Research Paper

From Fragmentation to Coordination in Resource-Depleted Regions: A Study of Township Cluster Development in Huludao, China

LIU Jiewen; Department of Architecture, National University of Singapore, 148962, Singapore; e1351239@u.nus.edu

DU Chenqin; Department of Landscape Architecture, School of Architecture, China Academy of Art, Hangzhou, 310024, China; 2220953001@caa.edu.cn

ZHANG Wei; School of Fine Arts, Northeast Normal University, Changchun 130024, China; weizhang@nenu.edu.cn

Abstract

Resource-dependent regions are undergoing deep structural challenges as rapid urbanisation and global resource shifts accelerate. Their long-standing reliance on extractive has produced fragile spatial forms that rapidly deteriorate once resources decline, making the conventional urban led development model ineffective. These realities highlight the need to rebuild regional functions by activating township development potential and improving internal coordination. This study focuses on the structural value of townships, which serve as functionally important nodes connecting urban and rural systems, and therefore hold strategic significance for regional resilience. To enable this role, the study constructs a township cluster model that reorganizes fragmented rural settlements into coordinated, networked, and functionally differentiated clusters, supporting long term regional sustainability. Using Huludao in Northeast China as a case, the research follows a three-step analytical framework and defines three development scenarios: industrial collabouration, public service sharing, and tourism integration. The study first evaluates township capability and then analyses interaction, integrating these results to delineate township clusters, identify node hierarchy, and classify cluster types. These results inform spatial strategies and policy tools that enhance cluster coordination and support regional transition. The study contributes to current knowledge in three significant ways. It establishes a novel Capability Interaction Cluster framework that offers a structured pathway for reconstructing regional functions in post resource contexts. It develops an integrated method that combines multidimensional capability indicators with interaction-based cluster identification, providing a highly replicable approach for similar regions worldwide. Finally, it proposes planning and governance instruments that translate clusterisation results into coordinated and sustainable regional development.

Keywords

rural revitalization; resource-dependent region; Gravity Model; social network analysis

1. Introduction

Against the backdrop of accelerated urbanisation and the restructuring of global energy and resource systems, resource-dependent regions worldwide are facing increasing transition pressures. International assessments consistently show that economies dominated by extractive industries demonstrate greater structural vulnerability and slower recovery when exposed to energy transition and industrial substitution. OECD highlights that resource-based regions tend to experience prolonged stagnation due to their heavy reliance on coal, metal extraction, and upstream material processing (OECD, 2020), while the World Bank similarly notes that mono-industrial mining cities are among the most susceptible to economic decline and population loss under shrinking global fossil-fuel demand (World Bank, 2018).

China represents one of the world's largest clusters of resource-dependent areas. According to the National Plan for Sustainable Development of Resource-Based Cities (2013-2020), 126 of China's 333 prefecture-level cities (37.8%) are classified as resource-based, with nearly one-fifth of county-level cities falling into the same category (State Council, 2013). These cities rely heavily on coal, steel, cement, petrochemicals, and ferrous/non-ferrous metallurgy, forming development paths characterized by high resource dependence and limited sectoral diversification (Shuna & Zhaohuai, 2011).

Within these regions, townships play a critical yet vulnerable role. They serve as carriers of regional industries and as the connective tissue between urban and rural systems (Rai, 2012), but face growing challenges including weakening industrial momentum, homogeneous competition, shrinking labour force, and constrained public service provision. Therefore, exploring spatial reorganisation pathways capable of enhancing the resilience and functional integration of the township system has become a core issue for regional coordination and high-quality development in resource-depleted areas.

"Clusterisation" offers a potential development pathway for resource-recession regions. Its core lies in transforming originally fragmented, compartmentalized, and mutually isolated townships into township clusters characterized by structural organisation, functional division, and network association. This transformation aims to leverage agglomeration effects, coordinate cross-township resource allocation, promote the flow of factors, and drive regional industrial and spatial transition (Li et al., 2023). In recent years, exploration regarding spatial clusterisation has continued to increase, including concepts such as "township clusters" (Jia et al., 2017; Rai, 2012) and "rural clusters" (Gusmanov et al., 2022; Liu et al., 2024) and "coordinated urban-rural units" (Ye et al., 2013). Corresponding policy practices have also emerged in various countries (Institute for European Environmental Policy, 2001), such as Germany's Integrated Rural Development (Böcher, 2008), Belgium's Rural Cluster Development (Cabus, 2002; Messely, 2014), France's inter-municipal cooperation, UK's Rural Sub-regional Planning (Marshall, 2007; Pemberton & Shaw, 2012), and China's " coordinated urban-rural development planning" (Ye et al., 2013). These studies generally emphasize cross-boundary resource sharing, integrated planning, and service network strengthening. Meanwhile, techniques such as spatial analysis, social network analysis (SNA) (Richter, 2019) and cluster analysis(Liu et al., 2024) have been utilized to characterize the spatial patterns of township systems, providing important methodological tools for identifying governance units.

