

From Phenomenon Identification to Governance Response: Research Domains, Agendas and Prospects for Shrinking Cities in China

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Abstract

Urban shrinkage in China has become increasingly visible and is accelerating, making shrinking-city research a frontier topic across urban and rural planning, geography, economics and management. This paper reviews Chinese scholarship over the past decade (2015-2024) to clarify directions and pathways for future research. It maps the field through three types of work, international experience, domestic empirical studies and theoretical discussion, and through three analytical levels, representations and causes, problems and mechanisms, and responses and pathways. On this basis, it summarizes major research progress and identifies two future orientations: deepening comparative research on international experience and its local translation, and advancing micro-level diagnosis and governance responses in domestic empirical research. The paper further proposes five key agendas: vacancy response, facility optimization, social equity, regional governance and planning transformation.

Keywords

Urban shrinkage; vacancy response; facility optimization; social equity; regional governance; planning transformation

Introduction

Shrinking cities have become an emerging field in Chinese urban and rural planning, geography, economics and management. In a broad sense, a shrinking city refers to an urban area experiencing population loss together with symptoms of structural crisis, such as economic recession, declining employment and social problems [1]. In China, scholarly attention to shrinking cities began with the Chinese translation of *Shrinking Cities* in 2012. Several representative review articles then appeared around 2015, including Gao Shuqi's literature review [2], Long Ying and colleagues' discussion of shrinking cities in China and their research framework [3], and Yang Zhenshan and Sun Yiyun's analysis of the phenomenon, process and problems of urban shrinkage [4]. These early studies marked the initial formation of a Chinese research field.

With China's population entering negative growth and urbanization moving into its "second half" [5], urban shrinkage has become more prominent and has continued to accelerate. Over the past decade, related research has moved from the introduction of concepts, international experience and phenomenon identification toward more refined conceptual work, characteristic analysis, pattern mining, problem diagnosis and locally grounded theoretical frameworks. Against this background, this paper maps the research domain, reviews major progress, assesses future trends and proposes key research agendas, with the aim of providing a reference for the further development of shrinking-city studies in China.

1 Basic Concepts and Approach

"Chinese shrinking-city research" can be understood in two senses. The first refers to research on shrinking cities in China, where Chinese cities constitute the object of analysis. The second refers to

research on shrinking cities conducted by Chinese academia, where Chinese scholars and institutions constitute the main research community. The two meanings overlap but are not identical. This paper adopts the second meaning. It therefore includes not only empirical studies of shrinking cities in China, but also Chinese scholars' research on international experience and their theoretical reflections on urban shrinkage.

The paper follows the analytical route of "mapping the domain, reviewing progress, judging trends and prospecting agendas." To construct the literature sample, Chinese-language articles were retrieved from CNKI using the topics "城市收缩" (urban shrinkage), "收缩城市" (shrinking city) and "人口收缩" (population shrinkage). The search was limited to CSSCI and Peking University core journals and covered the period from 1 January 2015 to 31 December 2024. After removing irrelevant documents, 281 articles were retained. English-language publications were retrieved from Web of Science using the topics "shrinking city" and "urban shrinkage"; the document types were limited to articles and reviews, the indexes to SCI and SSCI, and the author affiliations to Chinese institutions. This search produced 154 documents. Together, these sources form the basis for the following review.

2 Mapping the Research Domain

2.1 Research Types: International Experience, Domestic Empirical Studies and Theoretical Discussion

From its outset, shrinking-city research in China has been built on two foundations: the introduction of international experience and the development of domestic empirical studies. The former opened up a new research field and provided conceptual, methodological and practical references for recognizing urban shrinkage, identifying related phenomena and understanding common patterns. The latter provided the substantive basis for investigating China's own shrinkage processes. Between these two strands, theoretical discussion has been indispensable: it mediates the localization of international experience and provides an interpretive framework for domestic empirical findings.

