

An Overview of Coordinated Regional Development in China Utilizing CiteSpace Software

MEI Zhao

(College of City Construction, Jiangxi Normal University, Nanchang, Jiangxi 330022, China)

Abstract The coordinated regional development strategy, recognized as one of China's seven development strategies, plays a crucial role in reducing regional development disparities, optimizing resource allocation, and facilitating high-quality development. This study analyzes a total of 418 relevant publications from China spanning the years 1998 to 2022. Utilizing CiteSpace software, a visualization analysis of keyword co-occurrence, mutation, and other bibliometric characteristics was conducted. The findings indicate that the number of publications during the specified period exhibited a fluctuating upward trend, with a notable increase observed after 2018. Furthermore, the research demonstrated a weak interdisciplinary crossover and a low intensity of collaboration among authors. The primary thematic areas of focus were identified as follows: connotation, mechanisms, countermeasure and suggestion, and evaluation.

Keywords Coordinated regional development, CiteSpace, Visualization, Graphical analysis

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Regional coordination encompasses the integration of spatial economic efficiency and regional equity within the framework of regional development. It also involves the balance between regional cooperation and regional competition in the management of inter-regional relationships. In 2021, the framework of the 14th Five-Year Plan explicitly delineated the comprehensive execution of significant regional strategies and initiatives aimed at promoting coordinated regional development, thereby elevating coordinated regional development to the status of a national strategy^[1]. In July 2022, the National Development and Reform Commission proposed enhancements to the integrated development of urban agglomerations and metropolitan areas within the 14th Five-Year Plan for New Urbanization Implementation Plan. The plan aims to facilitate the coordinated development of large, medium-sized, and small cities, as well as small towns. China exhibits significant regional differentiation, and the issue of spatial imbalance in both regional and urban-rural development requires urgent attention. The concept of coordinated regional development has garnered increasing focus as a means to contain the unsustainable exploitation of land resources, facilitate the harmonious development of transportation and infrastructure, diminish environmental pollution levels, and promote equitable development across diverse regions^[2]. CiteSpace software was employed to systematically analyze the pertinent literature concerning coordinated regional development research. This analysis tries to identify the characteristics associated with the distribution of published articles, to delineate the research hotspots and

emerging themes, and to examine the evolving trends within this field.

1 Data acquisition and research methods

Through the China National Knowledge Infrastructure (CNKI) database, a targeted search of journals was conducted using the criterion 'Title=Regional Coordination'. The search encompassed the period from 1998 to 2022, focusing on core journals such as the Chinese Social Sciences Citation Index (CSSCI) and the Chinese Science Citation Database (CSCD). This process yielded a total of 518 relevant documents. Non-scholarly literature, including conference articles, book reviews, and other non-relevant materials, was excluded from the analysis, leading to a final selection of 418 documents. The selected documents underwent econometric analysis, after which the data was transformed into a format compatible with CiteSpace and subsequently imported into the software. A knowledge map, including keyword co-occurrence, was generated for visualization analysis. This process aimed to elucidate the research lineage, development trends, and research hotspots pertaining to domestic coordinated regional development, thereby assisting researchers in filtering relevant information.

2 Analysis of research trends

The annual publication count serves as an indicator of the research status of scholars within a specific field at various stages. Fig.1 presents the statistical distribution of publications by year in the domain of coordinated regional development in China. The research on coordinated

regional development in China can be categorized into three distinct stages. The initial stage, spanning from 1998 to 2011, marks the inception of this research area, characterized by a limited number of contributions, averaging 11.29 articles published annually. The establishment of Deng Xiaoping Theory as the guiding ideology of the Communist Party at the 15th Party Congress in 1997 marked a significant milestone. Coordinated regional development, recognized as a crucial component of Deng Xiaoping Theory^[3], has been extensively examined by scholars regarding its implications and fundamental principles. This exploration particularly focuses on the factors contributing to the regional development disparities in China, as well as potential strategies for addressing these issues. Since 1999, China has sequentially implemented regional development strategies, including the Western Development Strategy and the Northeast Revitalization Initiative. As a result, the country has established a coordinated regional development strategy encompassing four major sectors^[4]. Consequently, the volume of relevant research findings has progressively increased. The second stage, spanning from 2012 to 2017, is characterized as a stable phase, with an annual average of 15.00 published articles. Following the 18th Party Congress in 2012, General Secretary Xi Jinping emphasized the necessity of continuing the implementation of a comprehensive strategy for regional development. This strategy particularly highlighted the importance of refining policy units, focusing on cross-regional and sub-regional planning, and enhancing the precision of regional policies^[5]. Consequently, there has been a notable increase