Despite the continued growth of relevant research, three distinct gaps remain. First, at the theoretical level, existing studies tend to emphasize the vertical dependence between townships and central cities, while neglecting the horizontal collabouration among townships as peer nodes. In fact, townships possess not only the endogenous capability to host industries, facilities, and services but also the network function and interaction to radiate resources and services to the surrounding rural hinterland. They are typical regional "mediators" (Simic & Bajcetic, 2016), yet their strategic value in regional transition has been significantly underestimated. Second, at the methodological level, current research often oscillates between single-dimensional analyses of either capability or interaction, lacking a comprehensive

technical route capable of integrating both township endogenous capability and interaction structures. Third, at the level of planning practice, the policy system for implementing township cluster development in resource-depleted regions remains weak. There is a lack of systematic pathways based on empirical identification, and specifically, a shortage of comprehensive strategy research on clusterisation tailored to townships in "resource-recession regions."

Based on the research gaps, this paper aims to construct a pathway for the clusterisation development of townships in resource-depleted regions. The specific objectives include: (1) constructing a theoretical framework for township clusterisation based on "Capability-Interaction"; (2) establishing a comprehensive identification method that integrates multi-dimensional capability indicators and interaction networks to delimit the boundaries and types of township clusters; and (3) proposing implementable, categorized cluster-based development strategies based on the identification results, so as to support spatial optimization and industrial transition in resource-depleted regions.

The structure of this paper is organized as follows: The first part is the introduction, presenting the research background, theoretical gaps, and research objectives; the second part elabourates on the research methods and data system; the third part presents the results of township cluster identification and engages in discussion; and the fourth part provides conclusions.

2. Methodology

2.1. Study Area and Dataset

This study focuses on Huludao City, Liaoning Province (see Figure 1). Situated on the southeast coast of Liaoning Province, Huludao is a typical resource-based city. Influenced by a long-term reliance on resource extraction, and with the depletion of reserves, the city has increasingly faced challenges such as a monolithic industrial structure, ecological degradation, and lagging public services, subjecting township development to multiple constraints. The selection of Huludao as the study area is primarily based on two reasons: First, there is a significant disparity between the eastern coastal areas and the western mountainous regions in terms of urbanisation levels, resource endowments, and industrial foundations, resulting in a diverse range of township types and development scenarios. Second, as a typical resource-depleted region, the shrinkage and transition dilemmas emerging at the township level possess a high degree of representativeness; studying this region helps summarize general patterns applicable to similar areas and provides actionable pathways.

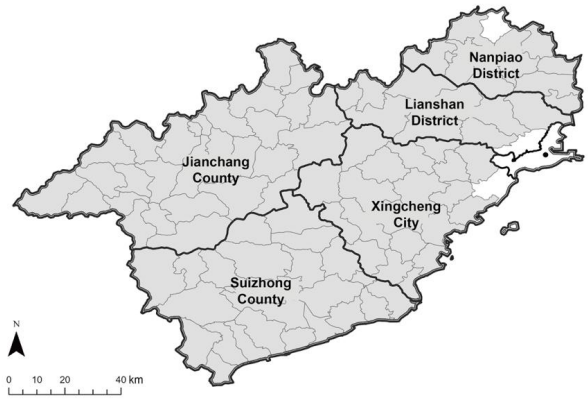

Figure 1. Study area. Source: Author.

Huludao City currently administers Lianshan District, Longgang District, Nanpiao District, Suizhong County, Jianchang County, and Xingcheng City, comprising a total of 90 townships. To ensure consistency in scale and the validity of the analysis, this study delimits the research scope to the township areas excluding the central urban district (Longgang District). The research data primarily consists of two categories (Table 1).