Accordingly, Chinese shrinking-city research can be divided into three broad types: international experience, domestic empirical studies and theoretical discussion. Their development shows a pattern of "main and auxiliary tracks in parallel" and "progressive advancement." Domestic empirical research is dominant. Among the sample publications, 344 papers belong to this type, accounting for 79.1% of the total; their number increased from 5 in 2015 to 105 in 2024, with an average annual growth rate of around 40%. Most of them are macro-level data analyses. Research on international experience accounts for 55 papers, or 12.6%, with a relatively stable annual output of about six papers. It is mainly composed of case-based studies and review articles. Theoretical discussion accounts for 36 papers, or 8.3%, and is concentrated in two periods: the stage of early concept introduction, and the years after nearly a decade of accumulated research. Localized theory construction is the main component of this type.

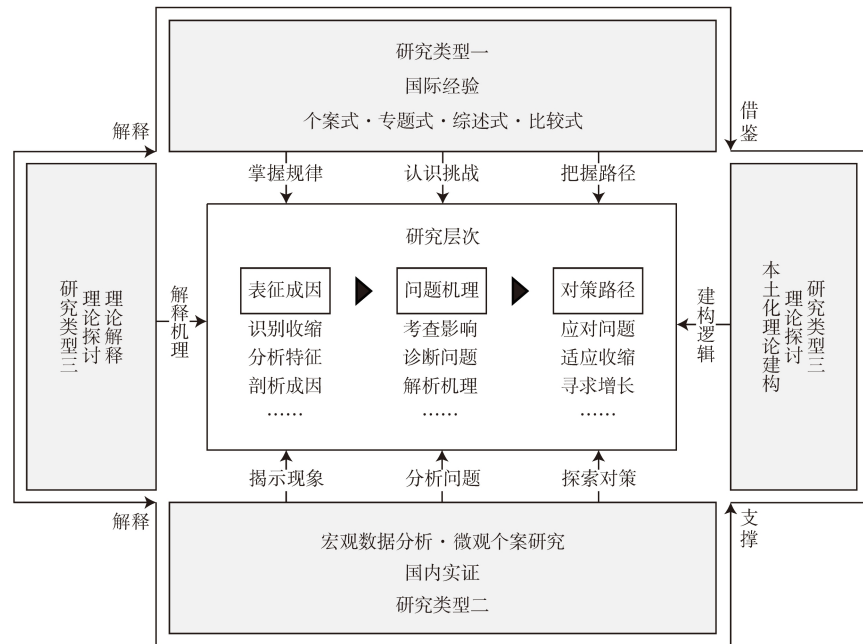


Fig. 1 Mapping of shrinking-city research in China

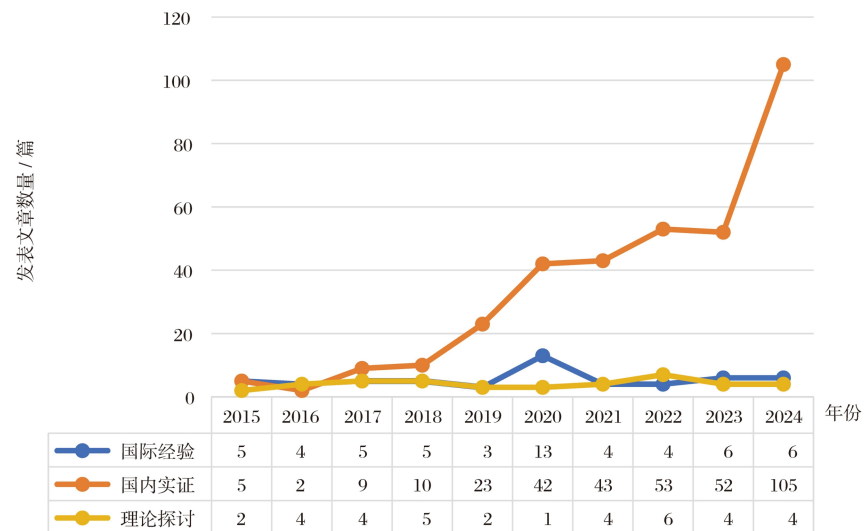


Fig. 2 Changes in the number of papers by research type

Table 1 Research types and subtypes in Chinese shrinking-city studies

Research type	Specific type	Description	Number of papers
Domestic empirical studies	Macro data analysis	Identifies shrinking cities or analyzes relationships among influencing factors at the macro scale, revealing patterns in population, economy, society and other	298