in studies concentrating on small-scale regions, including impoverished counties^[6], ethnic enclaves^[7], and border provinces and cities^[8]. Notably, precise poverty alleviation emerged as a representative policy during this period. Furthermore, research pertaining to large-scale regions continues to exhibit a significant level of enthusiasm^[9]. The observed decline in the number of publications during this period may be attributed to the deepening and maturation of research within this domain, which has consequently resulted in a diminished focus among scholars in this field. The third stage, spanning from 2018 to 2022, is characterized by rapid growth, with an average annual output of 34.00 articles. The 19th Party Congress, held in 2017, marked the first elevation of the coordinated regional development strategy to the status of an overarching regional development framework. This development has become a significant component of the construction of a modernized economic system. Furthermore, it initiated the implementation of integrated planning across urban and rural areas, as well as land and sea, thereby stimulating extensive discourse on the establishment of a comprehensive and multi-dimensional coordinated regional development strategy within the context of the new era^[10].

3 Research hotspots and frontier dynamics

3.1 Analysis of research hotspots

Keyword co-occurrence mapping serves as a valuable tool for elucidating the theme of literature research and identifying prominent topics within a specific research domain (Fig.2). By analyzing both the frequency and centrality of keyword occurrences (Tables 1–2), the prevailing issues in domestic research concerning coordinated regional development can be categorized into four key aspects: connotation, mechanisms, countermeasure and suggestion, and evaluation, all derived from an extensive

review of the literature.

(1) Connotation of coordinated regional development. The 9th Five-Year Plan formally introduced the concept of coordinated regional development; however, a unified and authoritative understanding of its connotation has yet to be established. For instance, some scholars argue that the connotation of coordinated regional development should be constructed in alignment with the fundamental principles governing regional and urban economic development^[11]. From the standpoint of coordination and cooperation among cities within the region, Yang Baojun^[12] posits that coordinated regional development entails adherence to the developmental principles governing regions and cities. This approach necessitates alignment with the trends and requirements associated with regional economic integration, the establishment of effective coordination mechanisms, and a focus on institutional arrangements. Furthermore, it advocates for the implementation of the Scientific Outlook on Development characterized by benign competition. The comprehension of coordinated regional development among scholars primarily emphasizes the level of coordinated economic development across regions, positing that this concept pertains to the economic interrelations among different areas. According to Qin Chenglin et al.^[13], coordinated regional development facilitates increasingly closer economic connections between regions and promotes a more rational division of labor among them. In this process, the disparity between economic and social development has been diminishing and converging, while overall economic efficiency has been enhancing. This perspective primarily underscores the importance of a rational division of labor among regions and highlights the transition of overall economic development from imbalance to relative equilibrium. There are perspectives that underscore the significance of inter-regional constraints and collaboration, highlighting the

necessity for coordinated development across economic, social, and ecological dimensions. For instance, Fan Hengshan^[14] posits that coordinated regional development should aim for moderate disparities in per capita GDP among regions, the equalization of basic public services, the maximization of each region's comparative advantages, and the promotion of harmony between humanity and nature. This viewpoint considers the immediate interests of individuals and emphasizes the integrated development of economic, social, ecological, and other facets.

(2) Mechanisms for coordinated regional development. The ultimate objective of regional development is to attain coordinated development across the entire region, and the development mechanism serves as a crucial means for the region to realize this objective^[15]. Within the study of these mechanisms, two primary directions can be identified, one of which pertains to the generation level of the mechanisms. In 2005, the *Recommendations of the Central Committee of the Communist Party of China on the Formulation of the 11th Five-Year Plan for National Economic and Social Development* proposed four key mechanisms, namely the market mechanism, cooperation mechanism, mutual assistance mechanism, and support mechanism, as essential strategies for fostering regional coordination and interaction^[16]. Scholarly research exhibits considerable diversity. For instance, Qin Chenglin^[17] develops a comprehensive system that encompasses a market mechanism, spatial organization mechanism, cooperation mechanism, assistance mechanism, and governance mechanism. Similarly, Wei Houkai et al.^[18] formulates a coordination mechanism that includes a market mechanism, compensation mechanism, support mechanism, cooperation mechanism, sharing mechanism, and participation mechanism. The second level pertains to operational level. For instance, Xing Haifeng^[19] advocates for the

