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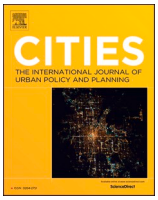

Towards coordination of spatial relations: Understanding Chinese mega-regionalization from a secondary city perspective

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ABSTRACT

Mega-regional planning in China is expected to tackle intra-regional unevenness, namely the development gap between regional core cities and the surrounding secondary cities. However, mega-regionalization processes seem to further increase the centrality of cores and push secondary cities towards greater polarization and peripheralization, as they lose socioeconomic vitality, industrial capacity, and political voice. To reflect on why mega-regions are not fulfilling their role of rebalancing regional urban systems, we conceptualize mega-regionalization as a mechanism to coordinate spatial relations within a territory and build a novel framework to analyze the relations between core and secondary cities. First, we show that visions of mega-regional planning regarding core-secondary relations pursue goals of morphological polycentricity, flow multi-directionality, and functional complementarity. Then, we use thematic analysis to evaluate the policy orientations of mega-regional planning to achieve these goals and extract three policy themes governing core-secondary spatial relations - coexistence, connectivity, and cooperation. These can systematically redefine mega-regional planning mechanisms by giving a central role to the spatial relations between core and secondary cities. Emphasizing spatial relations to conceptualize mega-regional governance allows a novel reflection on the challenges of unevenness grounded in the perspective of secondary cities. This deepens our understanding of governance mismatches that keep ideal visions and policy orientations misaligned when seen from secondary cities. Place, priority, and actor mismatches limit the potential of mega-regionalization to respond to their challenges. This research provides a relational understanding of mega-regions, calling for more attention to secondary cities, and the development of more balanced and sustainable mega-regions.

1. Introduction

Since the Reform and opening up of China in 1978, national economic development has primarily followed the growth pole pattern: the central government fostered some well-positioned cities on the southeastern coast to pioneer economic prosperity and drove the development of latecomers (Li & Wei, 2010). As a result, inter-regional unevenness in China has become increasingly pronounced along with marketization, economic decentralization, and globalization since the 1990s (Wei, 2001). Facing such challenges, the authorities encouraged a broader dissemination of the growth pole pattern. Since 2005, the authorities have introduced the concept of national core cities, and in the *National Urban System Plan (2006–2020)* published in 2010, Beijing, Tianjin, Shanghai, and Guangzhou were designated as the top of that hierarchy (Hamnett et al., 2023). Subsequently, the list of national core cities was expanded to take into account inter-regional unevenness. In 2016, Chongqing and Chengdu were selected as new national core cities to support the development of Western China in the *Development plan for Chengdu-Chongqing mega-region* (CNDRC & MHURD, 2016), while Zhengzhou and Wuhan became the driving forces of Central China, followed in 2022 by Shenyang's visionary plan of being another national core city in Northeastern China (Hamnett et al., 2023). At the provincial level, cultivating regional "superstar" cities to enhance competitiveness and visibility became an important development goal (Ke, 2010).

Although this approach effectively alleviated inter-regional unevenness and encouraged development in central and western China (Fan & Sun, 2008; Liao & Wei, 2016), another problem arose: *intra-regional unevenness*, namely the increasing development gap between regional core cities and other smaller cities in the same region. In this paper, we identify such non-core cities as regional secondary cities. They generally do not play a leading role in regional development due to poor public financing, peripheral location, and diverted policy priorities.

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Intra-regional unevenness affects regional sustainability because core cities face enormous development pressures, overcrowding, and environmental degradation (Yang et al., 2017; Zhang et al., 2019), while secondary cities risk economic shrinkage and social vitality decline (He et al., 2017). To cope with this problem, the authorities pinned their hopes on "regional coordination" in the *Twelfth Five-Year Plan* (2011–2015). In this national development document, cities of different sizes and types within the regional system are expected to interact optimally. This meant a shift in focus from large cities to the role of small and medium-sized cities (CNDRC, 2011) towards a more balanced regional system based on the division of labor and inter-city cooperation (Luo & Shen, 2009). This has been highlighted repeatedly over the past decade, and a concept emerged as a main spatial carrier for the coordination process: the mega-region (*chengshiqun* in Chinese), which usually consists of strongly interacting networks of one or two dominant core cities and a series of smaller secondary cities (Yeh & Chen, 2020).

The mega-region is not a new concept in international research. Scholars have discussed "global city-regions" and "mega city-regions" as a dynamic scale between country and city for socioeconomic development (Douglass, 2000; Sassen, 2001). Core cities and their surrounding smaller cities and hinterlands are treated as a closely interconnected network where beneficial network externalities and inter-city cooperation are expected (Florida et al., 2008). Therefore, flows and interactions between cities become an important focus of political and scientific concern. In China, the concept of mega-region largely follows this logic (Yeh & Chen, 2020).

However, there is a fundamental difference compared to the international context. In the global north, mega-regions are often used as an analytical concept, as cities are highly interconnected through infrastructure and flows, and complex regional networks have already emerged. In China, mega-regions tend to be considered an "imaginary planning concept" (Harrison & Gu, 2021), as in most cases, not all cities are well integrated. This is supported by previous studies of regional networks: Wang and Meijers (2024) examine the inclusion, connectivity, and consistency of Chinese mega-regional networks and find that only a few mega-regions, such as the Pearl River Delta, can be considered as real and highly integrated systems, while the rest are either in the developing or planning imagination stage. Instead, this aspirational concept looks at future trends and guides planning decisions, becoming a governance tool through which the authorities control the spatial agglomeration of cities, strengthen infrastructure connections, and optimize industrial (re-) distribution. Overall, the Chinese mega-region is a vision that has yet to be realized.

Although scholars have different understandings of mega-regions and debate them from the perspectives of national spatial governance (Li et al., 2022; Li & Wu, 2012), land use dynamics (Yu et al., 2019), and regional networks (He et al., 2023), two mega-regional competencies are typically recognized in rebalancing Chinese intra-regional development. First, they aim to create an integrated regional framework in which all cities are expected to be closely interconnected towards functional complementarity and agglomeration benefits. Second, they entail a centralized coordination approach that addresses regional risks and crises, especially zero-sum competition among cities and environmental challenges (Fang & Yu, 2017; Li et al., 2022; Li & Wu, 2012). Both competencies can help secondary cities overcome intra-regional unevenness: regional integration emphasizes efficient and mutually valuable inter-city connections, including the diffusion of knowledge and innovation, labor and talent mobility, large-scale project cooperation, and technological and financial support. Centralized coordination relies on regional planning and policy interventions, which can help secondary cities take more responsibility for regional development.

However, mega-regions do not necessarily benefit secondary cities: in most cases, their social, economic and industrial vitality is still declining and the gap to core cities is still significant (Yang et al., 2021; Yu et al., 2018). Two problems are exacerbated in this process: *polarization* and *peripheralization*. On one hand, despite the opening up of markets, the spread of infrastructure, and urban expansion enabling closer connections, the cores keep an exceedingly large socioeconomic pull (Cao et al., 2023). This results in polarization as development resources, including talent, investment, and labor, are drained away from secondary cities (Wei et al., 2020). For example, the expected integration driven by expanding the regional high-speed railway actually speeds up flows towards core cities instead of rebalancing them across secondary cities (Huang & Zong, 2021; Liu et al., 2020). On the other hand, as engines of economic growth, there is often a policy focus on core cities by regional authorities. Consequently, secondary cities are not policy priorities and lose political voice in the regional system (Li & Jonas, 2023), leading to peripheralization. For example, growing the cores into dominant "superstar cities" in economic networks requires forming stronger alliances with surrounding towns and hinterlands in pursuit of space for growth (Jaros, 2016). But this process reinforces the political and economic centrality of core cities and, conversely, exacerbates the peripherality of secondary cities.

This paper argues that focusing on the spatial relations between core and secondary cities is relevant to further exploring this intra-regional unevenness, namely polarization and peripheralization challenges. We define spatial relations as the intensity of spatial interactions, the establishment of spatial connections, and the governance of spatial planning actions between core cities and their surrounding secondary cities in the process of mega-regionalization. The research question is, therefore, *to what extent the coordination of core-secondary spatial relations can either reduce or exacerbate the problems of polarization and peripheralization of secondary cities in mega-regions*.

On this basis, we aim to understand spatial relations from three perspectives. First, we investigate ideal visions, namely what kind of coordinated spatial relations between core and secondary cities are envisioned in mega-regionalization processes to cope with polarization and peripheralization. Second, we analyze policy orientations. As a regional governance tool mainly driven by planning policy (Harrison & Gu, 2021), Chinese mega-regional policies directly affect the materialization of the visions and determine their effectiveness in addressing the secondary cities' challenges. Third, we discuss the real-world mismatches, namely the potential threats and policy obstacles that may prevent ideal visions from being realized.

The findings contribute to a new perspective on the impact of mega-regionalization on secondary cities. Reconceptualizing Chinese mega-regionalization through the lens of core-secondary spatial relations helps understand how planning visions and mega-regional governance approaches respond to intra-regional unevenness. The research sheds light on the roles of secondary cities in such systems to highlight the importance and potential of these smaller players in contributing to coordinated spatial relations. Finally, discussing the mismatches between visions and policy orientations provides a wake-up call for planners, policymakers, and implementers to address the exacerbated unevenness in Chinese mega-regions and a conceptual framework to explore future research on secondary cities.

2. Mega-regions as arenas to develop and coordinate spatial relations

2.1. Defining secondary cities

We represent regional unevenness by the development gap between two types of cities, not only in terms of population and economy, but also emphasizing the multiple functions of cities and the value they bring to the regional system. In that sense, the role of the "core" is significant in defining "secondary cities". The concept of mega-regions, especially from the perspective of economic globalization, is inherently accompanied by the image of a strong core city that integrates with its surroundings to provide wider and cheaper space for investment attraction (Florida et al., 2008). This process is often followed by regional functional repositioning, as the cores acquire advanced

financial, innovation and control roles that further empower them to grow into global economic hubs (Morshed et al., 2022).