Research type	Specific type	Description	Number of papers
		dimensions across regions.	
Domestic empirical studies	Micro case study	Provides in-depth analysis of individual cases, reveals problems and causes generated by population shrinkage, and proposes responses.	46
International experience	Case-based study	Discusses one or several specific international cases.	21
International experience	Comparative study	Compares commonalities, differences and practical experience across countries or regions.	7
International experience	Thematic study	Conducts systematic analysis around a particular topic or problem.	6
International experience	Review-based study	Systematically reviews and summarizes international research and practical experience.	21
Theoretical discussion	Localized theory construction	Builds localized research frameworks and governance models through reflection on domestic research and practice.	32
Theoretical discussion	Theoretical interpretation	Uses existing theories to interpret development problems in shrinking cities.	4

2.2 Research Levels: Representations and Causes, Problems and Mechanisms, Responses and Pathways

Shrinking-city research is strongly application-oriented. It is driven not only by the question of what urban shrinkage is, but also by the practical question of what should be done. Across the three research types, the literature follows a broadly progressive logic: from representations and causes, to problems and mechanisms, and then to responses and pathways.

Research on representations and causes forms the starting point. It answers the questions of which cities are shrinking, how shrinkage is manifested and why shrinkage occurs. Research on problems and mechanisms constitutes the core. It investigates the effects of shrinkage, the problems it generates and the mechanisms through which these problems are produced. Research on responses and pathways is the ultimate objective. On the basis of recognizing representations and revealing problems, it seeks to construct systematic governance pathways.

In domestic empirical studies, the research focus has gradually shifted from representations and causes toward problems and mechanisms, and then toward responses and pathways. Studies of

representations and causes appeared earliest and remained dominant for many years, with 164 papers, or 47.7% of domestic empirical studies. Studies of problems and mechanisms have grown rapidly in the past five years, reaching 165 papers, or 47.9%; they surpassed studies of representations and causes in 2023 and rose sharply in 2024. Studies of responses and pathways remain limited, with only 15 papers in the last five years. Research on international experience and theoretical discussion broadly follows the same logic, although the emphasis differs across subfields.

