

# A Study on the Framework for Spatial Performance Evaluation of Small Township Mergered

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**Abstract:** A spatial performance evaluation system was built to identify the effectiveness and problems of the small township mergered systematically and accurately. Based on the evaluation criteria of efficiency, equity and bottom line, KPI method is used to establish a four-level (goal - field - element - index) spatial performance evaluation framework for withdrawal and merger at regional and individual scales respectively. Two sets of index systems for regional small town groups and small town individuals respectively which are interconnected are established in the four fields of “system-policy”, “space-land”, “society-economy”, and “security-guarantee”. It provides a new idea and a practical technical model for the ex ante forecast, ex post evaluation and adjustment feedback about the formulation and implementation of small towns related policies.

**Keywords:** Small Township Mergered, Spatial Performance, Evaluation Framework.

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## 1. Introduction

The merger and adjustment of small towns is a method of administrative unit restructuring at the grassroots level, implemented as a significant decision by local governments. It inherently reflects the policy attributes of regional coordination and addresses the issues arising from the uneven development between individual small towns. The merger and adjustment process is not an end in itself, but rather a means to promote the healthy and high-quality development of regions and small towns. Currently, under the development concept that emphasizes social equity, both national and local governments provide relatively equal development opportunities and conditions for small towns. However, due to insufficient research on the development characteristics of the regions in which these small towns are located, as well as the hierarchical and differentiated development conditions of the small towns themselves, future development spaces, and directions, many small towns that have undergone mergers continue to blindly use more developed towns as models. They tend to evaluate their development based solely on indicators such as GDP and urbanization rates, leading to fragmented development within towns and increasing issues of unhealthy competition, low-quality homogenization, and structural similarity. These problems severely impact the healthy development of small towns and hinder their scientific and synergistic growth within the regional space. Therefore, there is a need for a clear theoretical analysis and scientific description of the spatial development issues of small towns under newly established administrative systems after mergers, in order to provide theoretical guidance and technical references for government decision-making and grassroots practice in selecting appropriate development strategies.

In recent years, performance research has gradually been introduced into spatial studies to assess spatial utility. Scholars mainly focus on the spatial performance of cities, urban clusters, or the various components that constitute them, exploring the relationship between the physical structure and form of space, and the development levels of the social, economic, land use, transportation, and ecological elements it

carries within a certain geographical scope. This research adopts performance evaluation methods to examine urban spatial utility. Given the current trend of small towns gradually integrating into metropolitan areas and their respective regions, and based on the development tasks of central cities, small towns post-merger often faces challenges in top-level decision-making regarding resource aggregation and migration due to the scale-efficiency preferences of decision-making departments. Moreover, there is a lack of precise understanding of the spatial performance issues related to small town mergered, as well as a scientific analysis and judgment of the complex and dialectical relationship between town contraction and development. As a result, these towns are often in a disadvantaged position or trapped in negative development scenarios. Therefore, systematically quantifying, describing, evaluating, and analyzing the spatial performance of small township mergered is crucial for providing scientific and reliable tools for resolving key issues in regional coordinated development. This analysis will also serve as a reference for guiding the high-quality development of small towns post-merger, as well as the dynamic allocation of urban and rural resources across entire regions, thus offering significant practical value and relevance.

## 2. Literature References

Research on spatial performance is no longer a novel concept in the field of urban and rural planning. In 1985, the economic significance of urban spatial structure was first discussed by Rao Huilin, marking the intellectual inception of spatial performance research in China. This early focus on performance primarily centered on the relationship between the spatial structure of cities, urban clusters, metropolitan areas, and economic performance. It was not until 2006 that Wei Yaping and Zhao Min [1] first introduced the concept of urban spatial performance, marking the formal foundation of research in this field. Since 2011, research on spatial performance has rapidly increased, with quantitative analysis becoming standard. During this period, the focus of research expanded beyond urban and regional town clusters to include a broader range of topics, such as green spaces, buildings, and

industrial land within cities. Scholars have primarily concentrated on urban, metropolitan, and urban cluster scales [2-3], exploring spatial performance across multiple dimensions, including socio-economic factors, land use, policy systems, and ecological environments. These studies have developed a series of evaluative frameworks and indicator systems [4-5], which offer valuable references for the present study. It is worth noting that in 2019, Ren Xiaojian and Chen Xiaojian [6], guided by spatial economic performance, proposed optimization methods for urban land use layout, applying the results of performance research to guide spatial planning practices, a highly practical contribution. Bai Yu et al (2023) [7], using Tianjin as a case study, improved the "triangle model" to assess the balance of urban spatial performance, refining the measurement model. Cheng Yao and Wang Qixuan (2024) [8] built a framework for evaluating land spatial development performance, responding to new demands in national land spatial planning. Clearly, spatial performance evaluation is not an end in itself but a tool for gaining a precise understanding of the characteristics and issues of the research subject.