Table 1 Top 10 keywords in terms of frequency in the research field of coordinated regional development in China

Rank	Keyword	Frequency
1	Regional coordination	65
2	Coordinated development	41
3	Regional economy	22
4	New era	15
5	Regional development	15
6	Industrial transfer	12
7	Common prosperity	12
8	Region	10
9	Urban agglomeration	9
10	Regional disparity	8

Table 2 Top 10 keywords in terms of centrality in the research field of coordinated regional development in China

Rank	Keyword	Centrality
1	Regional coordination	0.47
2	Coordinated development	0.27
3	Regional economy	0.11
4	Regional development	0.07
5	Industrial transfer	0.06
6	Urban agglomeration	0.06
7	New era	0.05
8	Common prosperity	0.05
9	Region	0.05
10	Regional disparity	0.05

establishment of an organizational mechanism, a benefit distribution mechanism, and a guarantee mechanism to enhance the regional cooperation framework in Northwest Xinjiang, addressing the existing challenges in this area. Additionally, Liu Shiqi^[20] examines the disputes and conflicts that arise during regional cooperation and proposes a regional dispute resolution mechanism that encompasses a superior coordination mechanism, an equal consultation mechanism, and an ADR mechanism.

(3) Countermeasures and recommendations for coordinated regional development. Research is predominantly approached from two perspectives: first, to examine the phenomenon of inter-regional development incoherence and to propose appropriate measures; second, to analyze and derive insights from international experiences. For instance, in the domain of urban planning, Zhou Lan et al.^[21] advocated for the optimal reconstruction of the spatial pattern associated with new urbanization and the enhancement of the territorial spatial development and protection system, particularly in light of the regional imbalances observed between the eastern and western regions of urban development in China. Hao Wensheng et al.^[22] utilized the Sino-Singapore Tianjin Eco-city as a case study to investigate the mechanisms

of coordinated regional development and the design of institutional guarantees. Similarly, Zhao Xiuqing et al.^[23] examined the city agglomeration in the middle reaches of the Yangtze River and propose policy measures, including the establishment of a regional cooperation committee and a talent exchange mechanism among the three provinces, to foster sustainable economic development. Using Duqiao Town in Zhejiang Province as a case study, Peng Zhenwei^[24] has suggested several measures, including the transformation of government functions, the reform of the land management system, the innovation of the financial management system, and the adjustment of administrative divisions. In the realm of economics, Zhang Shaojun et al.^[25] have advocated for the adoption of the global value chain model for industrial transfer, recommending a departure from traditional models and theories of industrial transfer. In the realm of law, Liu Shuilin et al.^[26] have utilized the legislative experiences of developed countries to propose a legal framework that encompasses various legal norms, including the Basic Law, the Law on the Development of Western China, and the Law on Special Policy Measures.

(4) Evaluation of coordinated regional development. Scholars frequently employ principal

component analysis, factor analysis, and various other methods to construct a comprehensive indicator system for assessing the coordinated development of a region. The selection of indicators is diverse and encompasses categories such as economic, social, demographic, environmental, and resource-related factors. Xu Yingzhi et al.^[27] conducted a nationwide study in which they selected indicators from four subsystems: economy, science and technology, culture, and society and ecological environment, to develop an evaluation system. Generally, existing research predominantly emphasizes the level of coordinated development among subsystems within individual regions, while insufficient attention has been given to inter-regional relationships. Future research could benefit from a more comprehensive examination of inter-regional interests and the coordination of elemental relationships.

3.2 Analysis of research frontiers

Keyword emergence denotes a significant alteration in the frequency of a specific keyword over a brief timeframe. The analysis of these emergent words can facilitate an understanding of the shifting research hotspots within a particular field during a defined period, thereby enabling the identification of cutting-edge research trends (Table 3).