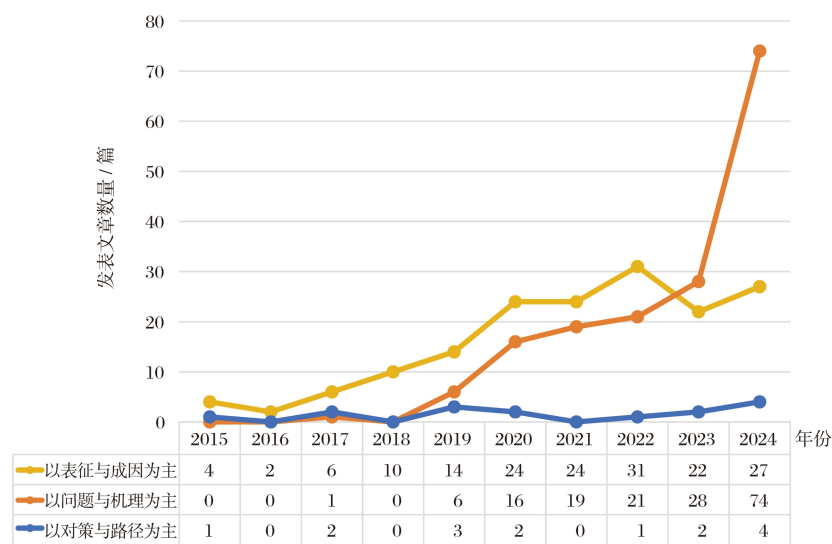


Fig. 3 Changes in the number of domestic empirical studies by research level

3 Reviewing Research Progress

3.1 Studies on Representations and Causes

Research on representations and causes builds the basic understanding of the external manifestations and internal drivers of shrinking cities. Over the past decade, domestic empirical studies have described the basic pattern of urban shrinkage in China through diverse research objects and multiple analytical perspectives. The main topics include conceptual definition, identification and measurement, spatio-temporal patterns and causal mechanisms. Together, they answer the questions of which cities are shrinking, how shrinkage unfolds and why it occurs.

Conceptual definition and identification are the preconditions for all subsequent research. Chinese scholars generally agree that sustained population loss is the core of shrinking cities, while economic, social, environmental and cultural decline constitutes the broader extension of the concept. Measurement has developed along two routes: single population indicators and composite indicators. The former emphasizes population loss as the essence of shrinkage, while the latter highlights the comprehensive effects associated with shrinkage. Research objects now cover multiple regions and scales, and identification methods have become more differentiated, diversified and technically complex.

Table 2 Identification and measurement systems in domestic empirical studies of shrinking cities

Indicator system	Judgment method	Data type	Judgment criteria
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Indicator system	Judgment method	Data type	Judgment criteria
Single population indicator system	Population change rate	Resident population	Negative growth of the resident population.
Single population indicator system	Population change rate	Resident population	Resident population growth rate lower than the regional total population growth rate.
Single population indicator system	Population change rate	Resident population and urban population	Negative growth of both resident population and urban population.
Single population indicator system	Population change rate	Resident population and registered population	Decline in both resident population and registered population for two consecutive years.
Single population indicator system	Population change rate	Resident population, total population and registered population	Continuous population loss for more than ten years, together with negative resident population growth.
Single population indicator system	Integrated change in population and nighttime lights	Population grid and nighttime-light data	Regression slope for population grids and nighttime-light DN values lower

Indicator system	Judgment method	Data type	Judgment criteria
			than 1.
Single population indicator system	Change rate of nighttime lights	Nighttime-light data	Decline in the ratio of illuminated area to identified area, or a fitted negative slope in nighttime-light radiation values over time.
Composite indicator system	Multidimensional cross-judgment	Population, economy and space	Potential shrinkage when population and space grow while the economy shrinks; significant shrinkage when economy and population shrink or decline while land-use space continues to expand.
Composite indicator system	Urban comprehensive development index	Composite development index	Composite evaluation based on population, economy, society and environment; decline in the index indicates shrinkage.
Composite indicator system	Two-step diagnosis	Population, economy, society, geography and related indicators	Step 1 determines

Indicator system	Judgment method	Data type	Judgment criteria
			whether population loss exists; Step 2 builds a comprehensive development index based on economic and social indicators to determine whether overall development declines.

After identification, many studies analyze the spatio-temporal pattern of shrinking cities using spatial autocorrelation, clustering and related methods. Existing research shows that shrinking cities in China are spreading and that the intensity of shrinkage is increasing [7]. Spatially, shrinking cities show marked regional concentration, especially in Northeast China and parts of central and western China, with an evolutionary trajectory that extends from Northeast China toward central and western regions [8].

Causal-mechanism research goes a step further. It has developed along three paths. The first uses qualitative interviews, surveys and case studies to reveal local processes. The second uses quantitative factor indicators and regression models based on identification results. The third draws on theoretical perspectives, including Marxist spatial political economy [10] and "space-behavior" interaction [11], to interpret the deep logic of shrinkage. The causes identified by existing studies include both internal factors, such as resource depletion, deindustrialization and industrial decline [12], and macro external factors, such as the spatial deprivation effects of capital choice and differentiated regional development under national strategies. The superposition of these forces forms the deeper structure and complex logic of urban shrinkage.