Similarly, in China, mega-regions are also recognized as spatial units for the (industrial) expansion of core cities and the transfer and redistribution of economic sectors (Yeh & Chen, 2020). Until 2018, a total of nine cities had been identified as such national core cities in different geographic areas (Hamnett et al., 2023). At the mega-regional scale, these cities are also explicitly designated in official planning documents. In addition to the national core cities, provincial capitals and sub-provincial cities are also often considered mega-regional cores for their large size, economic strength, and political power, amounting to a total of 34 core cities (Du et al., 2024). In this paper, secondary cities are simply all other (prefecture-level) cities that comprise the mega-region and are not designated as core cities, which amounts to 197 cities across 19 mega-regions (Du et al., 2024). By emphasizing the concept of spatial relations between core and secondary cities to reflect on the regional unevenness problem, we simplify, for the time being, the differentiation within both groups.

The challenge of unevenness suffered by secondary cities in mega-regional systems has been confirmed at several dimensions. Previous studies have explored it from the perspective of disparities in endowments of cities by evaluating their innovation capacity, economic potential, and spatial quality (Ren et al., 2020; Wang et al., 2021). Additionally, flows in regional networks are increasingly becoming the focus, including demography, transportation, knowledge, and cooperation (Scherngell & Hu, 2011; Sun, 2016; Wei et al., 2018), confirming that secondary cities suffer the negative effects of polarization as unidirectional flows reinforce the dominance of core cities. Regional planning initiatives and governance implementation have also contributed with insights, including the impact of environmental regulations on the industrial transformation in secondary cities (Kuai et al., 2015), the unrealistic expectation on the effect of high-speed rail systems on the sustainable development of secondary cities (Song et al., 2022), and land use efficiency disparities among cities due to uneven governance capacities (Jiao et al., 2020; Yu et al., 2019).

2.2. Poison or panacea: mega-regional responses to unevenness

Indeed, mega-regionalism has been blamed for unevenness, but has also been recognized as a panacea for the problem. As mentioned above, "regions" are promoted in various political and social contexts worldwide because they are often defined as engines of growth (John et al., 2005; Morshed et al., 2022), but within them contrasts of centrality and peripherality still appear. Although Sassen (2001) mentions that the paradigm of centrality is changing from the traditional scale of a few blocks of a central business district to entire metropolitan areas, strong, albeit upscaled, agglomeration shadows persist between cores hosting advanced functions and emptied out peripheral locations (Pendras & Williams, 2021; Burger et al., 2015). In Europe, for instance, as economic priorities take precedence and centralized governance is weakened, competitive models of regional development prevail over distributive ones, leading to even more unfavourable contexts for secondary cities (Beel & Jones, 2021; Cardoso, 2023; O'Brien & Pike, 2015).

In China, however, as mega-regions become a fundamental scale of inter-city relations, regional governance, and growth (Harrison & Gu, 2021; Li et al., 2022; Yeh & Chen, 2020), a growing number of scholars refer to them as a panacea for the unevenness between core and secondary cities. First, mega-regions are envisioned as polycentric networks of efficient, balanced, and multidimensional interacting activities (Liu et al., 2016). This appreciation of the polycentric model stems from a twofold discussion. On one hand, it implies regional integration, as individual cities are closely linked through multiple spatial flows to form a better-performing network (Meijers et al., 2018), triggering an increase in socio-economic vitality through sharing, learning, and matching. On the other hand, the system emphasizes the balance of importance among cities (Burger & Meijers, 2012; Liu et al., 2016), as integration implies interdependence and complementarity, and is also valued in this system (Meijers, 2005). This means that different cities play specialized roles to enhance the performance and effectiveness of the region as a whole.

In Chinese mega-regions, this has been repeatedly written into planning policies as "development direction", "functional positioning", and "building on one's own strengths" to encourage the spatial integration of secondary cities in a polycentric system. This comes with another perspective that values the recentralized governance capacity of mega-region in dealing with the aforementioned problems of excessive inter-city competition, over-marketized development paths, or short-sighted visions of growth. Typical points of attention tend to be the local assets of such cities and the support from higher-level governments through financial, regulatory, or technological development policies, such as industrial relocation strategies (Tian et al., 2019). Furthermore, inter-city connections, namely flows of knowledge, cooperation, and migration, have been studied based on the notion that the functioning of a mega-region relies on such networks materializing spatial connections between its elements (Wang et al., 2023).

2.3. Framing the research lens: spatial relations between core and secondary cities

Despite revealing the dynamics of intra-regional centrality and peripherality to some extent, existing studies either consider mega-regions as a whole and do not target the specificity of secondary cities, or focus on individual secondary cities, ignoring their relational context, specifically with the core. In response, based on the previously discussed problems of polarization and peripheralization, we argue that focusing on the spatial relations between core and secondary cities is a relevant lens to understand how the latter navigate mega-regionalization, as it allows us to approach the discussion from two dimensions. First, by materializing core-secondary spatial relations, we mean directly uncovering key drivers of intra-regional unevenness: disparities in city size and attractiveness, imbalanced distribution of urban functions, and polarization of spatial flows. On the other hand, if coordinating these complex relations is an essential governance task for rebalancing mega-regional systems and a critical agenda of Chinese mega-regionalization, then this perspective helps rethink why the polarization and peripheralization of secondary cities remain unresolved under mega-regional governance.

Through this lens, Chinese mega-regionalization can be understood as a governance process that stimulates the transformation of inter-city relations through strategic interventions aimed at spatial coordination. Since mega-regions are highly networked and interdependent systems, efficient and complementary spatial relations among their constituent elements – its cities – are essential to their functioning. As demonstrated in development policies and spatial planning documents, Chinese authorities encourage beneficial interaction between cities through various planning interventions at functional, infrastructural, and morphological levels. A recentralized governance approach is adopted to promote such relational transformations, which stands for a hierarchic system in which the higher-level government defines goals and proposes ideas, which are then implemented by local actors (Wu, 2016). In 2005, the central government produced the first strategic spatial plan of mega-regions, indicating the upscaling of Chinese planning towards regional governance aimed at coordination among cities (Li & Wu, 2013, 2012).

Although there is no explicit statement that recentralized regional governance aims to reshape core-secondary spatial relations, a growing body of literature discusses the role of mega-regionalization in rebalancing them. This includes, for example, the intensification of flows based on infrastructure extension (Sun et al., 2023; Wang et al., 2019), the promotion of inter-city cooperation in various fields of innovation, industrial transformation, and environment management (Lu & Huang,

2012; Sun et al., 2022), and the establishment of inter-city integration axes based on the implementation of regional planning initiatives (Huang et al., 2023; Ramondetti, 2023). This is a reform of the regional growth model in China: the downsides of self-reliant development and competition among cities stimulated by the market economy are acknowledged, and a model of regional integration based on inter-city alliances is preferred. In this way, a fundamental transformation of Chinese mega-regions occurs, from a hierarchical, inter-city competition-oriented "group of cities" to a relational emphasis on spatial coordination and cooperation in a "system of cities". To summarize, mega-regionalization in China takes the coordination of spatial relations between core and secondary cities as a governance approach to potentially respond to the latter's challenges of polarization and peripheralization.

3. Research design

We analyze spatial relations in three steps to gain a better understanding of the position of secondary cities in Chinese mega-regionalization, namely ideal visions, policy orientations, and governance mismatches. First, we deconstruct the ideal visions of mega-regions in relation to polarization and peripheralization in secondary cities, departing from morphological, functional, and connectivity components (Burger et al., 2014). Second, we employ thematic analysis to unpack Chinese mega-regional policies and explore what kind of

