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Taylor & Francis Group

Journal of Comparative Policy Analysis: Research and Practice

ISSN: 1387-6988 (Print) 1572-5448 (Online) Journal homepage: www.tandfonline.com/journals/fcpa20

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To cite this article: Lingyi Zhou & Hao Ren (30 Oct 2025): How Core and Peripheral Cities Select Partners for Inter-Local Public Service Delivery in the Digital Age: A Comparative Study in the Yangtze River Delta Region of China, Journal of Comparative Policy Analysis: Research and Practice, DOI: 10.1080/13876988.2025.2563872

To link to this article: https://doi.org/10.1080/13876988.2025.2563872

Journal of Comparative Policy Analysis, 2025
Vol. 00, No. 00, 1–20, https://doi.org/10.1080/13876988.2025.2563872

How Core and Peripheral Cities Select Partners for Inter-Local Public Service Delivery in the Digital Age: A Comparative Study in the Yangtze River Delta Region of China

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(Received 6 May 2025; accepted 13 September 2025)

ABSTRACT *Digital technologies are reshaping inter-local collaboration, yet little research has examined their varying effects across actors with different power and resource levels. This study investigates inter-local public service delivery in Yangtze River Delta region of China, contrasting core-periphery and periphery-periphery partnerships. Employing a gravity equation regression, we find that: (1) digital technologies significantly enhance inter-local collaboration; (2) core cities form ties with peripheral ones when they share digitalization priorities, whereas peripheral cities collaborate most with peers exhibiting similar economic profiles but divergent levels of policy attention to digital government.*

Keywords: inter-local public service delivery; digital technologies; core-periphery structure; Yangtze River Delta region

1. Introduction

Governments are increasingly confronted with "tangled" problems – complex challenges involving multiple actors, overlapping jurisdictions, and fragmented resources (Dawes et al. 2009). A notable example is the coordination of public service delivery for migrant workers, which often spans administrative boundaries between their places of residence and employment. In response to such complexity, cities have adopted various mechanisms to enhance responsiveness and citizen engagement. Government service hotlines – such as China's

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12345 system – have become prominent tools in this regard. These hotlines serve not only as a channel for citizens to express concerns and demands, but also as a feedback mechanism for identifying governance blind spots and improving service delivery in real time.

While such hotline systems help governments respond more quickly and transparently to localized issues, they also reveal the limitations of single-jurisdiction responses to increasingly cross-boundary demands. Many urban problems, particularly in metropolitan regions with high population mobility, require coordinated action across local governments. As a result, inter-local public service delivery has emerged as a critical dimension of responsive urban governance – one that goes beyond citizen interaction to address institutional collaboration across jurisdictions.

Digital transformation in government has evolved from simple digitization toward a comprehensive rethinking of core processes and services. Driven by technological progress, changing management practices, and rising citizen expectations, it involves reworking policies, workflows, and service delivery to create integrated, user-centered digital solutions (Mergel et al. 2018). This transformation is enabled by a broad array of digital technologies, including information and communication technologies (ICTs), cloud computing, big data analytics, artificial intelligence (AI), digital platforms and portals, among others. Over the past decades, a substantial body of research has focused on e-government collaboration, particularly examining the systems and factors influencing cross-boundary information exchange and sharing (Chen and Lee 2018; Gil-Garcia et al. 2019), as well as the determinants, strategies, and outcomes of integrated service delivery within e-government contexts (Boudreau and Bernier 2017; Juell-Skielse et al. 2017; Chen et al. 2019; Wouters et al. 2023). In the digital government realm, collaboration across organizational boundaries, such as departments within a government or local governments at different levels, is imperative to leverage technology for providing an integrated and customized view of public service (Chen and Lee 2018). Scholars have identified several potential benefits of digital technologies for inter-local collaboration, such as real-time data sharing, reduced transaction costs, enhanced trust and transparency, and mitigation of information asymmetry (Fauchart et al. 2022; Guo et al. 2025).

