A Study on the Path of Enhancing the Social-ecological System Resilience in Shrinking Small Towns in China

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Abstract
In 2022, China experienced its first population decline in decades, leading to an increasingly common phenomenon of urban and rural shrinkage. Small towns, under the dual pressures of the suction effect from larger cities and rural revitalization policies, face elevated development risks. This paper proposes pathways to enhance the resilience of the social-ecological system of shrinking small towns through the territorial spatial planning. These pathways include enhancing buffering capacity both within and beyond urban development boundaries, strengthening self-organisation at all levels, and improving learning capacity through dynamic assessment and adjustment. The aim is to proactively mitigate the risks faced by shrinking small towns, improve residents' quality of life, and offer insights for China's high-quality urbanization development and governance.

Keywords: shrinkage, small town, social-ecological system, resilience, territorial spatial planning

Full text

1. Introduction

Globalization has led to a reconfiguration of population distribution, increasingly resulting in the phenomenon of shrinkage (MARTINEZ-FERNANDEZ, C. et al., 2012), which is drawing scholarly attention at various scales. Scholars suggest that small towns, with weaker development conditions compared to larger cities, face more complex challenges due to shrinkage (Mayer, H. and Knox, P., 2010)(Atkinson, R., 2019)(Caselli, B., Ventura, P. and Zazzi, M., 2020)(Rogatka, K., Kowalski, M. and Starczewski, T., 2023).

China, a vast developing country, has a large number of small towns. Despite regional variations in development levels and potential (Liu, Z., Qi, W. and Liu, S., 2021), small towns generally have lower administrative levels and simpler functional structures compared to larger cities,

making them more vulnerable to internal and external risks. These towns also have smaller populations, economies, and land scales, which diminish their developmental momentum and attractiveness, increasing their risk of shrinkage (Chen, C., Luo, Z. and He, H., 2016). This is not only an issue in underdeveloped areas; even in developed regions such as the Yangtze River Delta and the Pearl River Delta, small towns are experiencing shrinkage (Lang, W., Deng, J. and Li, X., 2020)(Shan, J., Liu, Y. and Kong, X., 2020). Many shrinking small towns are long plagued by social, economic, and environmental risks, necessitating a shift in planning paradigms to address these risks. Since 2019, China's emphasis on new urbanization has repeatedly highlighted the need for "slimming and strengthening" shrinking small towns. As China's urbanization progresses from an intermediate to an advanced stage, the high-quality development of small towns is crucial for the healthy advancement of China's urbanization process.

Internationally, the issues of shrinking towns are increasingly recognized not merely as demographic or economic problems but require a comprehensive approach from a complex social-ecological perspective (Jin, H. et al., 2021)(Haase, A. et al., 2021)(Dona, W, G, T, C., Mohan, G. and Fukushi, K., 2022). As the concept of "resilience" has expanded from ecology to urban and rural planning, "resilient planning" has become a global focus (Folke, C., 2006). In 1999, the Resilience Alliance, an international research organisation from multiple disciplines, was established to conduct interdisciplinary research on the resilience of social-ecological systems worldwide, achieving significant results (Resilience Alliance, 1999). Planning concepts based on the resilience of social-ecological systems are crucial for addressing the challenges faced by China's shrinking small towns. Therefore, it is necessary to develop territorial spatial planning approaches for these towns that enhance social-ecological system resilience, promoting regional high-quality development through scientific planning methods.