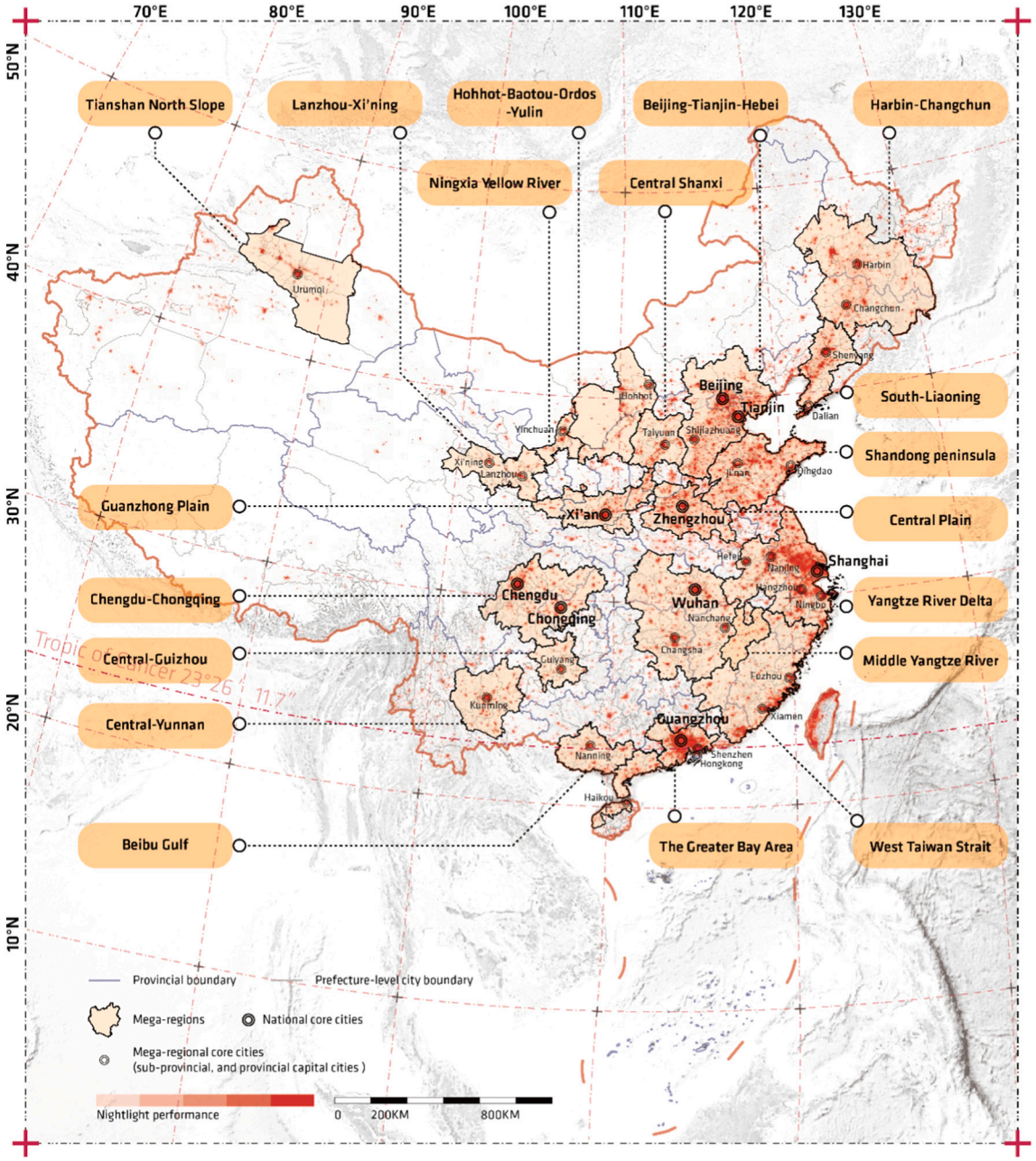

Fig. 1. The distribution of Chinese mega-regions, source: the authors.
Note: The scope of the mega-regions is determined by the relevant development plan and policies. If the plan specifies the "mega-regional core area", only the core area is outlined to avoid excessive overlap. As an evolving planning system, the scope of mega-regions is frequently adjusted, and we refer to the documents approved by the National Development and Reform Commission and other authoritative institutions.
Since no planning documents have been collected for the Tianshan North Slope mega-region, we outline its scope based on the existing literature on this mega-region (Fang et al., 2019).

policy orientations enable the creation, enhancement and governance of core-secondary spatial relations to support the realization of these visions. Third, we discuss why these policy orientations are ineffective in tackling the factors behind the exacerbation of polarization and peripheralization. We conceptualize these factors as governance mismatches, i.e. obstacles that prevent governance decisions and actions from being as effective as expected. Relevant theories, such as *meta-governance* (Meuleman, 2019) and *institutional collective action theory* (Feiock, 2009), underpin our discussion in the context of the practical difficulties faced by secondary cities, also grounded in existing cases and relevant secondary data.

3.1. Sources and materials

The Fourteenth Five-Year Plan (2021–2025) clarified the goals of mega-regions in terms of integrated development, infrastructure distribution, division of labor in industrial upgrading, public service sharing, and spatial structure optimization (CNDRC, 2021). Based on this, 19 mega-regions were redefined as fundamental spatial units for future sustainable urbanization, all of which are considered here (Fig. 1). The primary research materials are the development planning documents of each mega-region, generally promulgated by the *National Development and Reform Commission* (*NDRC*) or provincial governments. This is because, first, Chinese mega-regionalization is a recentralized governance process (Wu, 2016), with spatial planning and policy as the authoritative driving force. Interpretation of these policy documents clarifies the expected position of secondary cities in such emerging regional systems. Additionally, these policies issued by higher-level governments often serve as guiding principles for localized planning actions in individual mega-regions and cities, thereby allowing the subsequent study of specific strategies and implementation. Other planning policies are used as supplementary materials, including policy documents and spatial plans responding to specific mega-regional issues, such as industrial transformation and environmental restoration, and some plans by individual cities.

3.2. Thematic analysis

Since Braun and Clarke (2006) clarified specific techniques of thematic analysis, this social research method has been widely used in content investigation. In urban and regional research, such a method is effective in addressing a wide variety of questions and data types, including literature reviews (Ataman & Tuncer, 2022), news and media texts (Huang & Loo, 2023), and semi-structured interviews (Alyavina et al., 2020). Thematic analysis is based on a holistic and thoughtful understanding of the context and data, while being more open than other text analysis methods, leaving sufficient room for discussion and critique.

In this paper, this method is used to extract the policy orientations of mega-regional policies regarding the response to problems and realization of visions in secondary cities. First, the fragmented policy texts can be systematically categorized into different themes to provide an understanding of the roles of secondary cities in mega-regionalization and deconstruct the discourse priorities and specific policies. Second, the thematic connection between different mega-regional documents facilitates the answer to the question of which policy orientations does mega-regionalization adopt in realizing which visions. Here, the thematized policy orientations are extracted as “intermediary pathways”, offering a foundation for further evaluation of policy effectiveness, implementation of actions, and exploration of obstacles. Finally, the openness of thematic analysis allows us to retain space for critical thinking about these policy documents: instead of following a strictly theoretical framework, we allow our findings to be open-ended, as the extracted themes are not rigidly defined or closely bound to a particular theoretical perspective. Thematic analysis is an evolving conceptual framework with the potential for further refinement and deduction in more empirical studies, as well as a window for optimization of current policies.

While valuing the openness of the thematic analysis method, we designed a detailed methodological path to ensure the reliability of findings (Fig. 2). We develop the technical details based on the specific steps by (Braun & Clarke, 2006) and borrow the coding principles of *grounded theory* (Eaves, 2001), with two preconditions. First, although a growing number of studies have attempted artificial intelligence approaches to cope with large-scale textual data interpretation, given the immaturity of the relevant tools for regional policy research in China, the process of coding and extracting the relevant themes in this paper is completely manual. In total, we reviewed 21 policy documents with more than 400,000 Chinese characters (see Appendix). Second, we expect that themes (or sub-themes) emerge that are not necessarily enacted in secondary cities. Therefore, data selection based on certain rules is necessary and only policy text fragments that meet certain criteria are coded to extract relevant themes.

Based on this, the first step is to define the coding rules within the ideal visions framework. Ideal visions show the expected directions of spatial relations in mega-regionalization, therefore, texts that refer to envisioned spatial relations are coded. The initial coding is similar to “open coding” in *grounded theory* for the purpose of initial data cleaning and labeling. To develop a more systematic framework, we retain the second coding step of *grounded theory* (in conventional thematic analysis, this step is often skipped): axial coding to further re-organize the initial codes based on potential connections between them, and categorize them with similar meanings, purposes, or measures. Finally, we extract and name the policy themes. The process is conducted in Chinese to ensure continuity of coding and theme extracting, and translated into English in the last stage. Overall, this is an inductive process that searches, extracts, and names themes from fragmented policy texts using *Atlas.ti*, a platform that also provides tools to view the distribution and connections among codes and themes.

4. The ideal visions of core-secondary spatial relations

Although Chinese scholars have discussed spatial relations and their implications from multiple dimensions, systematic conceptual frameworks are rare. Burger et al. (2014) provide a guideline by conceptualizing these complex inter-city spatial relations as two models based on regional morphologies, configurations, linkages, externalities, interactions, and functional specializations: the *Network System* and the *Hierarchical System*. We adapt this framework with two new layers of thinking: first, we consider the specific Chinese context of mega-regionalization, which includes recentralized regional governance and the goal of coordinated and balanced regional development. Second, we consider the characteristics of mega-regional secondary cities, such as development gaps with core cities and weak political voices. On this basis, we summarize the focus of the mega-regional visions of core-secondary spatial relations: morphological polycentricity, flow multi-directionality, and functional complementarity (Fig. 3).

4.1. Morphological polycentricity

Morphological relations examine the spatial structure of the mega-regional systems. Monocentric patterns are commonly found in the hierarchical model, which, in the Chinese mega-regional system, means the dominant centrality of the core city accompanied by a significant development gap to its neighboring secondary cities. The intensification of centrality has led to more prominent monocentric patterns in the Chinese context. For example, in the Wuhan metropolitan area, the core city of Wuhan keeps rapidly expanding compared to secondary cities (Cheng, 2022). City size, including population, economy, and other functional attributes, tends to affect regional unevenness, as more massive urban centers exert a gravity effect over their surrounding areas, sometimes called an agglomeration shadow (Zhen et al., 2023). In

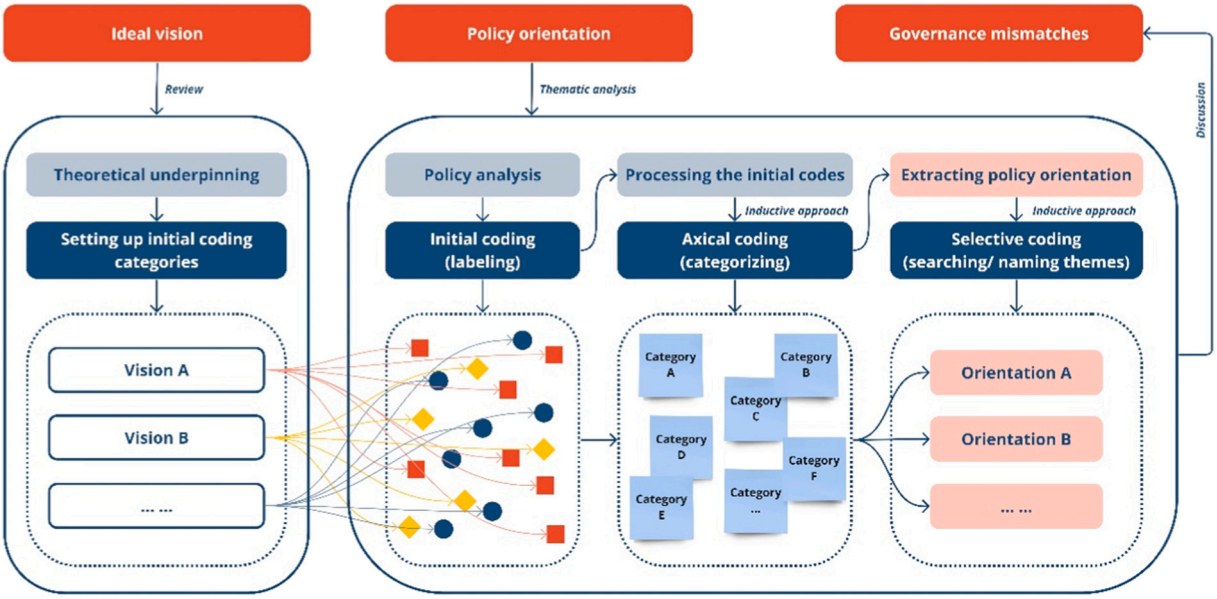

Fig. 2. Research methods, source: the authors.