Overall, research on representations and causes has achieved substantial progress, but it also faces risks. Continuous innovation in data sources, scales, indicators and methods may lead to conceptual misuse or overextension. Problems remain, including confusion between "shrinking cities" and "urban shrinkage," inconsistent population data calibers, and mismatches between population statistics and territorial boundaries [13]. Future research therefore needs to move further toward the practical domain of "problems."

3.2 Studies on Problems and Mechanisms

The significance of shrinking-city research lies in the fact that shrinking cities face new problems that require solutions. Compared with domestic empirical studies, research on international experience paid earlier attention to problems and mechanisms, because it sought to summarize universal problems and

practical logics from cities that had already experienced shrinkage. Domestic empirical studies, by contrast, began with representations and causes and only later moved into the problem domain.

Existing literature can be summarized into four problem domains: spatial contradictions, comprehensive effects, human-centered concerns and policy challenges. Spatial contradictions are the most direct reflection of shrinkage. They usually arise from mismatches between people and land, spatial redundancy, vacancy, low efficiency and physical decline. Comprehensive effects refer to the "complications" generated through interactions among social, economic and environmental systems, including both negative impacts and the distinctive development laws of shrinking cities. Human-centered concerns focus on residents' attitudes, behavior and needs, and thus form the social basis of governance. Policy challenges concern the tools and practices used to respond to shrinkage; they highlight the fact that existing policies designed for periods of population growth may not fit the conditions of population decline.

International experience shows that shrinking cities often experience a chain reaction: economic restructuring leads to job losses, which trigger population decline, fiscal decline and eventually abandonment in the built environment [14]. Spatial contradictions caused by population shrinkage are particularly prominent, including vacant land and housing, surplus infrastructure, urban perforation and human-land imbalance [15-16].

Table 3 Main problem types in domestic empirical studies of shrinking cities

Problem type	Subtype	Explanation	Number of papers
Spatial contradictions	Spatial problems	Identifies problems such as low urban compactness and declining efficiency of construction land use.	25
Spatial contradictions	Problem spaces	Identifies vacant housing, low-efficiency space and related spatial problems.	25
Comprehensive effects	Diagnosing problems accompanying population shrinkage	Shows that population decline may suppress economic efficiency, public-service levels and firm innovation.	116
Comprehensive effects	Analyzing laws and characteristics of shrinking cities	Reveals features such as lagging urbanization, low urban vitality and significant negative effects on economic resilience.	116
Human-centered concerns	Residents' subjective perceptions	Measures residential willingness, satisfaction, health and related perceptions.	17

Problem type	Subtype	Explanation	Number of papers
Human-centered concerns	Social realities	Reveals heterogeneity in social infrastructure levels, social capital and related conditions.	17
Policy challenges	Policy effects	Examines heterogeneous effects of policies such as shantytown redevelopment and administrative-division adjustment.	7
Policy challenges	Effects of spatial resource allocation	Reveals the constraining effects of construction-land allocation on social and economic development.	7

Domestic research is now entering the problem domain more rapidly. Studies of comprehensive effects remain the largest group, while research on spatial contradictions has increased in recent years. Human-centered concerns and policy challenges have only begun to emerge. This indicates that the scope of problem-oriented research will continue to broaden, and that its direction will become more closely connected with governance practice.

3.3 Studies on Responses and Pathways

Responses and pathways constitute the point at which shrinking-city research returns to practice. This line of research asks what should be done. Because most domestic empirical studies remain concentrated on representations, causes, problems and mechanisms, systematic work on responses has so far appeared mainly in research on international experience and theoretical discussion; in domestic empirical research, it often appears as an extension of empirical analysis.

International experience has generated response strategies at three levels. At the macro level, comparative studies have examined policy adjustment, governance models and the shift from growth orientation toward vitality cultivation, smart shrinkage and compact development. At the meso level, studies have focused on spatial structure, layout optimization, planning systems and planning tools. At the micro level, research has examined vacancy response, vacant-housing management and reuse, land banks, temporary use and resident participation.