The aforementioned studies suggest that digital technologies may be transforming the patterns of collaboration among local governments, but few have explored whether these technologies produce differentiated effects on collaborative relationships among actors with varying levels of power or resources. Power and resource asymmetries are critical factors influencing the formation and sustainability of collaborations. Given that collaboration often entails substantial transaction and administrative costs, actors with limited power or resources are frequently marginalized or relegated to subordinate roles within collaborative structures (Ansell and Gash 2008; Ran and Qi 2018; Ren 2025). From a social network perspective, the configuration shaped by power asymmetries is often characterized as a core-periphery structure (Borgatti and Everett 2000; Nordlund 2018). Extensive empirical research has demonstrated that such structural patterns – characterized by dominant core actors and dependent peripheral participants – are prevalent across various domains, including trade, environmental governance, and disaster management (Smith and Sarabi 2022; Ku et al. 2024). Moreover, scholars have found that digital technology allows more innovation collaboration between cities, and also provides an important window of opportunity for remote and peripheral cities to

integrate into the network (Guo et al. 2025). In that sense, if digital technologies contribute to breaking barriers to geographical distance and data sharing, how does collaboration between core and peripheral cities differ from that between peripheral cities themselves?

This study specifically focuses on a typical example of integrated service delivery supported by providers in different jurisdictions, that is, inter-local public service delivery. Inter-local public service delivery refers to the ability of residents to access government services not only within their own administrative district but also in other districts that have established collaborative agreements. This system enables residents to complete administrative procedures beyond their home districts, thereby enhancing service efficiency and exemplifying responsive urban governance through improved accessibility, timeliness, and alignment with citizens' spatial and service needs. As an emerging form of collaboration in China, inter-local public service delivery is increasingly supported by digital technologies, which enhance real-time data sharing, foster trust and transparency, and reduce entry barriers for less well-resourced jurisdictions. Thus, we argue that the factors influencing inter-local public service delivery between core and peripheral cities may differ from those between peripheral cities, particularly regarding the role of digital technologies. We aim to extend research on inter-local collaboration in the context of digital government through a comparative perspective, answering the following research questions: *What roles does digital technology play in inter-local public service delivery? Specifically, how do these influencing factors differ between inter-local public service delivery involving core to peripheral cities, compared to those between peripheral cities?* To answer these questions, we conduct a quantitative analysis of inter-local public service delivery, using the Yangtze River Delta (YRD) region of China as a case study. This region provides a suitable setting to examine variations in collaboration patterns due to its rich practices of inter-local public service delivery and nationally leading digital government development.

Our research contributes to the existing literature in three ways. First, this study focuses on the role of digital technologies in collaborations from a comparative perspective, which has been a relatively less studied topic, extending our understanding of how digital technologies exert differentiated impacts on collaboration between core-periphery regions compared to that between peripheral regions. Second, this paper studies inter-local collaboration for public service delivery within the context of e-government. While the e-government literature offers extensive insights into inter-agency and inter-organizational collaboration for information sharing (Gil-Garcia and Sayogo 2016; Chen et al. 2019), theoretical development on inter-local collaboration for public service delivery has lagged behind, and large-sample quantitative studies on this topic remain scarce. This study provides evidence of the role technological factors play in the process of inter-local public service delivery within e-government settings. Third, this paper contributes to the literature on core-periphery theory by extending the conventional model of core dominance and peripheral dependency. While existing studies primarily emphasize the hierarchical nature of such networks, this study suggests that advances in digital technologies – by lowering coordination cost – can facilitate collaborative relationships not only between core and peripheral actors but also among peripheral actors themselves. Moreover, the paper argues that peripheral actors adopt distinct strategic logics in collaboration, depending on whether they are engaging with core cities or with other peripheral counterparts.

2. Literature Review and Hypotheses

2.1 Literature on Integrated Service Delivery within Collaborative e-Government

In recent decades, digital technologies have played an important role in facilitating inter-organizational collaborations. Previous research has identified two key roles of technology (Bryson et al. 2015). First, technology serves as a practical tool that facilitates coordination (Pardo et al. 2010). Second, it can act as a "nonhuman actor" shaping interactions and offering system-level solutions beyond the control or perception of individual actors (Latour 2005). These technology-enabled collaborative environments for governments are referred to as collaborative e-government. Moreover, researchers have highlighted several benefits of digital government initiatives, including enhanced effectiveness, improved service delivery, greater accountability, performance-based communication, stronger inter-organizational collaboration, and increased knowledge sharing (Puron-Cid 2013).