2. The Significance of Enhancing the Resilience of Social-Ecological Systems in Shrinking Small Towns

Shrinking small towns face significant risks, with some experiencing various crises in economic, ecological, and social aspects. Addressing the sustainable development of shrinking small towns is an urgent issue. To promote harmonious development between humans and nature, many scholars have begun to understand human-environment relations from a resilience perspective, leading to the emergence of the concept of resilience in social-ecological systems that integrates natural, economic, social, institutional, and cultural characteristics. The Resilience Alliance defines the resilience of social-ecological systems as the capacity of the social subsystem, the ecological subsystem, and their interactions to absorb disturbances, reorganize, and fundamentally maintain the same structure, identity, and feedback mechanisms under change (Walker, B., Gunderson, L. and Quinlan, A., 2010). International experiences show that shrinkage does not necessarily lead to decline but can also present an opportunity to optimize urban system functions (Fitton, J. et al., 2021)(Wirth, P. et al., 2016). High resilience in social-ecological systems is typically recognized by three characteristics: achieving positive outcomes despite high risks, maintaining capabilities under threatening conditions, and

recovering from shocks and stresses (Kerner, D. and Thomas, J., 2014). Resilience in social-ecological systems emphasizes transformation and innovative potential, including attributes of buffering capacity, self-organisation, and learning ability (Speranza, I, C., Wiesmann, U. and Rist, S., 2014). (Figure 1)

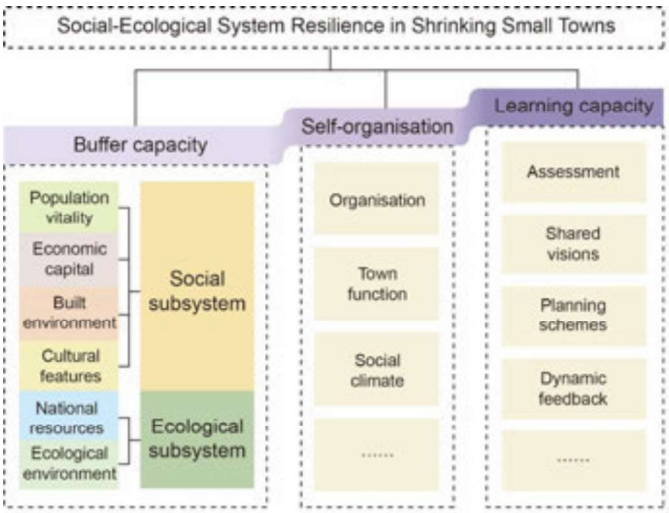

Figure 1: Attributes of the Social-Ecological System Resilience in Shrinking Small Towns

(1) Enhancing Buffer Capacity is Essential for Managing Complex Risks and Responding to Crises

Buffer capacity is the ability of social-ecological systems to withstand, absorb, and maintain their functions and structures when faced with risks (Carpenter, S., Walker, B. and Anderies, M, J., 2001), which is essentially their stability against shocks. Shrinking small towns, with their smaller scale and simpler functions, have relatively lower capacities to resist internal and external risks. Additionally, the increasing severity of climate change brings potential threats such as meteorological disasters, crop reductions, infrastructure damage, and outbreaks of infectious diseases (Haines, A. et al., 2006). On one hand, shrinking small towns need to uphold the functions of maintaining regional food and ecological security; on the other, they must seek stability and development amidst various crises. Modifying elements such as the infrastructure, landscape, land use, aesthetics, and policies of small towns can enhance the buffer capacity of their social-ecological systems (Pickett, A, T, S. et al., 2013). This enhancement improves the towns' ability to react, adjust, and adapt to shocks and disturbances from both internal and external factors, preventing their fragile social-ecological systems from facing significant crises when tackling risk challenges.

(2) Enhancing Self-Organisation is a Key Approach to Improving the Quality of Shrinking Small Towns

Self-organisation refers to the forms, processes, and outcomes through which social structures and human behaviors allow social-ecological systems to function (Obrist, B., Pfeiffer, C. and Henley, R., 2010). The shrinkage of small towns may bring a series of negative impacts, yet there is a continuous increase in residents' demands for quality of life. Residents of shrinking small towns require more comprehensive town functions and better ecological environments. Although generally shrinking small towns have an average level of socio-economic development, the decrease in population frees up some resources and environmental capacity, offering opportunities for ecological restoration and enhancing the overall quality of the town. Enhancing the self-organisation of social-ecological system resilience emphasizes trust and effective interaction between decision-makers and users, requiring the integration of resources from various departments related to the development and construction of small towns. It is also necessary to consider the basic conditions of ecological resources, as well as the economic base of the town and the needs of its residents. This approach coordinates the relationship between human society and the natural environment, promoting the improvement of town services and the protection and rational use of natural resources. This leads to the enhancement of the well-being and quality of life for residents of shrinking small towns.