Theoretical discussion has first reshaped basic cognition. It argues that the land-finance and expansion-oriented logic that supported rapid urbanization cannot cope with shrinkage, and that China needs a spatial-governance pathway suitable for shrinking cities [18]. It has then explored localized strategy systems, including governance mechanisms, development factors and spatial planning. Through discussions of context-specific policy responses, multi-actor collaborative governance, stock optimization and structural adjustment, this literature has begun to form a theoretical framework and action pathway for shrinkage governance [19].

Domestic empirical response studies remain at an initial stage and can be divided into three forms. The first, and most common, is extended discussion after empirical analysis: after clarifying representations or problems, studies propose strategies related to industrial structure, public services and land use. The

second consists of case-based practice explorations that propose targeted pathways for specific cities. The third involves specific technical schemes, such as scenario simulation or spatial optimization for ecological priority and land intensification.

Table 4 Main response pathways in shrinking-city research

Dimension	Type	Response or strategy	Number of papers
International experience	Macro level	Smart shrinkage, compact development, governance models and related macro policies.	32
International experience	Meso level	Rational downsizing and compact planning; Japan's "compact + networked" spatial structure; Germany's planning pathway toward smart shrinkage.	16
International experience	Micro level	Land-bank systems, transfer of use rights, side-lot transfer, green infrastructure, temporary use and functional replacement.	7
Theoretical discussion	Basic cognition	Recognizing the inevitability and complexity of shrinkage, and shifting from traditional growth toward "small but refined" intensive development.	32
Theoretical discussion	Strategy system	Exploring multi-actor behavior; industrial transformation, resident welfare and social security; spatial optimization and vacancy-response models.	32
Domestic empirical studies	Extended discussion after empirical analysis	Proposes strategies based on factors such as population change, industrial structure, public services and land use.	329
Domestic empirical studies	Case-specific response	For small towns, optimizes the built environment to attract population; for resource-based towns, supports moderate development under protection.	12
Domestic empirical studies	Specific technical scheme	Explores conversion pathways between low-efficiency industrial land and green infrastructure.	3

Overall, research on responses and pathways is still in the stage of theoretical reserve and preliminary exploration. Much of it remains at the level of macro-level advocacy. International experience and theoretical discussion, however, have already provided important concepts and references, such as acknowledging shrinkage, using shrinkage adjustment to improve human-settlement quality [20], smart shrinkage, welfare-oriented governance, morphological control and the improvement of urban attractiveness [19].

4 Judging Future Research Trends

4.1 Deepening Comparative Research on International Experience and Local Translation

Existing Chinese research has laid an important foundation, but shortcomings remain in the interpretation of deep mechanisms, the assessment of the applicability of international experience and the construction of systematic governance paradigms. Future research needs to further combine international experience with domestic empirical studies, using theoretical discussion to guide the localization of international knowledge and the optimization of empirical research.

International experience remains crucial for understanding the latest trends in shrinking-city research and practice. Future studies should track the evolution of shrinkage under different institutional, economic and social contexts; identify problems that arise at different stages; and examine the policy and governance tools used in response. Such research can provide a richer repertoire of concepts, mechanisms and instruments for Chinese practice.

At the same time, international experience must be translated through comparison rather than copied directly. Future research should compare the development trajectories of different cities, analyze commonalities, differences and connections among them, and clarify the contextual factors that shape policy choices and implementation outcomes. On the basis of China's own realities, particular attention should be paid to issues that have been central in international experience, such as vacancy, facility redundancy and social equity, so that they can inform the governance of shrinking cities in China.

4.2 Advancing Micro-Level Diagnosis and Governance Responses in Domestic Empirical Research

Domestic empirical research will continue to move from representations and causes toward problems and mechanisms. Its problem domain will become broader, moving from data presentation to human-centered analysis and from technical guidance to policy concern. Future studies should identify more targeted problems and carry out risk assessment in relation to specific urban contexts.