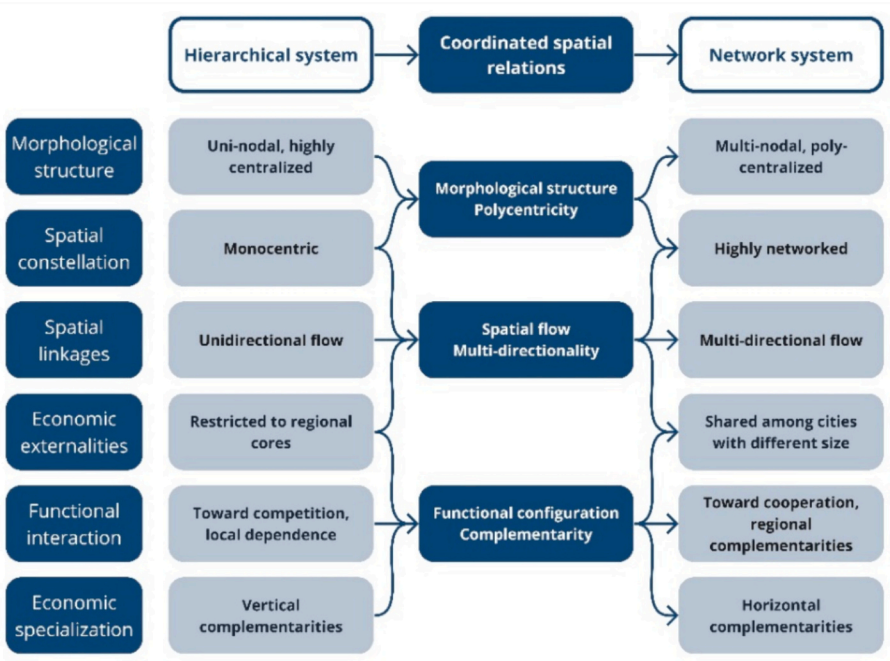

Fig. 3. The ideal vision of spatial relations in the Chinese mega-regional system, based on (Burger et al., 2014).

response, the authorities emphasize the benefits of polycentric regional networks in their planning policies and try to limit the expansion of core cities by transferring the development focus to non-core urban areas (Jaros, 2016; Zhao et al., 2017). Therefore, morphological polycentricity refers to such size and importance contrasts between core and secondary cities and how they change over time and/or through mega-regional planning interventions. Morphological relations are often the spatial skeleton of planning policies, and planners are keen to create axes in various directions, and urban clusters with various scales and functional orientations.

4.2. Flow multi-directionality

Flows between core and secondary cities help define their spatial relations. Flows often make visible the problem of regional polarization: highly centralized morphological structures trigger unidirectional flows, making core cities face an over-concentration of development factors such as housing shortages and environmental pressures (Liang et al., 2010; Tian et al., 2020), while labor shortages and shrinkage challenge the sustainability of secondary cities (He et al., 2017). Current research on inter-city flows provides evidence of regional unevenness from multiple perspectives, including transportation, migration, and material flows, as well as information, innovation, and technology exchanges (Dai et al., 2023; Lin et al., 2021). Although inter-city flows may carry positive economic externalities, as exemplified by sharing regional public service facilities and urban amenities (Meijers & Burger, 2017), Chinese mega-regionalization tends to exacerbate unevenness due to the over-centralization of development resources. Faced with such

problems, the authorities expect the core cities to decentralize, relieving development pressures through, for example, the redistribution of urban functions (Li et al., 2019). This is evident in the Beijing-Tianjin-Hebei mega-region, where many Beijing enterprises, research institutes, and social service facilities are gradually relocated to the surrounding secondary cities, following official planning policies (DNR Hebei, 2021). In parallel, the secondary cities hope to attract more consumption and visibility by developing local tourism or providing preferential policies in employment or housing (DNR Hebei, 2021).

4.3. Functional complementarity

Functional complementarity embraces themes widely discussed in mega-regional systems: competition and cooperation, complementarity, and shared externalities of urban functions. The intensified inter-city economic competition since the 1990s has resulted in urban development homogeneity and redundancy (Yeh & Chen, 2020). This led to a wide gap in economic competitiveness between core and secondary cities as the industrial upgrading in the former is supported by their advanced financial, technical, and innovation resources. As explained by Burger et al. (2014), in a hierarchical regional model, the core city aggregates functions with high profitability and efficiency (conceptualized as "vertical complementarity"). Networked regions rather rely on "horizontal complementarity", in which the importance of cities does not (only) depend on size but on functional positioning. This means that a regional division of labor can give cities more specialized functions and contribute to a balanced regional system, and economic externalities are enhanced by collaborative functional relations, with cities playing different roles in the regional system and increasing their potential importance in the regional network. This encourages the distinctiveness of secondary cities in the mega-regional system. For example, the emergence of local cultural industries has given some cities greater social vitality and economic opportunities (Liang & Wang, 2020).

5. Coordinating spatial relations in mega-regional planning

The deconstruction of the vision of coordinated spatial relations into three aspects illustrated previously becomes a lens to explore the orientation of mega-regional policies. This section discusses whether and how such policy orientations in official planning documents promote morphological polycentricity, flow multi-directionality, and functional complementarity between core and secondary cities. Based on the thematic analysis method, we extracted 1199 planning items from 21 official documents related to 19 mega-regions. We thematically coded these items 1578 times, of which 496 codes orientate towards morphological polycentricity, 484 codes towards flow multi-directionality, and 598 codes towards functional complementarity. This allows us to categorize the strategic policy interventions addressing the three components of spatial relations into three core themes: *coexistence, connectivity, and cooperation*. It is because of the emphasis on these themes in almost all planning policies and the enactment of the corresponding strategic interventions that the challenges of secondary cities have a chance to be addressed. The following subsections introduce specific interventions related to these themes and their impact on secondary cities.

5.1. Coexistence

Regional coexistence emphasizes the interdependent fortunes of cities in the mega-regional system by setting certain principles and guidelines to prevent the development of some cities at the expense of others. From a socioeconomic development perspective, an appropriate division of responsibilities and roles among cities prevents excessive inter-city competition. From a territorial-environmental perspective, cities in the mega-region face common crises and challenges, such as ecological degradation, climate change, pollution, and energy crisis. This forces them to establish coexistence relations to tackle these risks jointly. According to the codes extracted, coexistence can be deconstructed into 4 sub-themes, namely: COE-1: Restructuring regional spatial patterns; COE-2: Repositioning functional roles; COE-3: Managing environmental pollution and hazards; and COE-4: Responding to energy and natural resource crises (Fig. 4).

5.1.1. Restructuring regional spatial patterns

Regional planning provides guidelines for the spatial arrangement of each mega-regional system. It determines the future direction of urban expansion, and the role different cities play in the regional network. We find that the leading role of regional core cities is highlighted in all mega-regional planning documents. Besides envisioning their capacity to accommodate population, investment, industry, and services, metropolization is employed as an urbanization strategy by almost all regional core cities with two-fold consequences. On one hand, they remain engines of economic growth, aiming to improve the region's industrial competitiveness, brand visibility, and attractiveness for talent and investment, which is particularly valued by core cities in less developed mega-regions. On the other hand, since this also increases the unevenness between core and secondary cities, the plans make numerous references to the value of non-core cities in the mega-region. For example, creating economic sub-centers has emerged as a critical tool to drive the growth of lagging areas. Yuxi and three other secondary cities have been designated sub-centers of the Central-Yunnan mega-region to facilitate the development of the living environment, cultural industries, and educational services (an example coded as YN:18 from the Central-Yunnan mega-region. We use unique codes to tag all the strategic interventions; the mega-regional planning documents to which the codes specifically refer are presented in the Appendix). Furthermore, spatial linkages between cities are used to build up the spatial skeleton of mega-regions and are conceptualized as "axes", "corridors", and "networks". This provides a structural foundation for functional redistribution and zoning, division of labor, relocating industries and population, and infrastructure extension, across cities of different sizes. In this system, secondary cities (especially their centers) are envisioned as drivers of further urbanization and population agglomeration, providing the surrounding rural areas with better living conditions and services.