(3) Enhancing Learning Capacity is a Practical Necessity for Territorial Spatial Planning and Governance

The capacity for learning implies the transformation of knowledge into action through adaptive planning and management measures, thereby improving the performance of social-ecological systems (Armitage, D., Marschke, M. and Plummer, R., 2002). In the adaptive renewal cycle, the development stages of small towns can be divided into four repeating phases: periods of exponential change, periods of growing stasis and rigidity, periods of readjustments and collapse and periods of re-organisation and renewal (Folke, C., 2006). Traditional growth-oriented planning primarily focuses on the first two periods, often neglecting the last two periods, yet these are equally important for system development (Figure 2). The method to address shrinkage involves enhancing the learning capacity within the dynamics of shrinkage through continuous improvement via assessment alerts, planning regulations, and dynamic feedback, achieving balance and development to prevent the system from collapsing. Integrating the concept of enhancing resilience of social-ecological systems throughout the entire process of territorial spatial planning and management can promote the scientific formulation of assessment, planning, and governance strategies for shrinking small towns at various stages.

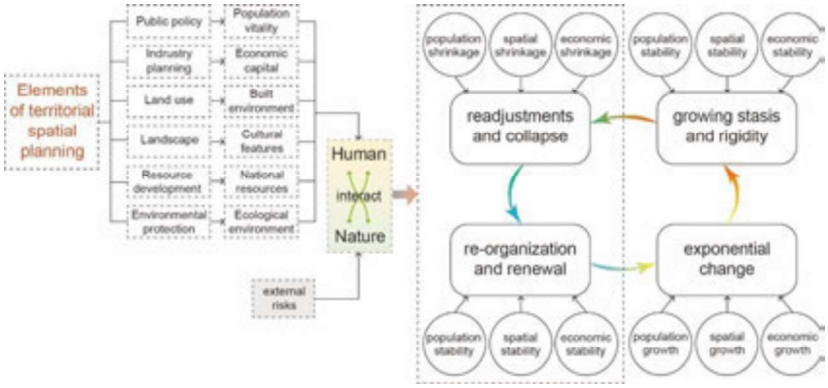

Figure 2: Relationship between Territorial Spatial Planning Elements and Enhancement of Social-Ecological Systems Resilience in Shrinking Small Towns

3. Pathways to Enhancing the Resilience of Social-Ecological Systems in Shrinking Small Towns from the Perspective of Territorial Spatial Planning

When the buffer capacity of a social-ecological system is stable, self-organisation is promoted, and learning ability continues to develop, the resilience of the social-ecological system is enhanced. The means to enhance the resilience of social-ecological systems in shrinking towns include introducing new technologies and industries, strengthening skills training, adjusting town sizes, enhancing cooperation between governments and enterprises, enhancing public participation, and providing external assistance when necessary (He, Y, S. et al., 2017)(Martínez-Fernández, C. et al., 2012)(Rosenman, E. and Walker, S., 2015)(Joo, Y. and Seo, K, B., 2018)(Leetmaa, K. et al., 2013)(Bernt, M. et al., 2013).

With the ongoing application of the results from China's third National Land Survey, the formulation of county-level and township territorial spatial planning will become a focus in the coming period. Therefore, scientific territorial spatial planning is a necessary means to enhance the resilience of social-ecological systems in China's shrinking small towns. Territorial spatial planning can comprehensively enhance the resilience of social-ecological systems in China's shrinking small towns through three pathways: enhancing buffer capacity, strengthening self-organisation, and developing learning capacity.