.

Category	Data Source	Usage
Statistical yearbook data	(1) China County Statistical Yearbook (Township Volume) (2019) (2) Liaoning Statistical Yearbook (2020) (3) Statistical Communiqué on National Economic and Social Development (district/county/township levels) (4) Seventh National Population Census	It supplements basic township-level indicators for functional analysis and Centrality Index construction
Publicly available data	(1) Nighttime light dataset for Huludao City (2020), resolution 1 km² (Li X.C., Zhou Y.Y., & Zhao X., Scientific Data, 2020, 7:168) (2) Road network data from open-source mapping platforms (3) Multi-category POI data (medical care, education, commerce, catering, culture, scenic spots, tourism, etc.)	It is used to characterize township economic vitality, public service capacity, and cultural-tourism resource distribution.

Table 1. Data sources and descriptions used in this study. Source: Author.

2.2. Research Framework

In the context of township shrinkage and transition, this study proposes a “Capability-Interaction” analytical framework for identifying township clusters (see Figure 2). The core idea of this framework is that the development potential of a township is determined not only by its internal functional endowments (capability) but also by its relational position within the regional network (interaction). Only by integrating these two dimensions can we reveal the actual operating mechanisms of townships within the regional system and, consequently, identify clustered units with genuine potential for coordinated development. The first stage is capability identification, which evaluates townships through three types of centrality, including industrial, public service, and tourism, to reflect their internal functional capacity. The second stage is Interaction identification. Through node centrality hierarchization, connection measurement and hinterland delineation, an interaction network among townships is established to reveal the radiation range and network structure of nodes at different levels. The third stage is Cluster delineation. Through a coupling analysis of the capability and interaction results, multiple township clusters possessing both functional characteristics and internal hierarchical structures are identified.

Dimension	Secondary Indicator	Tertiary Indicator	Calculation Method

Industrial centrality	Economic development level	Nighttime light intensity	Nighttime light value per pixel
	Industrial structure	Industrial development	Number of industrial enterprises
		Tertiary industry Development	Number of comprehensive shops or supermarkets with a business area ≥ 50 m²
Public service centrality	Basic conditions	Urban population size	Population density
		Land-use scale	Built-up land area
	Facility conditions	Road network density	Total road length per unit of land area
		Number of recreational facilities	POI count for dining, shopping, accommodation, leisure & entertainment, and sports & fitness.
		Number of comprehensive service facilities	POI count for transport, finance, education & culture, business services, daily services, and healthcare.
Tourism centrality	Cultural resources	Number of tourist attractions	Number of tourism-related POIs within the township
	Ecological conservation level	Forest coverage rate	Woodland area per total area
		Ecological service value	Gross ecosystem product

Table 2. Dimensions and indicators of the township centrality index. Source: Author.

2.3. Capability of Townships

To identify the functional status of each township within the regional structure, this study constructs a "Centrality Index" based on classical network centrality measures (Scott, 1991; Scott & Carrington, 2011). The index is measured across three dimensions: industrial centrality, public service centrality, and tourism centrality (Table 2). Industrial centrality reflects the township's capacity in industrial agglomeration, employment, and enterprise distribution; public service centrality measures the supply level and accessibility of facilities such as education, healthcare, and commerce; and tourism centrality captures ecological resources, scenic attractiveness, and tourism carrying capacity. Objective weights for each dimension are derived using principal component factor analysis, and standardized weighted calculations are applied to obtain centrality scores. These three dimensions jointly constitute township capability, and their integration forms the overall Centrality Index, which supports township hierarchization and capability classification. Finally, based on the three-dimensional centrality scores, the K-means clustering algorithm is applied to identify township capability types, including industry-dominant, public service-dominant, and composite types, providing a basis for subsequent cluster delineation.