The integration of digital technologies has profoundly transformed public service delivery, echoing broader trends across industries in enhancing productivity, enabling user-centered strategies, and expanding institutional reach. One of the most salient manifestations of this transformation is integrated public service delivery, which exemplifies how digital tools can reconfigure traditional bureaucratic processes. Conceptually, integrated service delivery entails the seamless coordination of public services across departmental, sectoral, and jurisdictional boundaries, often organized through loosely coupled yet interdependent inter-organizational networks (Chen 2008). From a digital government perspective, Wouters et al. (2023) frame integrated service delivery as a subset of digital public services – services delivered by different providers but orchestrated coherently within a unified service chain. This approach reduces fragmented interactions between citizens and public agencies, thereby lowering transaction costs and alleviating administrative burdens. However, achieving such integration requires robust inter-organizational collaboration, particularly in developing technical infrastructure and aligning back-office systems (Juell-Skielse et al. 2017).

Empirical research further reveals that the effectiveness of integrated service delivery hinges on a constellation of technological, managerial, and institutional enablers. For instance, Chen et al. (2019) demonstrate that factors such as leadership commitment, shared objectives, inter-agency trust, citizen-oriented and innovation-friendly organizational cultures, and administrative interdependence all exert differential influences on the efficiency, effectiveness, and accountability of inter-organizational e-government systems. Based on a two-dimensional typology grounded in technological and institutional analysis, Zhou (2025) argues that centralized guidance and policy support are crucial for standardizing procedures and aligning practices during inter-local collaboration. Notably, institutional factors play a more foundational role in shaping public service delivery across jurisdictions and can significantly influence the effectiveness of technological empowerment.

Despite its potential benefits, advancing integrated service delivery remains a complex endeavor. The involvement of diverse stakeholders, varying procedural requirements, and the need for robust technical infrastructure often hinder progress. Boudreau and Bernier (2017) highlight institutional, political, and managerial barriers to implementation, emphasizing how entrenched administrative routines, organizational autonomy, and fragmented governance structures complicate efforts to provide seamless online services.

In response to these challenges, scholars have proposed a more systematic understanding of collaborative strategies – focusing on stakeholder engagement, motivational alignment, and coordinated action. When effectively combined, these strategies can help mitigate the so-called "adoption paradox" and foster more coherent and sustainable approaches to integrated service delivery (Wouters et al. 2023).

2.2 Literature on Core-Periphery Structure

In social network analysis, a core-periphery structure is defined by a densely interconnected core of nodes surrounded by a periphery of nodes that are sparsely connected to each other but maintain ties to the core (Borgatti and Everett 2000). This structural pattern is commonly observed across various types of social networks. For instance, in world systems and international trade studies, some countries occupy the central position with greater access to resources and advanced technologies, while peripheral countries tend to engage in lower-end manufacturing and remain economically subordinate. Similar patterns emerge in inter-organizational collaborative networks (Smith and Sarabi 2022). Ku et al. (2024), for example, found that collaborative responses to the 2015 epidemic in South Korea reflected the core-periphery relationship – where central actors, particularly major cities, played a dominant role in driving network dynamics.

The emergence of core-periphery structures is fundamentally rooted in power and resource imbalances (Smith and Sarabi 2022). In the study of world systems or new economic geography, disparities in economic development, technological capacity, or market size are commonly identified as key drivers of the core-periphery relationship (Bănică et al. 2024). Regarding inter-local collaboration, some actors have more influence or administrative resources, which generates a power imbalance between different actors (Ku et al. 2024). This imbalance leads to two interrelated outcomes: first, actors with limited resources may be excluded from collaborative arrangements altogether; second, even when included, these actors often occupy peripheral roles, reliant on core actors for access to resources and information. Consequently, collaborative networks are frequently characterized by a dominant, resource-rich core and a dependent periphery (Ku et al. 2024). At the macro level, this manifests as peripheral actors maintaining ties primarily with one or a few core actors, while horizontal connections among peripheral actors remain limited (Nordlund 2018).

The aforementioned studies highlight that core and peripheral actors exhibit distinct behavioral logics within networks characterized by vertical power hierarchies. For instance, Smith and Sarabi (2022) demonstrated significant differences in export behavior between core and peripheral countries within international trade networks. While such research provides valuable insight into vertical interactions within core-periphery structures, relatively limited attention has been given to the horizontal dynamics – specifically, the interactions and collaborative behavior among peripheral actors themselves within these hierarchically structured networks. Existing literature has shown that digital technologies help break down barriers to knowledge exchange, reduce communication costs, and facilitate innovative collaboration among geographically dispersed actors (Van Alstyne and Brynjolfsson 2005; Forman and Van Zeebroeck 2019). Thus, considering the transformative impact of digital technology, comparing network formation between core-periphery and periphery-periphery city relationships is essential for

deepening our understanding of how digital tools reshape traditional core-periphery structures.