3.1 Differentiating Buffer Capacity Enhancement Within and Beyond Urban Development Boundaries

Territorial spatial planning emphasizes comprehensive control over all elements and areas. This approach involves differentiated management of spaces within the urban development boundaries and ecological and agricultural spaces beyond these boundaries. At the same time, it aims to enhance the capacity of the social-ecological system to cope with both internal and external risks. This is precisely where the comprehensive enhancement of buffer capacity for

shrinking small towns is targeted.
Within the urban development boundaries, the focus is on enhancing the ability to cope with risks to the social subsystem. This requires considering the current situation of population loss and demographic imbalance. Key areas of focus include talent policies, industrial development, land use, and landscape. Firstly, innovative mechanisms for attracting talent and strengthening vocational training should be implemented to boost the demographic vitality of shrinking small towns. Secondly, based on existing resource endowments, guide the diversified development of industries in these towns while also stimulating income growth for residents. Additionally, create an attractive built environment. Determine the appropriate scale of land use based on reasonable population projections. Towns with weaker development potential could trade surplus land quotas to other regions with greater development needs, alleviating fiscal debt while preventing inefficient land expansion. Inefficient and underutilized lands should be repurposed for service facilities and green spaces. Land degraded by industrial activities should be designated as ecological restoration areas to achieve improved urban functions, manage environmental pollution, improve living conditions, and enhance regional vitality. Moreover, special planning for towns with cultural characteristics should be carried out to fully exploit tourism resources and develop the tourism industry. Towns with weaker capabilities may apply for policy support and external capital to enhance the social capital of shrinking small towns and effectively cope with risks.

Beyond the urban development boundaries, the basic principle should be to protect the ecological environment and food security, enhancing the ecological subsystem's capacity to handle risks. In terms of natural resource management, pay attention to the development and control of non-construction land. Strictly implement controls for ecological corridors, water source protection areas, and other designated zones to protect the ecosystem services of shrinking small towns. Additionally, financial revenue can be increased through ecological compensation policies. For the natural resources of shrinking small towns, utilize excellent ecological and agricultural resources to cultivate cultural, educational, and scientific research functions, and develop ecological research and eco-tourism. In terms of ecological protection, promote the scale operation of agricultural land, improve the land inheritance mechanism, and prevent the abandonment of arable land. Enhance agricultural output while improving the livelihoods of farmers. Intensive and large-scale production and living modes also facilitate centralized municipal facility construction, reducing energy consumption and environmental pollution. High-quality natural resources and a good ecological environment form the ecological capital of shrinking small towns provide necessary support in times of risk.

Additionally, for towns particularly vulnerable to specific risks, special planning should be formulated, such as for managing mining subsidence areas and watershed ecological restoration. These plans should focus on addressing the most urgent risks faced by the towns and filling the gaps in their buffer capacity.

3.2 Strengthening Self-Organisation in Territorial Spatial Planning and Governance at All Levels

It is necessary to establish a well-defined organisational structure that ensures the smooth operation of small towns and fosters a harmonious social atmosphere. In China, county-level territorial spatial planning constitutes the "overall arrangement and comprehensive deployment" of land use, while township territorial spatial planning deals with the "specific arrangements" of land use purposes. Township planning plays a crucial role in transmitting and implementing the content of provincial and city-county level spatial planning to the township level, and in controlling and guiding rural planning. It is key to the new urbanization and high-quality rural development.

Thus, township-level territorial spatial planning plays a vital role in strengthening self-organisation. During the formulation, implementation, and management of territorial spatial planning, it is essential to coordinate governments at the city-county, township, and village levels and different departments such as environment, security, finance, industry, and agriculture. Encouraging local enterprises and residents of small towns to participate in decision-making is crucial to fully understand the challenges and development needs of different stakeholders.