In conclusion, the theoretical framework of urban spatial performance research is relatively rich in terms of practical outcomes. Although research in China began later than in some other countries, the depth of study has gradually increased, and quantitative research is beginning to emerge. However, most studies have focused on the urban core areas of large cities, with little attention given to the surrounding urban regions, and even less to small town clusters. Currently, the application of quantitative evaluation techniques to research on the spatial development issues of small towns has not yet been sufficiently explored.

### 3. Methods and Data

Small towns, as central units within a defined region, possess dual attributes: one is relative independence, meaning the ability to maintain internal balance within a relatively stable geographical space; the other is dependency, as small towns are an essential part of the national economy and the functional division of the urban system. Considering the balancing pull of these dual attributes in the development of small towns, their merger and adjustment involve not only changes in the internal spatial performance of individual towns but, more importantly, impact the overall spatial performance of the urban and rural regions they inhabit. Therefore, the spatial performance of small town merged is highly complex and multifaceted, representing dynamic spatial effects across various domains, such as economy, society, transportation, land use, and ecology, resulting from the interactive mechanisms of spatial restructuring and scale reorganization in regional small towns. The evaluation of such performance measures the achievements, effects, and efficiency of the institutional mechanisms of rural town reform in the spatial resource allocation of regional small towns, making it an extremely complex and systematic project. To address the limitations of existing research, which tends to focus on types and case studies, and considering the obvious commonalities across different samples under the same policy, this study adopts the Key Performance Indicator (KPI) method. This approach moves beyond the micro-level complexities and specific differences of small town merged, focusing on the key objectives, domains, elements, and indicators within a shared framework, and aims to answer key strategic and structural questions regarding the effectiveness

of policy implementation.

Based on the core orientation and key features of KPI evaluation, the principles for selecting spatial performance evaluation indicators for small town merged are strategic orientation, dynamism, refinement, and operability. There are numerous methods for selecting evaluation indicators. To further refine the key performance elements, the selection of key performance indicators follows the above principles, striving to minimize the influence of subjective judgment. To objectively evaluate spatial performance and accurately reflect the current characteristics, the selection of specific indicators utilizes theoretical analysis, frequency statistics, and expert consultation methods. Additionally, considering the objective needs of spatial performance evaluation for small town merged, risk orientation, and the distinct characteristics between small towns and cities, this study constructs an evaluation indicator system.

The research begins with a literature review method to compile entries related to spatial performance evaluation indicators. The main data sources for the literature are from China National Knowledge Infrastructure (CNKI). The research uses the terms "spatial performance" as search keywords, employing both thematic and keyword-based search methods, including Master's and PhD theses, as well as journals indexed in SCI, EI, Peking University Core Journals, CSSCI/CSCD databases. After gathering and filtering, 119 relevant papers and 45 theses were collected. Furthermore, the selection of evaluation indicators includes a risk recognition orientation. Using the same approach, relevant indicators for risk recognition and assessment were searched, and some recently published works were incorporated into the reference sources. Entries related to spatial performance evaluation indicators were manually screened. The study categorizes indicators based on frequency of occurrence: high (appearing more than 5 times), medium (3–5 times), and low (appearing fewer than 3 times), and compiles them accordingly. This leads to the selection of a series of bidirectional evaluation indicators that assess both performance levels and potential risks.

## 4. Construction of the Hierarchical Framework for Spatial Performance Evaluation

### 4.1. Evaluation Dimensions

Performance primarily considers whether maximum benefits in economic, social, ecological, and other aspects are achieved with minimal input. Given that the merger and spatial evolution of small towns are influenced by the dual effects of "driving forces" and "risks," this study suggests that the spatial performance of small town merged should be evaluated based on efficiency, fairness, and minimum standards as fundamental criteria and guarantees. Through the analysis of whether the merger of small towns promotes development, ensures fairness, and upholds minimum standards, the study identifies areas where policy objectives have been successfully achieved or where significant issues persist. Therefore, the key dimensions for evaluating the spatial performance of small town merged include the following: "Institution-Policy" dimension; Basic Dimension: "Land-Space" dimension; Core Dimension: "Social-Economic" dimension; Important Dimension: "Security-Protection" dimension.

