Configurational Paths of Collaborative Governance Among Multiple Stakeholders in Urban Renewal Projects: LLMTopic Modeling and fsQCA method

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1 Introduction

Urban renewal is an important strategic measure to optimize spatial structures, improve the living environment and achieve sustainable urban development. Urban renewal projects typically involve multiple stakeholders. Due to the heterogeneous interest demands and divergent cultural values, conflicts often arise among stakeholders during the implementation of projects(Liu & Zhang, 2026). As a complex governance process, urban renewal requires coordination across various aspects, including policy frameworks, interest distribution and stakeholder participation. However, these influencing factors do not exist independently. They interact with each other to collectively impact the collaborative governance of urban renewal projects(Liu & Zhang, 2024). Therefore, identifying the key factors that influence collaborative governance of urban renewal projects and examining their synergistic effects are crucial for improving project efficiency.

Existing studies have employed methods such as grounded theory and topic clustering to identify the factors influencing collaborative governance in urban renewal projects(Liu & Zhang, 2024). However, traditional text analysis approaches remain limited in their semantic understanding and knowledge extraction capabilities. A more comprehensive and accurate method is therefore needed to identify the deeper logical relationships among the influencing factors embedded in documents. Additionally, to further explore the impact of these factors, some studies have employed regression analysis to quantitatively assess the relationships between urban renewal and its influencing variables(Jiang et al., 2024). While this approach effectively examines the impact of individual or multiple factors on urban renewal, it falls short of addressing the interconnected nature of economic,

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social, and environmental factors. Therefore, adopting the configurational perspective is crucial for studying the combined effects of factors within complex urban renewal governance systems.

This study investigates the influencing factors and configurational pathways of collaborative governance among multiple stakeholders in urban renewal projects. Specifically, this study aims to answer two primary research questions:

(1) What are the core factors influencing collaborative governance among multiple stakeholders in urban renewal projects?

(2) How do multiple factors jointly interact to shape the configurational pathways of collaborative governance?

2 Research Design and Methodology

To address the questions, this study developed an integrated framework that combines text clustering based on the Large Language Models (LLMs) and fuzzy-set Qualitative Comparative Analysis (fsQCA). The specific steps of this research are shown in Figure 1.

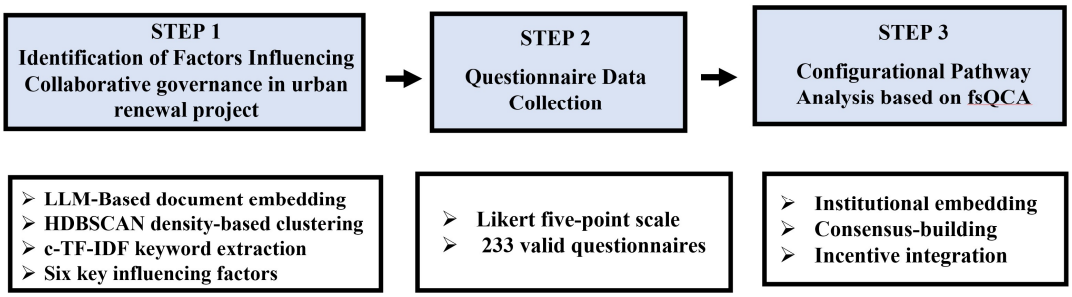

Figure 1. Research methods and steps

2.1 Step 1: Identify influencing factors through text mining and the LLMTopic modeling

This study employed text mining techniques and LLM-based text clustering methods to identify the factors influencing collaborative governance in urban renewal projects. We collected case study literature related to urban renewal projects. By searching for keywords such as “urban renewal”, “collaborative governance”, and “influencing factor” in the “Web of Science” database, the study manually selected 56 relevant papers(Chou et al., 2023).

Drawing on the BERTopic framework, this study developed an LLM-based topic clustering model (LLMTopic) through two main stages: document embedding generation and topic extraction. First, this study designed prompt engineering to direct the LLM to generate embedding vectors for

the documents. We employed the locally deployed open-source Qwen3-4B model. To enhance the consistency of semantic representations within the same thematic text, we used “Summarize sentence ‘[text]’ in one word:” as the standardized prompt. We extracted the hidden-layer representation of the final output token as the document embedding. After normalization, we applied HDBSCAN(Hierarchical Density-Based Spatial Clustering of Applications with Noise) for text clustering. Based on token frequency statistics within each cluster, c-TF-IDF(Class-based Term Frequency-Inverse Document Frequency) is finally utilized to identify representative keywords for each topic.

2.2 Step 2: Questionnaire data collection

This study conducted a questionnaire survey to collect quantitative data from different stakeholder groups in urban renewal projects, including government officials, developers, and residents. Respondents were invited to assess the collaborative governance conditions of actual urban renewal projects they had participated in or closely understood. To mitigate subjective bias, the study adopted multi-item measures and conducted reliability and validity tests before fsQCA analysis.