Firstly, in implementing county-level territorial spatial planning, it is important to maintain the overall pattern of land use. Ensuring that ecological protection red lines and permanent basic farmland are inviolable maximizes the ecological and agricultural functions of shrinking small towns. At the comprehensive planning stage, township construction guidance according to county-level spatial planning should be studied. Based on the unique characteristics of different towns, cultivate distinctive industrial features and development directions to avoid homogeneous competition. Given the limited allocation of land quotas in shrinking small towns, territorial spatial planning should prioritize the allocation of construction quotas to industrial development land and public facilities. During the detailed planning stage, smart provision of functional spaces and facilities should be ensured, utilizing limited resources to improve the industrial and public service functions of small towns.

Additionally, in linking rural planning, township territorial spatial planning should guide the development directions of the villages it governs. The migration of rural populations to towns is an important process in urbanization, and the villages under shrinking small towns may also be undergoing shrinkage. In shrinking small towns with development potential, focus on cultivating industries, allocating service facilities, and guiding rural labour to converge in small towns. Lastly, cultural construction should be strengthened. Promoting local historical and cultural heritage through tangible and intangible carriers fosters cultural identity and belonging among small town residents, enhancing their participation in local development. By optimizing the town operation model through top-down transmission by decision-making bodies and bottom-up feedback from town users, the self-organisation of shrinking small towns can be strengthened.

3.3 Developing Learning Capacity through Dynamic Assessment and Adjustment

Having the learning capacity means that shrinking small towns can continually acquire

development experiences from other towns and integrate their own past experiences into current actions. Learning capacity includes aspects such as alerts, shared visions, planning schemes, and dynamic feedback. The concept of "smart cities," widely adopted globally and increasingly combined with artificial intelligence in recent years, greatly aids in enhancing the learning capacity of shrinking small towns.

In the knowledge identification stage, it is crucial to scan and obtain knowledge valuable for enhancing the resilience of shrinking small towns, including the visions of town users, historical data, and current data. Therefore, it is necessary to learn the collection and analysis technologies for integrated data, such as through government transparency platforms and social media to gather users' opinions on town development. After establishing a database for small towns, data analysis and simulation can be performed using computer deep learning techniques and other methods. Under the goal of enhancing social-ecological resilience, deduce key elements such as population and economic changes, land scale, and facility siting to form learning outcomes, which is territorial spatial planning. After evaluation and public participation, planning schemes can be transformed into statutory planning and practical actions. Statutory planning and planning actions become a knowledge-sharing process within the shrinking small town's social-ecological system, thus continuously updating users' visions for the town.

Territorial spatial planning is a dynamically evolving planning and management process, so it is essential to regularly check whether the learning outcomes effectively serve the goals. That is, during the assessment of territorial spatial planning, determine whether the implementation of the plan effectively supports the enhancement of resilience. Develop different indicators for different types of towns and continuously collect data on the effectiveness and issues in resilience enhancement through a normalized monitoring system. Timely transform new data into knowledge, iteratively update decision-making simulation algorithms, thus providing a basis for dynamic adjustments in planning. Also, scientifically arrange the sequence of tasks based on the supply and demand relationships revealed by the assessment results, gradually realizing users' visions. This increases the attractiveness of small towns, mitigates the desire of residents to move out, and attracts rural populations, enabling shrinking small towns to achieve sustainable development.

4. Conclusion

Due to factors such as industry, location, and policy, a number of small towns in China have experienced a continuous population decline. These small towns play a crucial role in linking urban and rural development. Scholars widely recognize that growth is not the only option for small towns. The concept of resilience in social-ecological systems, through a dynamic adaptive cycle, has emerged as an approach to address the challenges faced by shrinking small towns. In the phase of widespread county and township level territorial spatial planning in China, in-depth research on planning for shrinking small towns guided by the enhancement of social-ecological system resilience is of great significance. This paper suggests enhancing the resilience of the social-ecological systems in shrinking small towns from the perspective of territorial spatial planning. It proposes planning response pathways in terms of enhancing buffer

capacity, strengthening self-organisation, and developing learning capacity. The aim is to improve the linkage role of shrinking small towns in the regional urban system and to promote healthy regional development.

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