Research also needs to shift from macro-level description to micro-level diagnosis. Macro data can reveal general laws and spatial patterns, but it is often insufficient for constructing the logic chain needed to guide practical governance. Future work should therefore strengthen micro-level risk diagnosis, bridge the gap between identification and response, and use case studies, fieldwork, interviews and mixed methods to understand how shrinkage affects everyday life, public services, local finance and spatial resources.

Finally, domestic empirical research needs to move further toward responses and pathways. It should answer the practical question of what should be done, support the construction of planning paradigms for shrinkage, and promote a shift from passive response to active adaptation. This requires exploration of adaptive spatial-optimization technologies, planning-control instruments and spatial-governance tools suited to shrinking cities.

5 Prospective Research Agendas

5.1 Vacancy Response

Urban physical space is often "easy to add but hard to reduce." Population shrinkage leads to spatial redundancy and vacancy, which can trigger a series of socioeconomic problems and threaten urban sustainability [21]. Vacancy identification, evaluation and reuse are therefore core topics in international shrinking-city research [22]. In China, related work has begun with the identification of vacant housing and the introduction of international experience [23-24], but a systematic research framework has not yet been formed.

Future research on vacancy response should address four questions: where vacancy occurs, why it occurs, what impacts it produces and how it should be governed. At the level of representations, studies need to diagnose the types, distribution and causes of vacancy. At the level of mechanisms, they should combine macro data with fieldwork to clarify the socioeconomic impacts of vacancy. At the level of response, they should localize international tools and conduct pilot studies in typical shrinking cities, so as to develop governance strategies that are both practical and context-sensitive.

5.2 Facility Optimization

Facility mismatch is another expression of the maladaptation between population and space. Unlike vacancy, it directly affects public welfare and the operation of urban society [25]. A mismatch between facility supply and demand may increase fiscal burdens, intensify social differentiation, and produce equity crises through school closures, medical-service contraction and the decline of other public services [26]. International studies have already explored tools for infrastructure and service adjustment [27]. In China, however, research remains limited, with only initial empirical work on accessibility and social impacts [28].

Future research should ask how and where facility mismatch occurs, what impacts it produces and how it can be addressed. At the level of representations, it should analyze facility layout, service capacity and supply-demand matching. At the level of mechanisms, it should assess socioeconomic impacts and examine the interaction between facility mismatch and population loss. At the level of response, it should optimize facility-allocation systems and explore governance strategies such as facility sharing, diversified financing and the adaptive reuse of idle facilities.

5.3 Social Equity

Social equity is a core value of modern governance and refers to the fair allocation of social resources and development opportunities [29]. In shrinking cities, facility mismatch and fiscal austerity may worsen the situation of disadvantaged groups, while some revitalization policies may further deepen class differentiation [27]. International research has gradually shifted toward a human-centered perspective, examining residential satisfaction [30], housing inequality and segregation [31], residents' policy preferences [32] and justice-oriented planning [33]. Chinese research has begun to explore residents' satisfaction and perceptions [34], but the topic remains underdeveloped.

Future research should clarify which groups are affected by shrinkage, why inequity occurs, how it is manifested, what impacts it produces and how it can be mitigated. At the level of representations, it should examine uneven allocation of both material and non-material resources, subjective satisfaction, and social and spatial differentiation. At the level of mechanisms, it should analyze how economic recession and policy intervention affect different groups and areas, and identify risks to social stability and well-being caused by resource deprivation. At the level of response, it should embed equity into

vacancy governance and industrial transformation, and localize tools such as vertical coordination, participatory planning and community empowerment.

5.4 Regional Governance

Spatial deprivation under globalization and national development strategies is an important cause of urban shrinkage. At the macro scale, it is expressed as the declining capacity of whole regions to attract and retain factors [35]. Responding to urban shrinkage therefore requires a perspective that goes beyond individual cities and turns toward regional governance. Internationally, cities and regions such as Liverpool and the Ruhr have pursued urban revival through regional coordination and economic rebalancing [27]. In China, the relationship between shrinkage and regional development has received attention, but systematic governance frameworks and practical strategies remain insufficient.