The factors identified in Step 1 were converted into measurable empirical variables. Each factor was scored on a 1–5 Likert scale based on its presence or importance in shaping collaborative governance in urban renewal projects.

2.3 Step 3: fsQCA configurational pathway analysis

The study adopted the fsQCA method to conduct a configurational pathway analysis of collaborative governance in urban renewal projects. FsQCA enables the analysis of interactions among multiple conditional variables and their impacts on outcome variables.

- Variable definition: The condition variables are the core influencing factors identified in the first step. This study selected collaborative governance efficacy as the outcome variable. Collaborative governance efficacy refers to the extent to which multi-stakeholder collaboration in urban renewal achieves effective coordination and produces governance outcomes that are perceived as satisfactory by participants. It captures three interrelated dimensions: inclusive engagement, coordination effectiveness, and perceived governance performance.

- Data calibration: We utilized the direct calibration method to convert the scale data(0–5) into fuzzy-set membership scores ranging from 0 to 1. This study established three anchor points: full membership at 0.95, intermediate membership at 0.50, and full non-membership at 0.05(Ragin, 2008).
- Necessity analysis: Necessity analysis examines whether a single condition is a necessary condition for the outcome. A condition is considered necessary when its consistency exceeds 0.90 and its coverage is greater than 0.80.
- Sufficiency analysis and configurational pathway induction: Sufficiency analysis identifies the different combinations of multiple conditions necessary for the successful implementation of urban renewal projects(Fiss, 2011). Core conditions appear in both the intermediate and parsimonious solutions, whereas peripheral conditions are present only in the intermediate solution.

3 Key Findings

3.1 Identification of influencing factors for collaborative governance among multiple stakeholders in urban renewal

Through LLMTopic modeling, this study ultimately identified six key factors influencing collaborative governance in urban renewal projects. Specifically, these factors cover political, economic, social, as well as communication and participation. They reflect the core governance mechanisms through which multiple stakeholders coordinate, negotiate, and sustain collaboration in urban renewal projects. The variable definitions are presented in Table 1.

Table 1. LLMTopic theme extraction results and variable declaration

Variable type	Variable name	Notation
Outcome Variable	Collaborative governance efficacy of urban renewal projects	R
Conditional variables	Government support and institutional assurance	A
	Public and community participation avenues	B
	Clear responsibilities and authority boundaries	C
	Diverse financing channels	D
	Reasonable interest coordination and benefit distribution	E
	Information sharing and transparency in communication	F

3.2 Configurational pathways of collaborative governance in urban renewal projects

This study collected a total of 245 questionnaires. After excluding 12 invalid responses, 233 valid questionnaires were retained for analysis. Following reliability and validity testing of the survey data, we utilized the calibrate function in fsQCA 3.0 to conduct data calibration(Di Paola et al., 2025). Subsequently, this study conducted the necessity analysis and sufficiency analysis. The configurational paths are presented in Table 2.

Table 2. Configurational paths of collaborative governance

	H1	H2	H3	H4	H5	H6	H7
A	●	●	•	⊗		⊗	⊗
B	●	●	⊗	⊗			•
C	⊗	●	⊗	•	⊗	⊗	•
D	⊗	•	⊗	•	•	•	⊗
E	●	●	●	●	●	●	⊗
F	⊗	⊗	●	●	⊗	⊗	●
Consistency	0.97	0.98	0.98	1.00	0.98	1.00	0.97
Original coverage	0.09	0.11	0.14	0.08	0.23	0.37	0.08
Unique coverage	0.06	0.07	0.12	0.05	0.08	0.22	0.05
Consistency of solutions				0.99			
Coverage of solutions				0.86			

Large circles(●) represent core conditions. Small circles(•) represent peripheral conditions; "⊗" signifies that the condition is absent. A blank space indicates that the condition may either be present or absent.

The sufficiency analysis yielded seven configurational pathways. Each configuration exhibits a consistency exceeding 0.9, which demonstrates high level of explanation(Fiss, 2011). Based on the above analysis, our study summarizes three types of driving pathways for the collaborative governance of urban renewal projects.

(1) Institutional embedding pathways of collaborative governance

The institutional embedding of collaborative governance pathways (H1 and H2) reflects a collaborative governance logic centered on formal institutions and public authority. In the H1 pathway, government safeguards public participation and facilitates interest coordination among multiple stakeholders. The H7 pathway indicates that governments reduce blame shifting and strategic gaming among stakeholders by clarifying responsibility boundaries and benefit distribution.

(2) Consensus-building pathway of collaborative governance

H3 and H4 can be regarded as a consensus-building pathway of collaborative governance. This pathway emphasizes the establishment of transparent information sharing and reasonable benefits distribution mechanisms. Reasonable benefits distribution reduces conflicts arising from asymmetric costs and returns, and reinforces stakeholders' willingness to engage in open communication. Through continuous and transparent information exchange, diverse stakeholders can gradually develop shared understandings of project objectives and risk-sharing arrangements, which in turn facilitates collective action.