Therefore, in the following section, we develop hypotheses regarding the factors that influence inter-local collaboration among core-periphery cities from a comparative perspective, drawing on insights from digital technologies, leadership transfer network, and homophily.

2.3 Hypotheses

Digital Technologies. Digital technologies – such as cloud computing, social media platforms, mobile applications, and big data – are reshaping the landscape of public service design and delivery. Social media enables real-time citizen engagement and participatory feedback mechanisms, while mobile applications provide ubiquitous access to services, enhancing user convenience and responsiveness (Wukich 2021). Cloud computing supports the scalability and resilience of digital infrastructure, ensuring service continuity during peak demand periods (Ionescu 2025). Moreover, big data analytics facilitate inter-agency collaboration and promote transparency, contributing to greater efficiency and public trust in service provision.

Digital technologies enable real-time, cross-spatial communication and data exchange, which helps overcome fragmentation, disjointed decision-making, and overlapping responsibilities in traditional governance process. This, in turn, supports the integration and reengineering of government–business processes for more coherent and responsive service delivery. Digitalization in public service delivery offers many benefits, including improved citizen-centric services, better customer experience, improved governance, and more efficient public service delivery. Moreover, technological factors play a critical role and can offer innovative solutions to enhance inter-local public service delivery, even partially overcoming existing institutional barriers (Zhou 2025).

First of all, the level of digitalization – reflected in the development of digital infrastructure and industries – constitutes a key dimension of digital technology and provides the essential foundation for building governments' digital governance capacity. Technical infrastructure, interoperable standards, and system compatibility are key determinants of inter-organizational information sharing and collaboration (Sanderson et al. 2015). In this regard, a higher level of digitalization provides the technical platform for inter-local public service delivery by enabling interconnected information systems and the deep integration of heterogeneous data resources. Digitalization enhances the efficiency, scalability, and responsiveness of inter-local cooperation by allowing seamless data sharing and real-time coordination. Emerging technologies such as blockchain and interoperable databases foster mutual trust and transparency in cross-jurisdictional collaborations, particularly where formal governance mechanisms are weak or fragmented.

Policy attention to digital government serves as a key indicator of the degree of focus, visibility, and prioritization that policymakers assign to digitalization over time. Attention, as a policy resource, is inherently scarce, flexible, and transient. Elevated levels of policy attention are often associated with increased allocation of resources and stronger institutional coordination. When digital government becomes a focal point of political and administrative agendas, it can mobilize essential support – human, financial, and material – necessary for implementation. Moreover, sustained leadership attention can help overcome

institutional inertia and resolve conflicts that may arise during policy execution, thereby enhancing the coherence and effectiveness of digital initiatives. In the context of inter-local public service delivery, technological compatibility and system interoperability across jurisdictions are often prerequisites. Achieving this requires shared standards, metadata frameworks, platform and application interoperability, and algorithmic alignment (Reichman et al. 2011). When local governments exhibit similar levels of policy attention to digital transformation, their systems tend to converge, and reform needs become more aligned – facilitating the emergence of inter-local service networks.

Additionally, we argue that digital technologies play a more pivotal role in shaping collaborative relationships between core and peripheral cities than between peripheral cities themselves. On the one hand, peripheral cities often exhibit greater economic dependence on core cities, leading to more frequent population flows and heightened demand for inter-local public service delivery. Digital technologies facilitate such cross-tier collaborations by enhancing social proximity between migrants and their places of origin (Wilke and Pyka 2025). On the other hand, the adoption of digital technologies significantly enhances knowledge exchange, enables data sharing, and reduces communication costs (Van Alstyne and Brynjolfsson 2005; Forman and Van Zeebroeck 2019). These technologies also offer peripheral and remote cities a critical opportunity to connect and collaborate with core cities, overcoming spatial and institutional barriers (Guo et al. 2025). Accordingly, we propose the following hypotheses:

Hypothesis 1a: A higher level of digitalization facilitates the formation of inter-local public service delivery networks.

Hypothesis 1b: Greater homogeneity in policy attention to digital government promotes the formation of inter-local public service delivery networks.

Hypothesis 1c: Compared to collaborations between peripheral cities, the homogeneity of policy attention exerts a more significant and positive influence on the formation of inter-local public service delivery networks between core and peripheral cities.