## 4.2. Hierarchical Framework of the Evaluation System

The original purpose of the merger of small towns (or townships) was to reduce administrative costs, strengthen public service functions, and effectively meet public needs and development demands in rural areas. The key performance issue lies in whether these original objectives have been achieved. However, today, the merger of small towns must also align with the new national development strategies of "new urbanization," "urban-rural integration," "ecological civilization construction," "rural revitalization," and "food security." Consequently, the key areas for successful implementation and risk categories of these policy strategies have expanded significantly in terms of dimensions. Thus, this evaluation aims to examine the degree of implementation and sustainability of small town merged, addressing issues such as: Spatial-Land Issues: Whether

mergers have occurred; whether the post-merger scale meets the target requirements; and whether they promote the aggregation of spatial elements. Institution-Policy Issues: Whether mergers help reduce administrative costs and enhance public service functions in towns. Social-Economic Issues: Whether the merger effectively meets the public needs and development of town residents, and whether it promotes urban-rural integration (economically, socially, culturally) post-merger. Additionally, whether it reflects fairness and cares for vulnerable groups. Security-Protection Issues: Whether the merger supports ecological conservation and ensures food security. This framework integrates the theoretical analysis of small town merged spatial performance, the identified levels and mechanisms, and aligns with the issues that the evaluation needs to address, forming the hierarchical framework for this spatial performance evaluation (Figure 1).

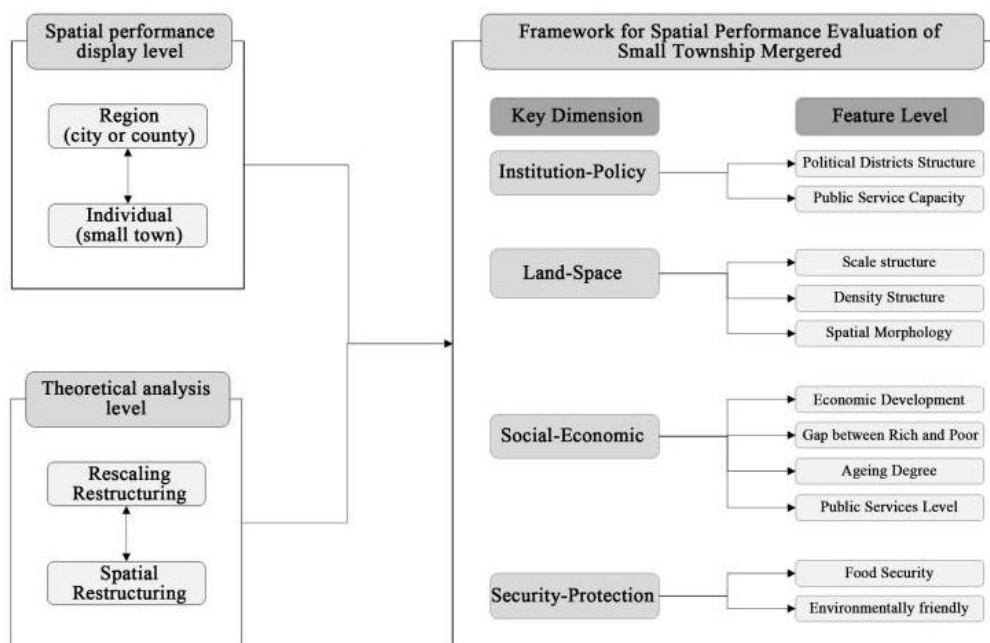


Figure 1. Idea diagrams of framework for spatial performance evaluation of small township merged

## 5. Construction of the Indicator System

Based on the principles for selecting indicators, this study constructs a preliminary indicator system by extensively reviewing domestic and international literature on spatial performance and quantitative evaluations of small towns. This review includes comparative analysis with indicator systems for livable small towns and key national economic and social development indicators. Using frequency statistics, high-frequency indicators are selected, and for those indicators that are not suitable for the characteristics of small

towns, corresponding adaptations are made. Subsequently, the Delphi method is employed to conduct expert interviews and consultations with township officials, incorporating iterative feedback until a consensus is reached, resulting in an optimized indicator system. Additionally, considering that the KPI method should form relevant corresponding evaluation indicators at the departmental (or individual) level based on the organizational-level evaluation system, this study determines the spatial performance evaluation indicators for small town merged at the individual township level, building on the indicators established at the municipal and county levels (Table 1).