5.1.2. Repositioning functional roles

The functional arrangement of mega-regions is based on the characteristics and strengths of the different cities, aiming to create a complementary and efficient regional growth strategy. The centrality of the core cities is often reinforced through functional primacy in transport, communication, or science and technology, particularly in monocentric mega-regions or those with national core cities, such as Wuhan and Chengdu (MYR:4, CC:1). We also find a superficial functional division in a few mega-regions with multiple core cities. For example, in the Greater Bay Area, Guangzhou is defined as the center for trade, transportation hub, and culture (GBA:9), while Shenzhen is identified as innovation and scientific research center (GBA:10). In contrast, the functional positioning of secondary cities is typically oriented to regional complementarity. In the Central-Guizhou mega-region, Zunyi's information industry and aerospace manufacturing become significant strengths (GZ:9), Bijie is expected to focus on coal and mineral industries and agriculture (GZ:10), and Anshun turns to tourism and local manufacturing (GZ:11). Alongside individual city specializations, a preference for multifunctional corridor planning is evident in almost all mega-regional plans. In the Ningxia mega-region, the Yellow River is the main development axis linking all types of cities, and a top-down planning regime coordinates industrial, landscape, ecological, and social functions along that corridor (NX:19). In summary, from a functional perspective, coexistence between core and secondary cities relies on the specialization and complementarity of the latter, sometimes organized along structural corridors, to maintain their attractiveness in

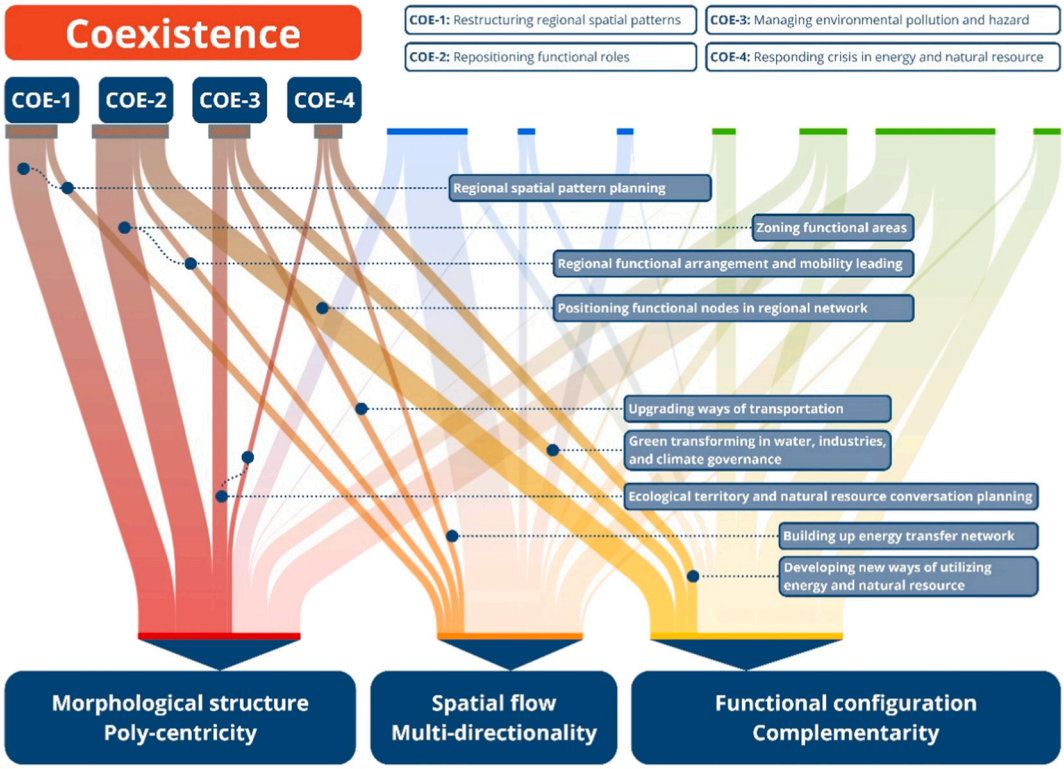

Fig. 4. Deconstructing the policy orientation of Coexistence source: the authors.

the regional system. However, they must also comply with regional imperatives, such as preserving agriculture, ecology, and natural landscapes, while may forgo more profitable functional attributes.

5.1.3. *Environment, ecology, and energy*

In recent decades, addressing the severe costs of environmental pollution, ecological degradation, and energy waste resulting from rapid growth has become urgent (Zhang, Liu, & Zhang, 2022). Therefore, managing environmental pollution and hazards and responding to crises in energy and natural resources are coded as sub-themes of coexistence since they also contribute to coordinating core-secondary relations. First, spatial corridors and zones based on the natural landscape are the spatial foundation for ecological protection and environmental remediation. This redefines the overall morphology, turning the ecological structures into another essential element alongside urban areas to distribute socioeconomic activities. The non-urban territory is also expected to create multiple values, especially for secondary cities, such as tourism and ecological conservation and innovation. Second, both interventions to manage environmental pollution and respond to the energy crisis require inter-city joint governance. This includes shared responsibility for climate management and ecological restoration, upgrading heavy pollution and high energy consumption industries. In summary, the territorial ecology and environment in which cities coexist are considered essential for regional development. This places strict requirements on secondary cities, but the transformation towards eco-friendly economic growth models is starting to challenge their economic competitiveness.

5.2. *Connectivity*

Inter-city connectivity of labor, information, and materials facilitates the diffusion of regional agglomeration effects. We divide the relevant strategic interventions towards connectivity into three sub-themes: CON-1: Building a comprehensive transportation system; CON-2: Encouraging labor flows and open markets; and CON-3: Creating informational connections (Fig. 5).

5.2.1. *Building a comprehensive transportation system*

The inter-city transportation system is dominant in shaping regional connectivity networks, contributing 66 % of the coded items on this theme. Planning transportation systems leads to a restructuring of morphological relations. First, it enhances centralization to create a stronger mega-regional core. The expanded road network in the Central-Guizhou mega-region integrates the core city of Guiyang and the neighboring secondary cities, creating a metropolitan circle with a one-hour traveling distance and a mega-regional economic center (GZ:1). Second, the authorities expect that transport connections can leverage the driving role of core cities and support secondary cities, as well as functional linkages between mega-regions. Regarding regional industrial cooperation, the Guiyang-Chongqing national transportation line serves as a basis for the main regional economic belt, connecting the core city, Guiyang, and an important secondary city, Zunyi, to encourage the expansion of equipment manufacturing, commerce, and logistics industries from cores to the secondary city. Third, upgrading the transportation system aims to exploit the secondary cities' assets. For example, cities in the mountainous area of the Guanzhong-Plain mega-region plan to attract cultural tourism through dedicated railway transportation (GP:27). The pursuit of an integrated transportation system is reflected in all mega-regional plans, with multiple dimensions of rail, road, air, and water transport. Secondary cities are envisioned as essential nodes in regional networks and are expected to contribute to enhanced integration and benefit from regional economic externalities.

5.2.2. *Encouraging labor flows and open markets*

The encouragement of labor flows can also reinforce inter-city connectivity, especially in technology and information exchange. Policies and planning actions for talent mobility and attraction are on the agenda of almost all mega-regions, including entrepreneurship support and social service guarantees for workers. Building inter-city functional corridors promotes interaction and exchange. For example, in the Greater

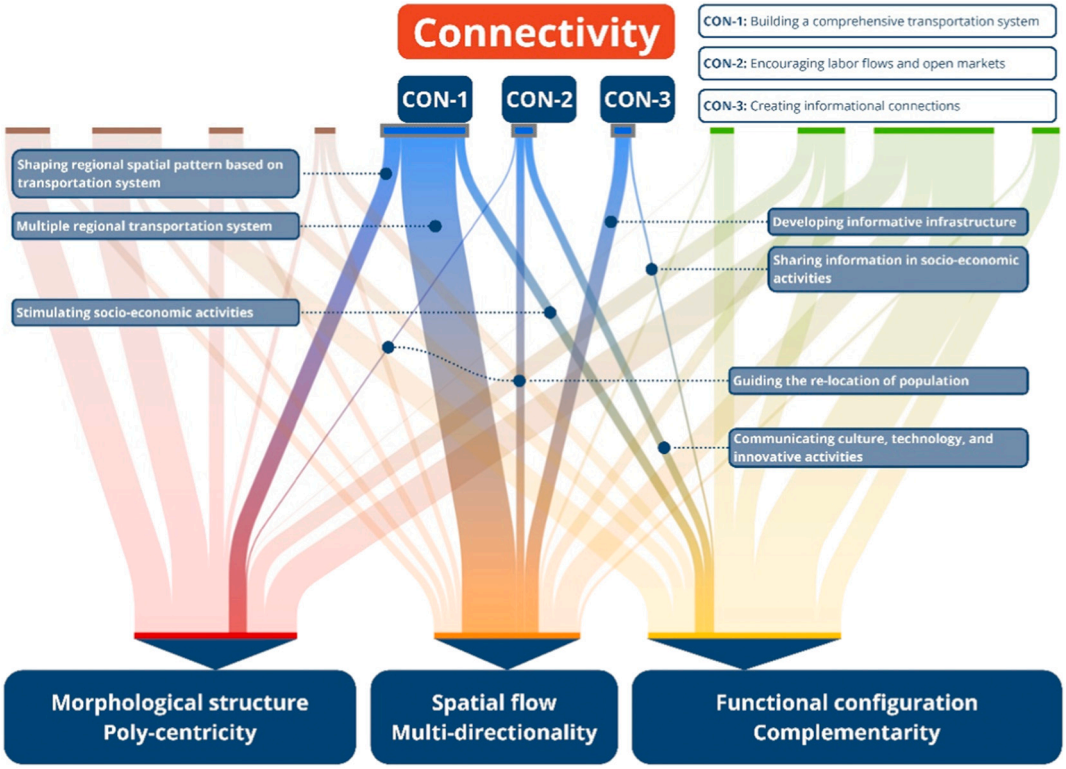

Fig. 5. Deconstructing the policy orientation of Connectivity source: the authors.

