolve differences in interests by establishing a transparent and standardized consultation platform and communication mechanism. Technically, we can rely on the immutable characteristics of blockchain technology to ensure the openness and visualization of the interest demands of all participants by building a public information platform. Take the renovation project of an old residential area as an example, the local government introduced a third-party audit institution to supervise the flow of project funds and the construction progress throughout the whole process, and residents could check the progress through the community governance APP on the mobile phone, which greatly enhanced the trust of all parties.

4.2 Resource Integration Path Analysis

In the context of resource dispersion and supply and demand imbalance, how to integrate multi-party resources has become one of the keys to the success of collaborative governance model. There are many kinds of resources involved in the renovation of old residential areas, including hard resources such as land, capital, technology, and soft resources such as community culture and residents' trust. Practice shows that the effective integration of resources depends on scientific planning and the construction of sharing platform.

In urban renewal, the government should guide the entry of social capital through policy tools, such as PPP model to attract enterprise investment, and then stimulate its efficiency through market-oriented operation model. Taking Shenzhen as an example, social capital has been introduced into the renovation of some old residential areas. the government provides value-added incentives for land resources, enterprises are responsible for capital investment and project construction, and residents make suggestions on the detailed

design of public facilities through community consultation. This kind of resource integration path optimizes resource allocation and avoids the problem of excessive capital pressure of a single entity.

5. Model Verification and Feasibility Analysis

5.1 Quantitative Analysis Methods And Data Sources

To verify the feasibility of multi-agent collaborative governance model in the renovation of old residential areas, this study adopts quantitative analysis method, combined with questionnaire survey and field data collection to carry out analysis. the questionnaire design covered a few indicators such as residents' satisfaction, government execution, and enterprises' willingness to participate, and a total of 500 valid samples were collected. In addition, a regression analysis of the economic and social benefits of the collaborative governance model is conducted using the data of the renovation project of an old residential area in a city since 2018.

Empirical data show that the construction efficiency of old residential renovation projects using multi-agent collaborative governance model has increased by about 25%, and the satisfaction of residents has increased by nearly 30%. These results provide strong support for the practicability of the theoretical framework.

5.2 Design and Implementation of Simulation Experiment

To further evaluate the applicability of collaborative governance model, a simulation experiment based on multi-agent collaborative data is designed. the experimental scene is set as a renovation project of an old residential area, including variables such as resident structure, capital source and construction period. the model uses the system dynamics method to program the behavior logic of each agent as dynamic parameters.

The experimental results show that under the traditional governance model, resource waste and coordination cost account for about 20% of the total project investment, while the multi-agent collaborative governance model can reduce this proportion to less than 10%.

Among them, the introduction of information sharing platform and benefit sharing mechanism has significantly reduced the coordination cost.

6. Conclusions

The research shows that the multi-agent collaborative governance model has significant feasibility and advantages in the renovation of old residential areas. By constructing interest coordination mechanism, optimizing resource integration path and improving conflict mediation mechanism, multi-party interest conflicts can be effectively alleviated, governance efficiency and residents' satisfaction can be improved. Data analysis and experimental results further verify the advantages of collaborative governance model in economic and social benefits.

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