(3) Incentive integration pathway of collaborative governance

The incentive integration pathway (H5 and H6) highlights economic incentives and project value redistribution among multiple stakeholders. Diversified financial support reduces uncertainty in project implementation and enhances stakeholders' commitment. Meanwhile, well-designed benefit-sharing mechanisms mitigate relationship conflicts by clarifying how costs, risks, and returns are allocated across stakeholders, thereby strengthening cooperative expectations.

4 Implications

4.1 Theoretical implications

This study employs LLMTopic modeling and fsQCA method to systematically uncover the interactions among various influencing factors and their collective effects on the collaborative governance of urban renewal projects. Compared with traditional topic modeling methods, LLM-based topic clustering demonstrates stronger semantic understanding and contextual sensitivity. LLMTopic modeling reduces reliance on predefined vocabularies and improves the robustness of topic extraction in complex, multidisciplinary research domains. The fsQCA method overcomes the limitations of traditional regression analysis in handling complex causal relationships, which offers a more comprehensive perspective for understanding the systemic interactive mechanisms within urban renewal projects. Furthermore, this study extends existing governance frameworks by identifying three configurational pathways—institutional embedding, consensus-building, and incentive integration. The classification enhances the understanding of the multidimensional coordination mechanisms in urban renewal projects and provides strategic guidance for urban

renewal project practice.

4.2 Management implications

The findings offer practical insights for policymakers and practitioners seeking to enhance collaborative governance in urban renewal projects. The institutional embedding pathway highlights the pivotal role of governments not only as regulators but also as facilitators of transparency, participation, and interest alignment. Strengthening resident participation channels and information disclosure mechanisms reduces coordination costs and stakeholder conflicts. Moreover, the consensus-building and incentive integration pathways suggest that clearly defined responsibilities, transparent communication, and benefit-sharing mechanisms are critical for sustaining collaboration in projects with high stakeholder heterogeneity. Practitioners should pay attention to aligning incentives and clarifying authority boundaries to prevent governance fragmentation.

4.3 Limitations and future research

This study investigates the influencing factors and configurational pathways for the collaborative governance of urban renewal projects. Nevertheless, this study is subject to several limitations. This study relies on questionnaire-based data collection, which may be influenced by respondents' subjective perceptions and value preferences. Additionally, cross-sectional data often struggle to reveal the evolution process and causal temporal relationships of collaborative governance among diverse entities at different stages of urban renewal. Future research could be strengthened by incorporating longitudinal data and in-depth case studies to further complement and refine the findings.

Acknowledgments

This project was supported by the National Natural Science Foundation of China (Project No. 72271180)

Reference

Chou, J.-S., Chang, Y.-H., Molla, A., & Chong, W. O. (2023). Determining critical success factors for residential reconstruction in the urban city from the perspective of developers. *Sustainable Cities and Society*, *99*, 104977. https://doi.org/https://doi.org/10.1016/j.scs.2023.104977

Di Paola, N., Chari, S., Iannacci, F., & Kraus, S. (2025). Configurational theory in business and management research: Status quo and guidelines for the application of qualitative comparative analysis (QCA). *Technological Forecasting and Social Change*, *211*, 123907. https://doi.org/https://doi.org/10.1016/j.techfore.2024.123907

Fiss, P. C. (2011). Building Better Causal Theories: A Fuzzy Set Approach to Typologies in Organization Research. *Academy of Management Journal*, *54*(2), 393-420. https://doi.org/10.5465/amj.2011.60263120

Jiang, l., Lai, y., Guo, r., Li, x., & Hong, w. (2024). The Spatial Variation of Market-dominated Urban Renewal and Influences of Government Factors:A Case Study based on the Urban Village Reconstruction in Shenzhen. *Southern Construction*(07), 1-10. https://cfffgee62dc72a18c4273s6nxf0vn9n0n66pucfgfy.eds.tju.edu.cn/urlid/44.1263.TU.20240424.1128.004

Liu, N., & Zhang, L. (2024, 4-8 Aug. 2024). Research on Network Relationships and Collaborative Governance of Multiple stakeholders in Urban Renewal. 2024 Portland International Conference on Management of Engineering and Technology (PICMET),

Liu, N., & Zhang, L. (2026). From ethical tensions to value co-creation in project networks: Exploring the mediating role of moral reflexivity and the moderating role of network embeddedness. *International Journal of Project Management*, *44*(1), 102799. https://doi.org/https://doi.org/10.1016/j.ijproman.2025.102799

Ragin, C. (2008). Redesigning Social Inquiry: Fuzzy Sets and Beyond. *Bibliovault OAI Repository, the University of Chicago Press*. https://doi.org/10.7208/chicago/9780226702797.001.0001