Bay Area, science and technology innovation corridors are planned to facilitate the intensive flow of talent, capital, information, and technology among cities (GBA:18). Additionally, the authorities want to guide the labor force flows to rebalance the regional morphology. Shanghai, for example, aims to control the inflow of population in the central area and alleviate overcrowding through the construction of satellite cities and associations with neighboring secondary cities (YRD:8). In response, these secondary cities, such as Wuhu and Taizhou, are determined to attract a more extensive and diverse labor force by releasing the restrictions on household registration (YRD:12).

5.2.3. *Creating informational connections*

Alongside transportation networks and labor flows, information linkages are an emerging approach to regional connectivity. In the Guanzhong-Plain mega-region, Xi'an (the core) and Baoji (a secondary city) plan to develop information infrastructures to create joint administrative databases and cloud computing platforms (GP:28). Beyond information sharing and regional communication, this brings industrial development opportunities in secondary cities: Lvliang and Yangquan in the Central-Shanxi mega-region are being supported in building data and information industry clusters (SX:51). Furthermore, the increasing information connectivity can respond to the functional unevenness between core and secondary cities, not only because information connection stimulates economic growth in secondary cities, but also helps to promote the equalization of accessibility in social resources, such as online access to health care activities in some cities (HC:6, YN:67).

5.3. *Cooperation*

Inter-city cooperation is often based on a self-motivated willingness among cities to achieve the benefits of complementary advantages. In mega-regions, cooperation relations coordinated by the higher-level government are increasingly valued, often targeting specific economic sectors, social issues, and environmental challenges (Li & Wu, 2018). Here we identify four sub-themes that receive specific strategic interventions: COO-1: Innovation and knowledge; COO-2: Conserving cultural and natural heritage; COO-3. Collaborating industrial clusters; and COO-4: Sharing public services (Fig. 6).

5.3.1. *Innovation and knowledge*

Knowledge sharing and innovation cooperation among cities drive socioeconomic transformation. For example, in the Central-Plain mega-region, the core city of Zhengzhou and the secondary city of Kaifeng plan to jointly establish an innovation corridor with a series of high-tech industrial parks located in the areas between both cities, aiming to integrate higher education and research institutions in both cities (CP:20). Regional core cities tend to dominate regional innovation networks because of their assets in industrial technology, research talent, and academic institutions. However, secondary cities are encouraged to play a more significant role through multiple innovation activities. In the Shandong peninsula mega-region, the core cities Jinan and Qingdao take the lead in developing innovation platforms, while secondary cities like Yantai and Weihai are invited to use research facilities and share information according to their research needs, a strategy conceptualized as "regional innovation communities" (SD:22). Another approach to enhance core-secondary spatial relations through innovation cooperation is the "brain + implementation base" model. The core city undertakes cutting-edge technology and knowledge creation, while the innovation outcomes can be applied to enterprises in secondary cities. For example, in the Beijing-Tianjin-Hebei mega-region, secondary cities cooperate with research institutes in Beijing to accelerate the upgrade of their high-tech industries (HB:31). Innovation capacity is, therefore, a competence that secondary cities need to develop to integrate more extensively into mega-regional knowledge networks and economic cooperation.

5.3.2. *Conserving cultural and natural heritage*

Similar cultural backgrounds and natural landscapes motivate mega-regional cooperation towards heritage promotion and conservation, and secondary cities must seek a balance between conservation and

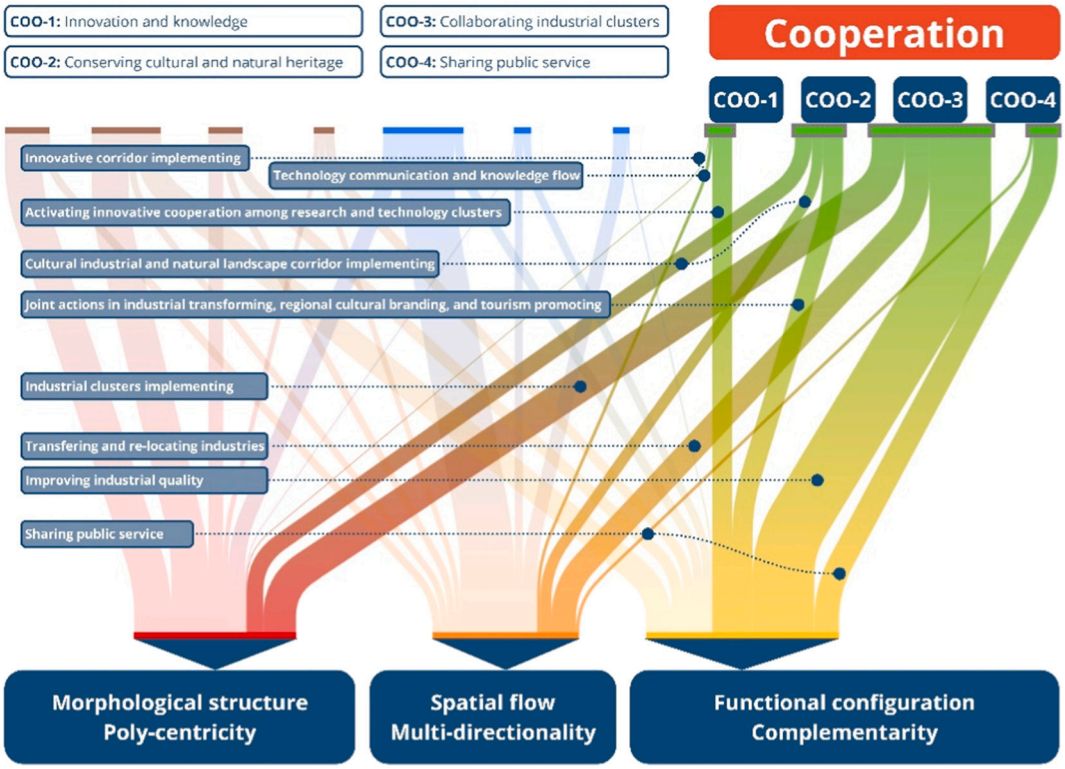

Fig. 6. Deconstructing the policy orientation of Cooperation source: the authors.

development. The "corridor" remains a popular concept for the joint conservation and utilization of ecological and cultural heritage. Corridors often link heritage resources to provide a spatial foundation for the concentration of cultural brands, handicrafts, local agriculture, tourism, and relevant start-up industries. Secondary cities can take the initiative due to the inherent attractiveness of their cultural landscapes: along the Qingshui River in the Ningxia mega-region, local farmland and the related agricultural tourism, brands, and products have become a new driving force of urbanization (NX:13). For natural landscapes and ecological heritage, cooperation among cities is not limited to the development of tourism and eco-industries but focuses more on the conservation of the ecological area. For example, in the Chengdu-Chongqing mega-region, functional zones related to species diversity protection, water purification, and soil treatment are implanted in the Wuling Mountains, which requires joint governance among surrounding cities (CC:67).

5.3.3. *Collaborating industrial clusters*

Industrial cooperation is the most important component of cooperative relations among cities. The related strategic interventions contribute 48.5 % of the codes on the theme of cooperation. On one hand, industrial development visions in mega-regional plans determine the future shape of the regional spatial structure. Some mega-regions want to pursue a more dominant role for core cities through industrial concentration. For example, the Central-Guizhou mega-region aims to enhance the competitiveness of its core city, Guiyang, by identifying it as the core of industries such as big data, advanced manufacturing, finance, and exhibitions (GZ:8). On the other hand, spillover effects of core cities to benefit secondary cities are still anticipated. Beijing's decentralization of over-concentrated industries is one of the tasks of the Beijing-Tianjin-Hebei mega-region. Beijing initiates cooperation with secondary cities, using its resources to support the transformation of Baoding's steel and chemical industries (BJ:39), and cooperating with Zhangjiakou in new energy vehicles and information industries (BJ:41).

5.3.4. *Sharing public services*

Sharing better quality public services in core cities is recognized as a practical approach to improve the living quality in secondary cities, by making such core facilities more accessible to residents of neighboring cities. Furthermore, core cities can decentralize educational, medical, and cultural facilities to the surrounding secondary cities by establishing branches, also as a way to relieve their own development pressure. Beijing, for example, plans to transfer medical, cultural, and educational institutions to secondary cities in Hebei province to avoid excessive population concentration (HB:17). Besides, the authorities have also encouraged the creation of public service centers in densely populated areas other than mega-regional cores to improve their livability, such as secondary cities in the Chengdu-Chongqing mega-region, where social welfare, pension, and cultural facilities are planned as an integrated inter-city cluster of public services (CC:85).

6. Governance mismatches in coordinating spatial relations

Chinese mega-regional spatial planning aims to coordinate core-secondary city relations through three themes of policy orientations – coexistence, connectivity, and cooperation – that potentially address the challenges of secondary cities. Although secondary cities are still not a priority concern in all mega-regional plans, we argue that the emphasis on these three themes and their associated strategic interventions has the potential to alleviate their problems of polarization and peripheralization. However, if mega-regionalization offers opportunities for secondary cities, we must acknowledge that it is not working as well as it should. To better understand why this is the case, we discuss three potential governance mismatches that still hold back secondary cities from overcoming intra-regional unevenness.

The discussion of governance failures among scholars has enriched our thinking, even though it does not explicitly target Chinese mega-regionalization as a regional governance process. Typical cases of governance failure can be categorized in two different sequences (Howlett & Ramesh, 2014): either the inadequate formulation of

governance tools that fail to achieve the set goals, or the failure to utilize the relevant governance tools due to the lack of capacity of those who implement them. This is also reflected in *institutional collective action theory* (Feiock, 2009) from the perspective of collaboration between cities in the context of spatial governance of metropolitan areas. Feiock explains that conflicts are triggered by problems of horizontal collaboration (caused by the lack of endogenous capacity of cities to generate sufficient externalities), vertical cooperation (failure to target problems due to misaligned governance policies), and functional cooperative action (conflicts that arise among the city's functional departments responsible for the implementation of governance decisions). *The meta-governance concept* (Meuleman, 2019) discusses a more comprehensive range of potential threats to governance, categorized into three types. These include capacity failures due to a lack of motivation, skills, resources, and experience; design failures due to a lack of clarity of focus on problems, insufficient consideration of relevant stakeholders, and weak implementation mechanisms; and governance management failures due to a lack of coordination among government departments and a lack of solid guidance.