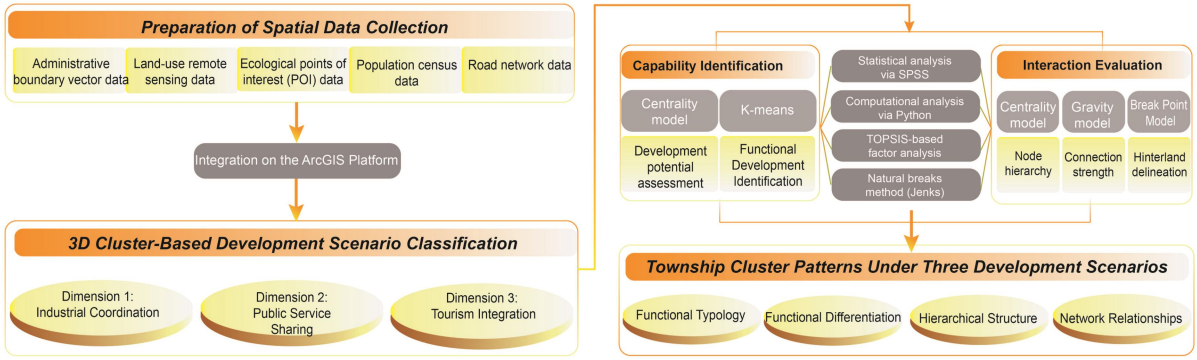

Figure 2. Research framework. Source: Author.

2.4. Interaction among Townships

The identification of interaction relationships follows the technical path of "measuring points—drawing lines—delineating areas" to systematically construct the township interaction network within the region. First, measuring points: Identification of node hierarchy. Based on the comprehensive Centrality Index, townships are classified using standard deviation to construct a hierarchical system of "primary centre—secondary centre—general township." This hierarchical system reflects the differences in the central status of different townships within the regional structure, providing a nodal basis for hinterland delineation and connection measurement. Second, drawing lines: Calculation of township connection strength. Adopting the Gravity Model, with the Centrality Index as the mass term and the shortest road network travel time as the friction term, the potential connection strength between any two townships is quantified. Thresholds are set according to connection strength quantiles to extract backbone connections and construct a multi-level township interaction network, thereby revealing the spatial flow structure and the degree of cluster cohesion within the region. Finally, delineating areas: Delineation of hinterland boundaries. Based on the Break Point Model and using township centrality levels and road network accessibility time as weights, Weighted Voronoi Polygons are generated to delineate the hinterland delineations of centres at various levels. The hinterland boundaries reflect the spatial scope of influence of central nodes on surrounding townships and serve as the spatial carrier for township clusters.

2.5. Cluster Delineation

Based on the results of Capability and Interaction, aggregated units possessing capability complementarity and close external ties are identified. Building on this, and integrating factors such as actual township administrative divisions, the continuity of geographical boundaries, and socioeconomic connections, necessary manual verification and adjustment are performed on the cluster boundaries preliminarily delineated by the model. This ensures the rationality and implementation of the cluster scope in terms of spatial logic and governance scale. Ultimately, multiple township clusters with distinct functional characteristics and clear internal hierarchies are obtained, laying the foundation for the subsequent typological classification and the formulation of development strategies.

3. Discussion

3.1. Capability Identification Results

To systematically reveal the functional differentiation of Huludao City's townships, this study examines three types of centralities—industry, public services, and tourism—to characterize the development capability of 90 townships.

Across the three dimensions, a clear spatial differentiation emerges. Industrial centrality exhibits a pronounced southeast–northwest gradient, with higher values concentrated in the southeastern coastal belt due to stronger industrial bases, more active tertiary sectors, and higher nighttime economic activity. In contrast, northwestern mountainous townships remain significantly weaker, constrained by terrain, accessibility, and limited industrial foundations. Public service centrality follows a broadly similar distribution, with higher levels in and around county seats such as Jianchang and Chengjiao, where population concentration and facility density are greater. By contrast, tourism centrality presents a reversed pattern, with the northwestern mountainous areas performing best due to their concentration of ecological and scenic resources.

When considered jointly, the three centralities reveal a clear functional differentiation across townships. The clustering results identify eight distinct capability types. Southeastern coastal townships are predominantly "industry-dominated" or "industry–public service composite," reflecting their strong economic base. Northwestern mountainous areas are mainly "tourism-dominated" or "public service–tourism composite," forming a resource-oriented development belt. Townships located in or near county seats tend to be "public service-dominated" or "comprehensive development" types, functioning as key nodes for population aggregation and service provision. Meanwhile, a number of "non-dominant" townships remain constrained by geographic isolation and limited resources, indicating relatively weak development capacity.

3.2. Interaction Identification Results

The interaction structure of the township system reveals a clear hierarchical differentiation. Based on industrial, public service, and tourism centrality, the 90 townships can be classified into primary, secondary, and tertiary levels, forming a pyramid-like structure with an approximate ratio of 1:3:9.