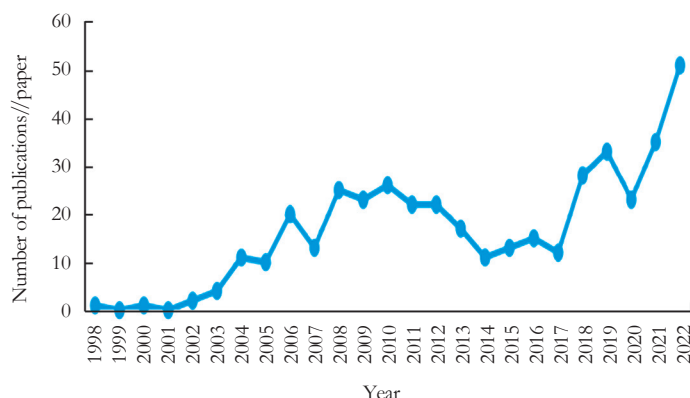


Fig.1 Changes in the annual number of publications in the field of coordinated regional development in China

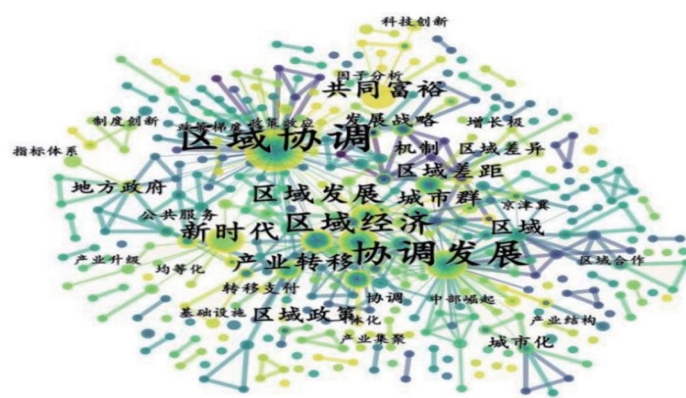


Fig.2 Keyword co-occurrence mapping in the research field of coordinated regional development in China

Table 3 Top 10 keywords in terms of emergence intensity in the field of coordinated regional development in China

No.	Emergent word	Intensity	Beginning year	Terminal year	Hotspot evolution (1998–2022)
1	Regional disparity	1.54	1998	2008	
2	Planning	1.30	2003	2004	
3	Coordinated development	2.22	2005	2006	
4	Regional development	1.99	2005	2009	
5	Mechanism	1.56	2007	2012	
6	Region	1.32	2008	2014	
7	Industrial agglomeration	1.75	2010	2011	
8	Policy gradient	1.38	2010	2014	
9	New era	5.85	2018	2020	
10	Urban and rural integration	1.30	2019	2022	

During the initial phase of research on coordinated regional development (1998–2011), eight emergent words, including regional disparity, planning, and coordinated development, were identified. Furthermore, with the deepening of reform and opening up, the developmental gap between the eastern coastal region and the central and western regions became increasingly pronounced. Scholars have examined the factors contributing to regional disparities and proposed various countermeasures, including the transformation of government functions, the redefinition of policy objectives, and the innovation of planning concepts. The concepts of coordinated development and regional development were informed by policies such as the Rise of Central China. Notably, in 2010, the notion of industrial agglomeration became a significant focal point in this discourse. In order to mitigate the issues associated with increasing inter-regional disparities, declining environmental quality, and heightened competition resulting from excessive industrial agglomeration, researchers have investigated a range of countermeasures. The development of a policy gradient is linked to the implementation of differentiated policies, which aim to diminish the extent of regional economic integration and disrupt the circular cumulative causal mechanism that reinforces the locational advantages of developed coastal regions^[28].

The second phase (2012–2017) of the coordinated regional development study did not exhibit keywords with high emergence intensity. In contrast, the third phase (2018–2022) identified two emergent terms: new era and urban-rural integration. In 2018, new era became an emergent term. Xi Jinping articulated in the report of the 19th Party Congress that socialism with Chinese characteristics has entered a new era. Furthermore, during the Central Economic Work Conference held in December of the same year, the three primary objectives of coordinated regional development in this new era were reiterated^[29]. Scholars have investigated the novel connotations, implications, and pathways for the realization of coordinated regional development within the context of new backgrounds and objectives. The concept of urban-rural integration was introduced at the 19th National Congress in 2017, gained prominence in 2019, and continues to be a significant initiative for promoting coordinated regional development.