**Table 1.** List of Transformation of Spatial Performance Evaluation Indicators for Unit-level Withdrawal and Merger in Small Towns (Key Indicator Level)

Regional Level		Town Level	
Key metrics	C	Key metrics	C
Total number of townships	C1	Total number of village and neighborhood committees	C1
Proportion of organized towns	C2	Proportion of neighborhood committees	C2
Ratio of government revenue and expenditure	C3	Ratio of government revenue and expenditure	C3
per capita investment in fixed assets	C4	per capita investment in fixed assets	C4
		Number of featured demonstration projects or titles	C5
The average land use size of the township	C5	Scale of township land use	C6
The proportion of townships with more than 50,000 people	C6		
Township density of 100 square kilometers	C7		
Average population density in townships	C8	Average population density in townships	C7
Fractal dimension	C9	Fractal dimension	C8
Shape index	C10	Shape index	C9
Aggregate index	C11	Aggregate index	C10
Connectivity Index	C12	Connectivity Index	C11
Per capita GDP	C13	Per capita fiscal income	C12
Relative labor productivity of secondary and tertiary industries	C14		
The ratio of investment in fixed assets to GDP	C15		
Ratio of income of urban and rural residents	C16	Per capita (disposable) income of farmers	C13
Proportion of the number of people enjoying the minimum subsistence allowance for residents	C17	Proportion of the number of people enjoying the minimum subsistence allowance for residents	C17
Proportion of residents aged 60 (or 65) or older	C18	Proportion of residents aged 60 (or 65) or older	C14
Number of hospital beds per 1,000 people	C19	Number of hospital beds per 1,000 people	C15
(Middle) primary school density	C20	Primary school density	C16
Proportion of administrative villages with running water	C21	Proportion of people participating in medical insurance	C18
Rural public transport accessibility	C22		
Cultivated land area per capita	C23	Cultivated land area per capita	C19
Food production per capita	C24	Food production per capita	C20
Ratio of forest cover	C25	The number of natural and cultural characteristic resources at or above the municipal level	C21
The rate of reduction in energy consumption per unit of GDP	C26		

In conclusion, this study argues that the construction of the spatial performance evaluation indicator system for small town merged should fully consider both the objective reflection of the post-merger spatial development outcomes and the identification of existing issues and latent risks. For example, indicators such as the total number of townships, the proportion of established towns, average land size per township, the proportion of townships with populations over 50,000, township density, and population density reflect the political-administrative structure, scale, and density. These indicators are used to evaluate the spatial development outcomes of small town merged, particularly the spatial distribution, morphology, and structural evolution within the city. Additionally, four major indicators related to spatial morphology, indicators for food security such as per capita arable land and per capita grain yield, and environmental sustainability indicators such as forest cover and GDP energy consumption reduction are used to evaluate ecological risks in spatial evolution. Other indicators in the system, which reflect economic, social development, and public service levels, are aligned with the objectives, methods, and factors influencing small town merged, including scale reorganization, spatial restructuring, and spatial performance characteristics. Moreover, the selection of these evaluation indicators fully takes into account the political and governance demands of town merged, particularly in relation to the strategic goals of improving public service capabilities, service levels, and governance in small towns as emphasized by the state.

## 6. Conclusion

The merger of small towns not only has public policy implications but is also a crucial organizational strategy for local governments. Given that small town mergers embody both political authority and spatial representation, the effects generated during their interaction are reflected in spatial performance. Therefore, using spatial performance evaluation as a means to examine the small town merged policy is a suitable approach. In response to the limitations of existing research, which often focuses on specific types or cases, and considering the evident commonalities across different samples under the same policy, this study adopts the KPI method. The evaluation is based on three criteria: efficiency, fairness, and minimum standards, aiming to extract key goals, domains, elements, and indicators within a shared framework, while addressing the critical strategic and structural issues of policy implementation. The evaluation focuses on four main areas: "Institution-Policy," "Space-Land," "Social-Economic," and "Security-Protection," constructing an indicator system to assess the achievement of the strategic objectives of the small town merged policy. Considering the dual adaptability of the evaluation system to both small town clusters and individual towns, two slightly differentiated indicator systems are generated under the same overarching framework, tailored for municipal, county, and individual small town scales. This system provides a comprehensive framework and technical methodology for administrative reorganization at the small town level and spatial performance research, answering key strategic and structural questions

about policy implementation. It offers systematic and scientific technical support for ensuring the overall high-quality development of regional small towns.

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