Further analysis of connection strength highlights pronounced spatial disparities in interaction intensity. Coastal townships exhibit stronger connections in terms of industrial support, public service concentration, and transport accessibility, indicating a higher level of factor aggregation and circulation. In contrast, western mountainous areas remain weakly connected and relatively marginalised due to geographical constraints and limited infrastructure. Tourism connections, although more concentrated in mountainous regions, display a comparatively milder gradient, reflecting the more diffuse and resource-dependent nature of tourism flows.

By integrating node hierarchy and connection strength, three typical interaction network structures can be identified: Hierarchical Network, Polycentric Network, and Monocentric Network. The Hierarchical Network is characterised by a clear vertical structure, in which high-level nodes dominate resource allocation and lower-level nodes depend strongly on them, resulting in a pronounced top-down organisation. The Polycentric Network consists of multiple high-level nodes jointly forming the network core, with dense horizontal linkages and frequent interactions, enabling greater flexibility and stronger capacity for coordinated development and factor diffusion. In contrast, the Monocentric Network is

organised around a single dominant core, forming a radial structure with a distinct core–periphery relationship. While this configuration strengthens the driving role of the core township, it also entails higher dependency risks.

Overall, the interaction patterns reflect differentiated organisational logics across industrial, public service, and tourism systems. These network structures not only shape the spatial organisation of factor flows but also provide a structural basis for the coupling between capability and interaction in subsequent analyses.

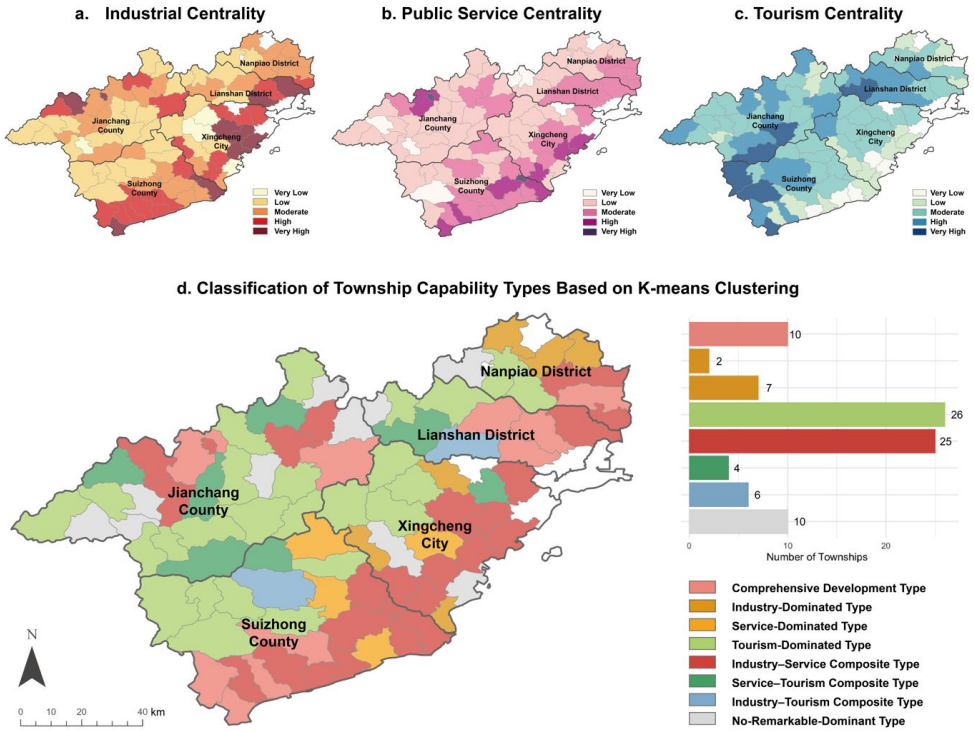

Figure 3. Centrality characteristics and capability types of townships. Source: Author.

3.3. Results of the Coupling Analysis and Township Development Strategies

Based on the coupling analysis of capability and interaction, this study identifies differentiated township cluster structures under three development mechanisms—industrial collaboration, public service sharing, and tourism integration. The superimposition of node hierarchy, connection strength, and spatial distribution reveals distinct structural configurations and organisational logics across the three systems, providing a typological basis for differentiated development strategies in resource-based regions.