When critically extending these factors of governance failure to the characteristics of Chinese mega-regional development, we can conceptualize the inadequate coordination of spatial relations between core and secondary cities as three governance mismatches.

The first governance mismatch stems from the capacity problem of secondary cities, which we conceptualize as the *place mismatch*. This originates from the rapid development path of mega-regionalization in China in the past 40 years (Tang et al., 2022), starting with the unofficial mega-regional cooperation system formed around Shanghai in the 1980s with the goal of economic growth and foreign investment attraction, and then in the post-millennium period with the megacities acting as engines of regional development (Wu, 2016). It implies that, in order to enhance regional competitiveness based on an integrated and enlarged network system, the authorities have either actively pushed for the extension of infrastructure to enhance the connectivity among cities (Harrison & Gu, 2021), or planned the process of metropolization to expand the power and dominance of the core cities (Jaros, 2016). Little attention has been paid to the readiness of secondary cities to participate in this transformation game into a new spatial system seeking greater overall competitiveness (Jonas, 2020). Regarding coexistence, secondary cities can take population, knowledge, and industry spillovers from core cities and improve their functional positioning. Regarding connectivity, the transportation infrastructure reinforces interactions between core and secondary cities. Regarding cooperation, complementary functions and an appropriate division of labor allow core cities to support secondary cities in technology, investment, and services. However, these imaginary visions are based on the assumption that secondary cities have the capacity to rapidly adapt to take on critical functional roles in increasingly complex regional systems, such as new population agglomeration centers or bases for regional industrial innovation and transformation. In fact, the challenge faced by many secondary cities is that they are unable to benefit from mega-regionalization because of their lack of such multidimensional capacity (Lambe, 2012), experience, and resources. Furthermore, these cities cannot refuse to participate in this process of spatial transformation and must face ever-intensifying infrastructural linkages and an increasingly powerful core city, as discussed in the policy orientations study. As a result of this capacity-based place mismatch, mega-regionalization processes increase the polarization and peripheralization of secondary cities.

The second governance mismatch arises from the emphasis on strengthening the leadership of core cities in mega-regionalization processes. This context allows core cities to prioritize their own development rather than build partnerships with secondary cities based on financial, knowledge, and technological support, as advocated by planning policy. We conceptualize this as the *priority mismatch*. Over the past decades, central governments have been conservative in their attitudes towards large cities: they do not want to see the excessive rise of megacities but instead value equalitarianism. For example, in the *Seventh Five-Year Plan* (1986–1990), it was explicitly announced that the central government would resolutely prevent the over-expansion of large cities and place the priorities of development on small and medium-sized cities and towns (CNDRC, 1986). However, in the *Ninth Five-Year Plan* (1996–2000), emphasis was gradually placed on the creation of new territorial cooperation units with large cities as central pillars, conceptualized as "economic circles", in order to highlight their status as economic engines (CNDRC, 1996). In this way, the authorities have recognized the development and expansion of large cities as economic growth machines, which have come at the cost of severe intra-regional unevenness, as mentioned previously. As a result, initiatives for mega-regional cooperation have gradually replaced the encouragement of competition, with a recentralization of mega-regional governance attempting to manage the vicious competitive relations between cities. However, the lack of willingness of the core cities to cooperate under this new model has hindered the achievement of the policy orientations. Existing studies uncover this difference in regional cooperation priorities. For example, Hebei Province took the initiative to Beijing based on the *Beijing-Tianjin-Hebei Integration Plan* issued by the NDRC in 2006, but Beijing did not accept the term "integration" and only suggested the possibility of cooperating with Hebei's relevant secondary cities under certain conditions with an emphasis on its own interests (Li & Jonas, 2023). In the case of lagging mega-regions with more limited resources, the preference for core cities is even more pronounced, as evidenced by the policy of "strengthening regional capitals" (Zhang, Tian, & Sohail, 2022). Even though mega-regional planning agendas favor of a more cooperative and balanced system where smaller cities play important roles, the big cities have retained a competitive mindset to consolidate their dominance in the region, and prioritize their own development rather than the demands for inter-city cooperation, further contributing to polarization and peripheralization.

The two governance mismatches mentioned above concern, respectively, the capacity of secondary cities to integrate into mega-regional systems and the unwillingness of core cities to face a new cooperation-oriented development scenario. They have been somewhat alleviated in recent years. On one hand, the strengths of the secondary cities are gradually being tapped into, and some cities are emerging as competitors in the region. For example, Dongguan, located close to Guangzhou, Shenzhen, and Hong Kong, has become a substantial manufacturing base in the Greater Bay Area (Wang et al., 2016). On the other hand, cooperation between core and secondary cities is gradually being established under the coordination of higher-level government. The Shenzhen-Shanwei economic cooperation zone is a compelling example, where the core city has taken on the responsibility of driving the industrial transformation of the secondary cities (SCGD, 2023; Zhang & Sun, 2019).

However, a third governance mismatch obstructs mega-regionalization's potential to respond to the former two: *the actor mismatch*. This is triggered by the imbalance of political voice between core and secondary cities in the mega-regional system. That is to say, the term "secondary" does not only mean that these cities are smaller in terms of population, economy, and built-up land, but more importantly, in terms of unequal political power relations. This inequality has a direct impact on the policy effectiveness of mega-regions. Spatial relations based on industrial linkages, as identified in the policy orientations analysis, are a good example. As mentioned in the coexistence theme, core cities are expected to gradually transfer industrial clusters, firms, and labor to neighboring secondary cities to reduce their development pressures. At the connectivity level, infrastructure links enhance exchanges between the industries of core and secondary cities and allow the former to support the latter. At the level of cooperation, the authorities encourage closer spatial relations between core and secondary cities, including the co-development of new emerging industries, and joint governance actions towards industrial transformation. However, such spatial relations have not contributed to development

opportunities for secondary cities due to the unequal political power of the actors involved. In the Beijing-Tianjin-Hebei mega-region, for example, Hebei hopes to locate its industrial clusters in the vicinity of Beijing to take advantage of investment attraction and technological support, and was limited by Beijing's objections to potential pollution from these industries (Li & Jonas, 2023).

Mega-regionalization seems to offer opportunities for core cities to establish closer connections with neighboring secondary cities under the pretext of "regional integration" (Jaros, 2016; Zhang & Sun, 2019; Zhang & Wu, 2006). But the shift to recentralized mega-regional governance does not seem to cope with such a dilemma. As Li and Jonas (2023) point out: *"these initiatives did not achieve substantial progress towards metropolitan or regional integration because none of the departmental promoters on either the planning side or the NDRC side was powerful and authoritative enough to coalesce the localities."* To some extent, the growth pattern centered on large cities continues despite what if formulated in planning policies. The concept of "*state spatial selectivity*" plays a role, by organizing urban (regional) functional and productive space through careful national policy arrangements guided by a broader development strategy. Such policies aim to create new "champion urban regions" (Zhong & Su, 2019). Thus, the expectations of large cities as growth machines have not diminished, and industrial clusters with higher profitability have been spatially located in the core of mega-regions and only in a few critical secondary cities (Herlevi, 2017; Tang et al., 2022).

7. Discussion and conclusion

The growing development gap between core and secondary cities in Chinese mega-regions is increasingly worrying, and the challenges of polarization and peripheralization are becoming bottlenecks for regional sustainability. The mega-region is an emerging spatial governance concept to promote regional coordination, thus offering a chance to tackle the secondary cities' challenges, but it does not necessarily alleviate polarization and peripheralization. In the face of this problem, we analyzed the spatial relations between core and secondary cities, aiming at a deeper understanding of intra-regional unevenness. We developed a three-step conceptual framework (Fig. 7). First, we borrowed existing frameworks to define three relational categories guiding the visions behind mega-regions: morphological polycentricity, flow multi-directionality, and functional complementarity, which supported the systematic study of mega-regional planning policies. Then, we explored the policy orientations of mega-regional planning in response to the challenges faced by secondary cities and extracted three main themes: coexistence, connectivity, and cooperation. Coexistence implies the need for core and secondary cities to set their development directions based on shared rules and visions, including spatial, functional, ecological and environmental considerations. Connectivity refers to managing multi-directional population flows, infrastructure extension, and information exchanges. Cooperation includes strategic interventions regarding industry, knowledge and innovation, heritage preservation, and shared services.

Finally, we take a critical position on why mega-regionalization, an ambitious approach towards regional coordination, fails to address the problem of intra-regional unevenness. We conceptualize a place mismatch, caused by the lack of inherent capacity of secondary cities to adapt to rapidly changing regional integration paths and emerging cooperation networks due to a lack of governance capacity, resources, and endowments; a priority mismatch, caused by the unwillingness of core cities to follow policy orientations towards coordinating spatial relations, as they remain more concerned with consolidating their dominance in the regional system than with supporting a more balanced mega-region; and an actor mismatch, referring to the imbalanced power relations between core and secondary cities, as the latter lack the political voice to co-direct integration and cooperation processes for their benefit.