4 Conclusions and prospects

4.1 Conclusions

An analysis of core journal literature pertaining

to coordinated regional development, as sourced from the CNKI database between 1998 and 2022, reveals that the research themes primarily encompass the connotation, mechanisms, countermeasure suggestions, and evaluation levels. The majority of scholars approach the topic from the standpoint of regional economic coordinated development, with comparatively limited research conducted from the perspectives of social factors and transportation. The research method employs various theoretical frameworks, including the theory of regional division of labor, the theory of regional dependent development, and the theory of fiscal decentralization, to enhance the understanding of coordinated regional development and to investigate pathways for achieving such development. For the assessment of coordination levels, the study utilizes several analytical techniques, including principal component analysis, factor analysis, the coordinated development degree model, the systematic integrated development model, the ESRE evaluation index system, SPSS analysis, etc. The research subjects primarily encompass urban agglomerations, provinces, and larger-scale entities. The most frequently examined urban agglomerations include the Pearl River Delta (PRD) and the Yangtze River Delta (YRD). In contrast, the provincial subjects are more diverse, covering all regions; however, the focus tends to be on the more developed provinces, such as Guangdong, Jiangsu, Zhejiang, etc. Future research should prioritize multidisciplinary perspectives by incorporating findings from regional ecology, regional sociology, and other relevant disciplines to address integrated development goals. Additionally, it is essential to enhance the investigation of the impacts of high-speed rail and other transportation infrastructures on the coordinated development of regions. Regarding research method, there should be an increased integration of GIS and remote sensing technologies to facilitate visualization and analysis. Furthermore, the scope of research subjects may be refined to focus more specifically on county and city-level areas, particularly in economically disadvantaged regions.

4.2 Prospects

(1) From a research content perspective, domestic studies predominantly examine coordinated regional economic development. These investigations primarily focus on regional industrial development and the spatial structure of regional economies. However, there is comparatively limited exploration of areas such as transportation planning and distribution,

educational development levels, local culture, and governmental functions. Consequently, significant disparities in development persist among different regions. (i) Future research may benefit from leveraging practical experiences related to the organization and implementation of coordinated regional development, both domestically and internationally. This research should focus on the management systems in place, elucidate the division of functions at the local level, and enhance communication, cooperation, and coordination among government agencies across various levels. Additionally, it is essential to ensure the protection of local interests through a structured approach to hierarchical planning. (ii) The research can draw upon findings from regional sociology, regional ecology, political science, sustainable development, and other pertinent disciplines. It aims to consider the coordination and balance among the development objectives of environmental protection, social equity, and economic growth, while striving for overall optimization. The study will address critical issues such as economic disparity, growth management, social equality, welfare protection, environmental conservation, and resource distribution within the context of regional and urban development. Furthermore, the research will investigate innovative methods and tools for regional development planning in the contemporary era, with the goal of fostering social progress and enhancing the quality of life and well-being of individuals. (iii) It is essential to enhance legislative research. (iv) It is crucial to conduct an in-depth exploration of the relationship between the construction of transportation infrastructure, such as high-speed railways, and coordinated regional development. (v) It is important to emphasize the promotion of coordinated regional development through tax adjustments and the strengthening of economic complementarity.

(2) In terms of research method, domestic studies predominantly employ qualitative approaches. However, future research endeavors should focus on enhancing the analysis of specific cities and regions. It is essential to consider regional characteristics, honor local cultures, and engage in field research. A systematic analysis of regional development conditions should be conducted, taking into account both historical contexts and current circumstances. This analysis aims to identify both favorable and unfavorable conditions for further development, predicts developmental trends, and proposes targeted regional planning strategies. Furthermore, the methodology can be integrated with GIS

and remote sensing technologies to facilitate visual analyses, thereby providing an intuitive understanding of the development status of the research subjects.

(3) In the context of research subjects, the majority of domestic studies have predominantly focused on large-scale entities. These include not only the nation as a whole and extensive regions such as the East, Central, and West, but also urban agglomerations like the Beijing–Tianjin–Hebei region, the Yangtze River Delta, the Pearl River Delta, and the middle reaches of the Yangtze River. Additionally, provinces such as Guangdong, Jiangsu, Inner Mongolia, and Gansu have garnered significant attention. However, there is a notable scarcity of studies that concentrate on smaller-scale entities. Future research could benefit from a more focused approach by narrowing the research unit to emphasize county and city-level areas, as well as economically disadvantaged areas. Furthermore, it would be advantageous to enhance the focus on central provinces to create synergies with research efforts directed at the eastern and western provinces.

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