In industrial collaboration clusters, eight agglomeration systems are identified, primarily centred on townships with strong industrial bases and high economic energy levels. These clusters are mainly organised in Monocentric or Polycentric network structures. The polycentric structure, characterised by dense horizontal linkages, facilitates multi-directional flows of information, capital, and labour, thereby enhancing industrial coordination and resilience. By contrast, monocentric structures rely on a dominant core township to organise surrounding areas through a centre–radiation pattern, which can strengthen agglomeration efficiency but may also limit network flexibility. In some cases, hierarchical structures

persist, where connections are predominantly unidirectional, constraining factor circulation and industrial-chain integration. This suggests that the effectiveness of industrial collaboration is closely associated with the degree of network connectivity and the balance between centralisation and decentralisation.

Public service sharing clusters exhibit a distinct organisational logic oriented towards regional balance rather than resource concentration. Unlike industrial or tourism clusters, their formation is less dependent on strong capability nodes and more on achieving equitable spatial coverage. These clusters typically combine hierarchical and polycentric characteristics: high-level townships concentrate advanced services, while intermediate and lower-level townships function as relay and service extension nodes. Such a gradient structure supports the tiered allocation of public services and improves overall accessibility. However, in clusters dominated by a monocentric structure, excessive concentration of high-level facilities may extend service distances and weaken effective accessibility for peripheral areas. This highlights the importance of establishing multi-level service nodes to mitigate spatial inequality and enhance network efficiency.

Tourism integration clusters are primarily distributed in mountainous and ecologically sensitive areas. Although these townships are relatively weak in industrial and public service functions, their development relies on the integration of resource endowments within a network structure. A typical pattern can be conceptualised as a “resource–service–support” chain, in which core scenic or cultural nodes attract visitors, while surrounding townships provide complementary services such as accommodation and catering. Compared with the other two systems, tourism clusters exhibit a more linear and network-dependent structure, where connectivity plays a critical role in transforming resource advantages into economic value. This indicates that tourism development is less driven by node hierarchy and more dependent on the effectiveness of route-based integration.

Overall, the results demonstrate that township cluster formation is jointly shaped by internal capability differentiation and external interaction structures, but the dominant mechanisms vary across functional systems. Industrial collaboration emphasises efficient factor linkage and network cohesion; public service sharing prioritises hierarchical coordination and spatial equity; and tourism integration relies on resource conversion through network connectivity. This differentiation highlights the necessity of adopting system-specific strategies in regional planning, rather than applying a uniform development model.