Despite this comprehensive conceptual framework, it is important to recognize that there are huge differences among Chinese mega-regions, in terms of socio-economic development, geopolitics, and functional positioning (Fang, 2015; Harrison & Gu, 2023). In this paper, we did not emphasize this variation but found that despite their differences, policymakers prefer to use similar terminology to elaborate visions and related strategies. We argue that this is because all mega-regions play similarly important roles in "imagined planning" at the national level. For example, in most mega-regional plans, the core cities are the centers of political, economic, cultural, transportation, and innovation development. In other words, similar planning policies across different mega-regions try to create similar core-secondary spatial relations, which leads to highly contrasting fortunes of secondary cities, as recently shown by Du et al. (2024).

When comparing our conceptual framework with international research, spatial patterns and governance paradigms are also the two main perspectives to focus on mega-regional unevenness (Hanssens et al., 2014; Innes et al., 2010). For example, secondary cities can benefit

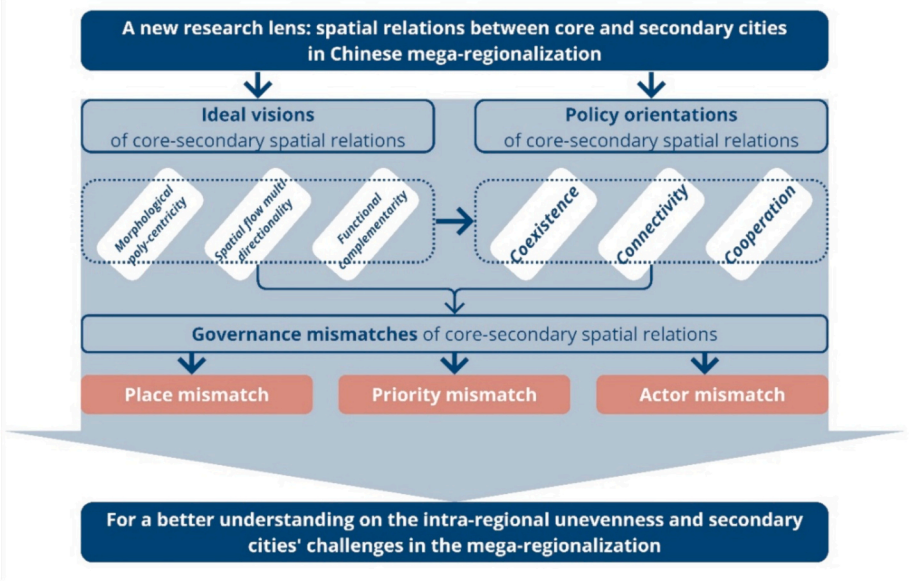

Fig. 7. Conceptual framework for the understanding on the core-secondary spatial relations source: the authors.

from the polycentric model of the Randstad in the Netherlands (i.e. borrowing size: Meijers & Burger, 2017). However, the overly fragmented administrative system in this region creates practical barriers to regional governance with a common vision. Discussions on the core-secondary spatial relations appear in both perspectives. While polycentricity constantly emphasizes the greater role that secondary cities should play in the regional system, the dominance of core cities is increasingly entrenched in highly marketized and capitalized networks. In Switzerland, for example, the knowledge economy continues to agglomerate in large cities, while secondary cities must attract business from global firms through favorable tax policies or targeted services (Thierstein et al., 2008).

These two perspectives are in line with the lens we adopt in this paper. Globally, there is potential for mega-regionalization to tackle intra-regional unevenness. This is also applicable to the Chinese context, however, from the governance perspective, the differences between China and other countries raise different concerns. First, the over-ambitious scale of Chinese mega-regions (Harrison & Gu, 2021) makes beneficial interactions between cities harder to achieve and more likely to polarize talent, investment, and technology in the core cities. Second, China prefers a top-down approach to promoting mega-regionalization. This improves the efficiency, but may lead to over-dominance by the core cities or a mismatch between the policy vision and the development needs of the secondary cities. Clearly, the governance mismatches we propose are specific to the Chinese context.

Another innovative contribution of this paper is to frame the policy orientations of mega-region authorities within coexistence, connectivity, and cooperation. We have yet to find a similar conceptualization in the global context, but these approaches are widely practiced. Coexistence appears in the *Transportation and Climate Initiatives* in the United States in response to the climate crisis (Ross et al., 2016), or the revitalization of the Rhine-Ruhr region through regional branding (Goess et al., 2016). Regarding connectivity, the regional railroad system in Japan reinforces population mobility across cities (Hiramatsu, 2023). In Munich, informational links between large APS firms define a polycentric regional system where secondary cities provide high value (Lüthi et al., 2010). As for cooperation, the emergence of inter-city collaborative bodies promotes the optimization of governance practices, including information exchange, data sharing, and strategic planning (Ross et al., 2016). The conceptualization and potential impacts on secondary cities of these practices are similar to what we found in Chinese policy, considering the differences in spatial and governance contexts.

In summary, this paper unravels the spatial relations between core and secondary cities as a new lens to understand intra-regional unevenness. This has significant implications for both academia and practice. To start, the framework serves as an analytical tool that can lead to more in-depth empirical investigations. For example, the three policy orientations extracted from the spatial planning documents provide a theoretical basis for more detailed case studies (e.g., focusing on a specific city or mega-region) to clarify relevant governance strategies and actions and study the implications of existing coordination policies. In addition, the three governance mismatches (place, priority, and actor) can be further developed into different research questions to understand the potential negative side effects of mega-regionalization governance on secondary cities. They can, to some extent, remind policymakers of the need for risk aversion in planning practice to build a more balanced mega-regional system. In conclusion, this conceptual framework utilizes nine specific concepts through three sub-studies to understand the complexities of the spatial relations between core and secondary cities in mega-regions. It is the first conceptualization of such a complex system of mega-regions in China grounded in the challenges of secondary cities and seen from their perspective. It aims to stimulate a broader discussion about a more efficiently functioning, structurally rational, and sustainable mega-regional system.

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CRediT authorship contribution statement

Yizhao Du: Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Rodrigo V. Cardoso:** Writing – review & editing, Validation, Supervision, Conceptualization. **Roberto Rocco:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Appendix

Coding ID	Mega-region	Planning documents	Issued institution	Issued date
HC	Harbin-Changchun mega-region	*Development plan for Harbin-Changchun mega-region*	China National Development and Reform Commission (CNDRC)	March. 2016
BJ	Beijing-Tianjin-Hebei mega-region	*The fourteenth five-year socioeconomic plan for Beijing*[a]	People's Government of Beijing municipality	January. 2021
TJ		*The fourteenth five-year socioeconomic plan for Tianjin*[a]	People's Government of Tianjin municipality	February. 2021
HB		*The fourteenth five-year socioeconomic plan for Hebei*[a]	People's Government of Hebei Province	
SX	Central-Shanxi mega-region	*High quality development plan for Central- Shanxi mega-region*	People's Government of Shanxi Province	October. 2022
HY	Hohhot-Baotou-Ordos-Yulin mega-region	*Development plan for Hohhot-Baotou-Ordos-Yulin mega-region*	CNDRC	February. 2018
NX	Ningxia mega-region	*Strategic development plan for Ningxia*[a]	People's Government of Ningxia Autonomous Region	March. 2016
LX	Lanzhou-Xi' ning mega-region	*Development plan for Lanzhou-Xi' ning mega-region*	CNDRC, and Ministry of Housing and Urban-Rural Development (MHURD)	March. 2018
TS	Tianshan North Slope mega-region	*The fourteenth five-year socioeconomic plan for Xinjiang autonomous region*[a]	People's Government of Xinjiang Autonomous Region	February. 2021

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(*continued*)

Coding ID	Mega-region	Planning documents	Issued institution	Issued date
GP	Guanzhong-Plain mega-region	*Development plan for Guanzhong-Plain mega-region*	CNDRC, and MHURD	February. 2018
CC	Chengdu-Chongqing mega-region	*Development plan for Chengdu-Chongqing mega-region*	CNDRC, and MHURD	May. 2016
GZ	Central-Guizhou mega-region	*Development plan for Central-Guizhou mega-region*	Guizhou Provincial Development and Reform Commission	April. 2017
YN	Central-Yunnan mega-region	*Development plan for Central-Yunnan mega-region*	People's Government of Yunnan Province	August. 2020
BBW	Beibu gulf mega-region	*Development plan for Beibu gulf mega-region*	CNDRC, and MHURD	February. 2017
GBA	The Greater Bay Area	*Outline development plan for the Guangdong-Hong Kong-Macao Greater bay area*	The State Council of the People's Republic of China	February. 2019
HXX	West-Taiwan strait mega-region[b]	*Development plan for West Taiwan strait economic region*	CNDRC	March. 2011
MYR	Middle Yangtze river mega-region	*Development plan for Middle Yangtze river mega-region*	CNDRC	April. 2015
YRD	Yangtze river delta mega-region	*Development plan for Yangtze river delta mega-region*	CNDRC, and MHURD	June. 2016
CP	Central-Plain mega-region	*Development plan for Central-plain mega-region*	CNDRC	December. 2016
SD	Shandong peninsula mega-region	*Development plan for Shandong peninsula mega-region*	People's government of Shandong province	December. 2021
LN	South-Liaoning mega-region	*Development plan for South Liaoning mega-region*	People's government of Liaoning province	September. 2018

[a] All planning documents are obtained from the relevant official governmental websites. We are not able to collect planning documents related to the Beijing-Tianjin-Hebei Coordinated Development Planning Outline, Ningxia Yellow River Mega-region, and the Tianshan North Slope Mega-region, so we used the relevant chapters in Overall development plan of Ningxia and The 14th Five-Year Plan of Beijing, Tianjin, Hebei, and Xinjiang, which have detailed arrangements for the development of these three Mega-regions as substitutes.

[b] The West Taiwan strait mega-region was renamed as Guangdong-Fujian-Zhejiang coastal mega-region in the 14th Five-Year Plan. Since the related plan was not promulgated so far, we followed the original name.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cities.2024.105375.

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