Unlike the preceding agendas, regional governance emphasizes nationally grounded institutional analysis and policy innovation. Future research should first identify the types and characteristics of different regions, then focus on key governance fields and construct differentiated strategies. In terms of type identification, studies should integrate the degree of population shrinkage, location conditions and factor-flow mechanisms to assess the potential and necessity of regional collaborative governance. In terms of governance fields, they should clarify the coordination effects of industrial transformation, employment environments and public-service provision [36]. In terms of strategy construction, they should translate international experience in functional redistribution and fiscal incentives, clarify the governance roles of different levels of government, and propose operable policy and institutional strategies suited to China's context.

5.5 Planning Transformation

Shrinking cities face structural crises such as population decline and economic recession. Existing growth-oriented planning paradigms cannot resolve these new problems and may even intensify imbalances in urban operation [37]. The United States, the United Kingdom and Germany have all experienced a cognitive shift from ignoring shrinkage to accepting it [38], as well as a practical shift from expansionary strategies to "planning for shrinkage" [39]. This indicates that the era of single-minded growth planning has ended [40]. Chinese scholars have recognized the need for transformation, but systematic technical pathways and policy tools remain inadequate.

China therefore needs to establish a new planning paradigm that adapts to urban shrinkage and fits national conditions. Research on planning transformation should not discuss planning in isolation. It must clarify development laws, define core value orientations and build a complete strategy system. In terms of development laws, studies should analyze how existing planning and governance systems operate under shrinkage and thereby clarify the logic of planning change. In terms of value orientation, they should coordinate the mitigation of negative impacts with long-term development goals, including active adaptation, economic revitalization and population regrowth. In terms of strategy systems, they should propose differentiated responses for different types and stages of shrinkage, optimize resource allocation, innovate control tools and build collaborative governance systems, thereby promoting a fundamental transformation of the planning paradigm.

6 Conclusion

Over the past decade, China's shrinking-city research has deepened and expanded continuously. It has moved from the early introduction of concepts and experience, to localized exploration of the

representations and problems of urban shrinkage, and then to preliminary efforts to construct theoretical frameworks suited to China's conditions. A shift from "growthism" toward intensive and endogenous development has become a broad scholarly consensus. This process has advanced concepts of urban governance and laid a foundation for more practice-oriented shrinking-city research.

Looking toward the next decade, China will face more complex demographic change, more refined social-governance needs and new opportunities for governance transformation brought by digitalization. It is therefore urgent to establish a new paradigm of "planning for shrinkage" and to move from passive response toward active adaptation. Future research on shrinking cities should develop broader and more specialized studies of international experience, deeper and more forward-looking domestic empirical research, and a more systematic theoretical and strategic framework, so as to support the sustainable and high-quality development of shrinking cities.

Notes

1. According to population data released by the National Bureau of Statistics, China's urbanization rate reached 65.2% in 2022. Urbanization has entered the "second half," a key transition from rapid development to maturity.
2. "Population shrinkage" is the core representation of urban shrinkage. Many related studies use this term as a keyword, so it was included in the search to ensure comprehensive coverage.
3. "Main component" refers to the content or orientation that occupies the core position in a study, that is, the dominant part among the three dimensions of representations and causes, problems and mechanisms, and responses and pathways. Although many studies overlap across types, they usually have a clear emphasis. For example, research focusing on the spatial distribution and evolution of shrinking cities takes "representations and causes" as its main component, even if it may extend to discussions of "problems and mechanisms" or "responses and pathways."
4. Existing studies have identified shrinking cities nationwide using census data for 2000-2010 and 2010-2020, finding that the number of shrinking cities increased by 86 in the latter decade, indicating an expanding scale of urban shrinkage [6]. Multi-indicator identification also shows that from 2009 to 2019, both the number and degree of comprehensively shrinking cities increased, with stronger spatial heterogeneity and clustering.

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