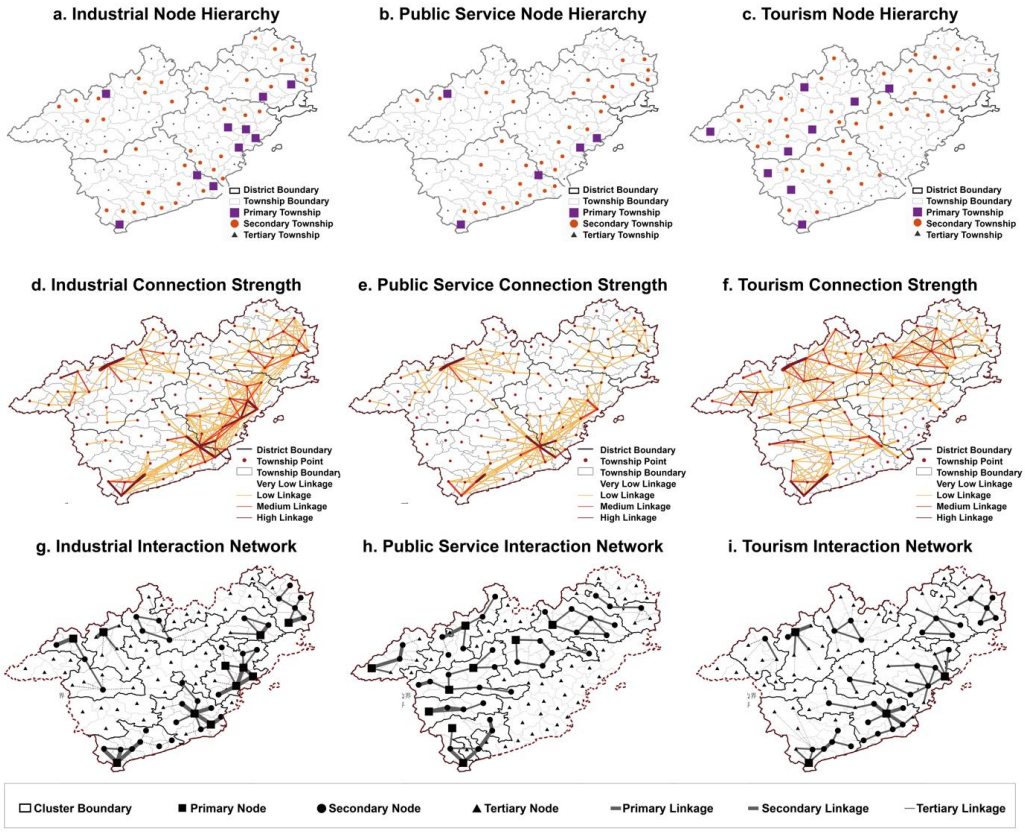

Figure 4. Node hierarchy, connection strength, and interaction networks. Source: Author.

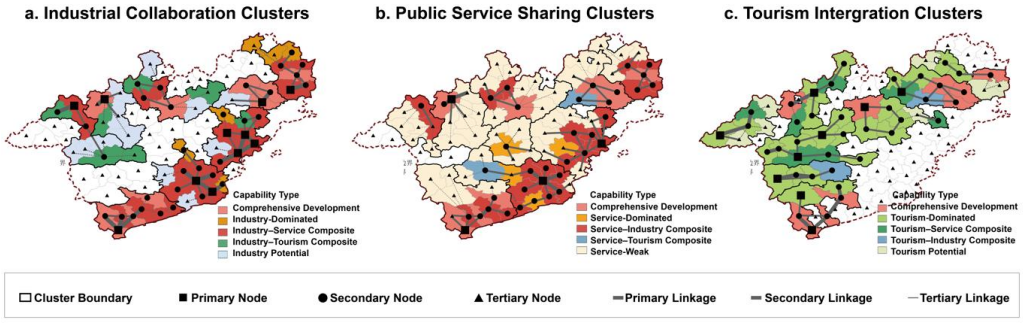

Figure 5. Township cluster patterns under three development scenarios. Source: Author.

4. Conclusion

This study advances a systematic approach for understanding and restructuring township systems in resource-depleted regions. By integrating functional capability and inter-township interaction into a unified analytical framework, the research reveals how townships with different industrial strength, service concentration, and tourism resources can be transformed into internally connected township

clusters. The findings demonstrate that township capabilities in Huludao follow a clear gradient from coastal industrial-service centres to central mixed-function zones and finally to northwestern tourism-oriented areas. Interaction analysis further shows that these differentiated townships organise themselves into three recurrent network forms, namely monocentric, polycentric, and hierarchical systems, each shaped by different intensities of factor circulation and service accessibility. More importantly, the coupling of capability and interaction uncovers three development mechanisms that underpin clustered transformation in resource-based regions. Industrial collabouration clusters rely on multi-level coordination of production factors; public service sharing clusters operate through graded service allocation and strengthened accessibility; and tourism integration clusters convert ecological and cultural resources into networked economic functions. These mechanisms move beyond descriptive spatial patterns and provide an internally coherent way to understand how coordinated township units may emerge from originally fragmented landscapes.

Theoretically, the study reframes townships as mediator nodes within regional systems and proposes a Capability-Interaction-based cluster framework that deepens the understanding of horizontal coordination among peer settlements. Methodologically, it offers a transparent and transferable pathway that combines multidimensional capability indicators with interaction-based network delineation, enabling cluster boundaries to be identified in a structured and scalable manner.

The approach also demonstrates strong potential for scaling up. It can be applied to resource-dependent regions facing industrial decline, service imbalance, or ecological constraints, including mining hinterlands in Northeast Asia, old industrial belts in Eastern Europe, and rural transition zones in Latin America. More broadly, the framework can support rural-urban governance in regions seeking to rebalance service networks or strengthen inter-settlement linkages under demographic decline or spatial fragmentation.

Future research may incorporate dynamic flow data to capture changes in township interactions and examine how governance institutions shape the implementation of cluster-level strategies. As high-resolution spatial data and real-time monitoring technologies become more accessible, the framework can evolve into a tool for adaptive planning and multi-level coordination, supporting the transition of resource-depleted regions toward resilient, balanced, and integrated development trajectories.

References

Cabus, P. (2002) ‘Governance in Flanders’ regional policy: Subregional platforms as development coalitions’, Belgeo: Revue Belge de Géographie, 3, pp. 277-294.

Christaller, W. (1966) Central Places in Southern Germany. Englewood Cliffs: Prentice-Hall.

Gusmanov, R., Stovba, E., Kuznetsova, A., Gusmanov, I., Taipov, T., Muhametshina, G., and Akhmetova, L. (2022) ‘Rural area sustainable development strategies on the basis of a cluster approach’, Regional Science Policy & Practice, 14(4), pp. 778-796.

Institute for European Environmental Policy (2001) The nature of rural development: Towards a sustainable integrated rural policy in Europe; a ten-nation scoping study for WWF and the GB Countryside Agencies (Countryside Agency, Countryside Council for Wales, English Nature and Scottish Natural Heritage). London: IEEP.

Jia, L., Li, S., Tallman, S., and Zheng, Y. (2017) ‘Catch-up via agglomeration: A study of township clusters’, Global Strategy Journal, 7(2), pp. 193-211.

Li, H., Lai, W., Xiao, W., and Gao, L. (2023) 'Practical directions, theoretical logic, and methodology of rural contiguous planning: An analysis from the "function-network" perspective', Urban Planning Forum, (3), pp. 47-55.

Liu, H., Fan, W., Zhou, X., Wang, Y., Yuan, C., and Liu, L. (2024) 'From Solo to Cluster Governance: An Empirical Study of Transforming Rural Management in Guiyang, China', Land, 13(10), p. 1564 [online]. Available at: https://doi.org/10.3390/land13101564 (Accessed: 22 November 2025).

Marshall, T. (2007) 'After Structure Planning: The New Sub-regional Planning in England', European Planning Studies, 15(1), pp. 107-132.

Messely, L. (2014) On regions and their actors. An analysis of the role of actors and policy in region-specific rural development processes in Flanders. PhD thesis. Ghent: Ghent University.

OECD (2020) Managing Environmental and Energy Transitions for Regions and Cities. OECD Publishing [online]. Available at: https://doi.org/10.1787/f0c6621f-en (Accessed: 22 November 2025).

Pemberton, S. and Shaw, D. (2012) 'New Forms of Sub-regional Governance and Implications for Rural Areas: Evidence from England', Planning Practice and Research, 27(4), pp. 441-458.

Rai, P. T. (2012) 'Townships for Sustainable Cities', Procedia - Social and Behavioral Sciences, 37, pp. 417-426.

Richter, R. (2019) 'Rural social enterprises as embedded intermediaries: The innovative power of connecting rural communities with supra-regional networks', Journal of Rural Studies, 70, pp. 179-187.

Scott, J. (1991) Social network analysis: A handbook. Thousand Oaks, CA, US: Sage Publications, Inc.

Scott, J. and Carrington, P. J. (2011) The SAGE Handbook of Social Network Analysis. Thousand Oaks, CA, US: SAGE.

Shuna, L. and Zhaohuai, J. (2011) 'Development Models of Resource-dependent Cities' Transformations and Its Experience and Lessons-Take Baishan City's Development of Transformations as an Example', Energy Procedia, 5, pp. 1626-1630.

Simic, I. and Bajcetic, R. (2016) 'Small towns as mediators towards spatial resilience: The case study of network of settlements in Vojvodina region', Facta Universitatis - Series: Architecture and Civil Engineering, 14(3), pp. 331-342.

State Council of the People's Republic of China (2013) National Plan for Sustainable Development of Resource-Based Cities (2013-2020) [online]. Available at: https://www.ndrc.gov.cn/ (Accessed: 25 January 2025).

World Bank (2018) Managing Coal Mine Closure: Achieving a Just Transition for All. Washington, DC: World Bank [online]. Available at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/ (Accessed: 25 January 2025).

Ye, Y., LeGates, R., and Qin, B. (2013) 'Coordinated Urban-Rural Development Planning in China: The Chengdu Model', Journal of the American Planning Association, 79(2), pp. 125-137.