Leadership Transfer Network. Local leaders play a key role in decision-making and governmental behavior (Ren et al. 2024). Previous studies have shown that leadership's communication and coordination capacity, and the degree of attention and support for collaboration, are influencing factors of collaborative governance (Mu et al. 2019). Based on the practice of China, many scholars have found that the professional network formed by cross-regional transfer can promote the collaboration of local governments in public services, environmental governance, economy, and trade (Jiang and Yuan 2020). Inter-local public service delivery necessitates that local governments share information, align relevant standards and procedures, and formalize agreements – all of which can incur significant communication and negotiation costs. When local leaders have previously worked in the jurisdictions of

their inter-local counterparts, forming professional networks, the resulting trust and familiarity between governments can help reduce transaction costs and mitigate coordination uncertainties. This relational capital becomes particularly vital in collaborations between core and peripheral cities, where institutional and developmental disparities often increase the likelihood of risk and conflict. In such cases, leadership networks serve as crucial mechanisms for facilitating cooperation and fostering more stable inter-local partnerships. Accordingly, we put forward the following hypotheses:

Hypothesis 2a: Leadership transfer network enhances the formation of inter-local public service delivery network.

Hypothesis 2b: Compared with inter-local public service delivery between periphery-periphery cities, leadership transfer network has a more significant and positive role in forming the network between core-periphery cities.

Economic Homophily. The existing research shows that participants are often more willing to choose organizations similar to themselves as the partners, because it is easier for them to reach a common goal and could effectively reduce the potential risks and transaction costs (Zhou and Dai 2023). Homophily in economic development reduces asymmetries in bargaining power and resource endowments, thereby lowering the perceived risks and transaction costs associated with collaboration (Ren et al. 2025). Moreover, similar levels of economic development often reflect shared policy priorities and planning horizons, which facilitate consensus-building and joint problem-solving (Berardo and Scholz 2010). When local governments exhibit a high degree of economic homophily, their development priorities and policy agendas tend to be more aligned, making it easier to reach consensus on inter-local public service delivery aimed at improving the business environment. Moreover, we argue that economic homophily plays an even more critical role in facilitating collaboration between peripheral cities, where mutual needs and resource constraints necessitate stronger interactions and joint initiatives. In contrast, in partnerships between core and peripheral cities, collaborative demands often arise from population migration flows toward economically stronger core areas, which naturally stimulate the formation of intercity service networks despite asymmetries in development levels. Accordingly, we put forward relevant hypotheses:

Hypothesis 3a: High economic homophily among local governments promotes the formation of inter-local public service delivery networks.

Hypothesis 3b: Compared with inter-local public service delivery between core-periphery cities, economic homophily has a more significant and positive role in forming the network between periphery-periphery cities.

3. Case: Inter-Local Public Service Delivery in Yangtze River Delta Region

3.1 Case Selection

The Yangtze River Delta region, comprising Shanghai Municipality and approximately 40 prefecture-level cities across Jiangsu, Zhejiang, and Anhui provinces, forms one of China's most economically developed and densely integrated urban clusters. Covering just 4 per cent of China's land area and housing around 17 per cent of the national population, the YRD's 2022 GDP reached nearly 29 trillion RMB, representing about 25 per cent of the country's total economic output.[1]

This region reflects high levels of both population and corporate mobility. Migration flows and urbanization trends have accelerated in recent years, reinforcing inter-jurisdictional ties and service needs. Based on data from the China Statistical Yearbook, the proportion of inter-provincial migrants in this region increased from 64.4 per cent in 2010 to 71.7 per cent in 2017.[2] In 2023, the Yangtze River Delta Regional Collaborative Innovation Index reported 5,389 cross-regional investments among listed companies in the YRD,[3] with Shanghai attracting 53.3 per cent of Jiangsu's, 49.2 per cent of Zhejiang's, and 37.0 per cent of Anhui's out-of-province investment projects.[4]

These patterns heighten the demand for integrated public service systems across administrative boundaries. In response, the YRD region has pioneered inter-local public service delivery, initiating the Pilot Work Plan for the "One Network Service" in the Yangtze River Delta region in 2019 to coordinate access to 23 personal-service items. This effort was formally endorsed by the State Council's 2020 Guiding Opinions on Accelerating Inter-Provincial Public Service Delivery, which designated the YRD as one of four national pilot zones.

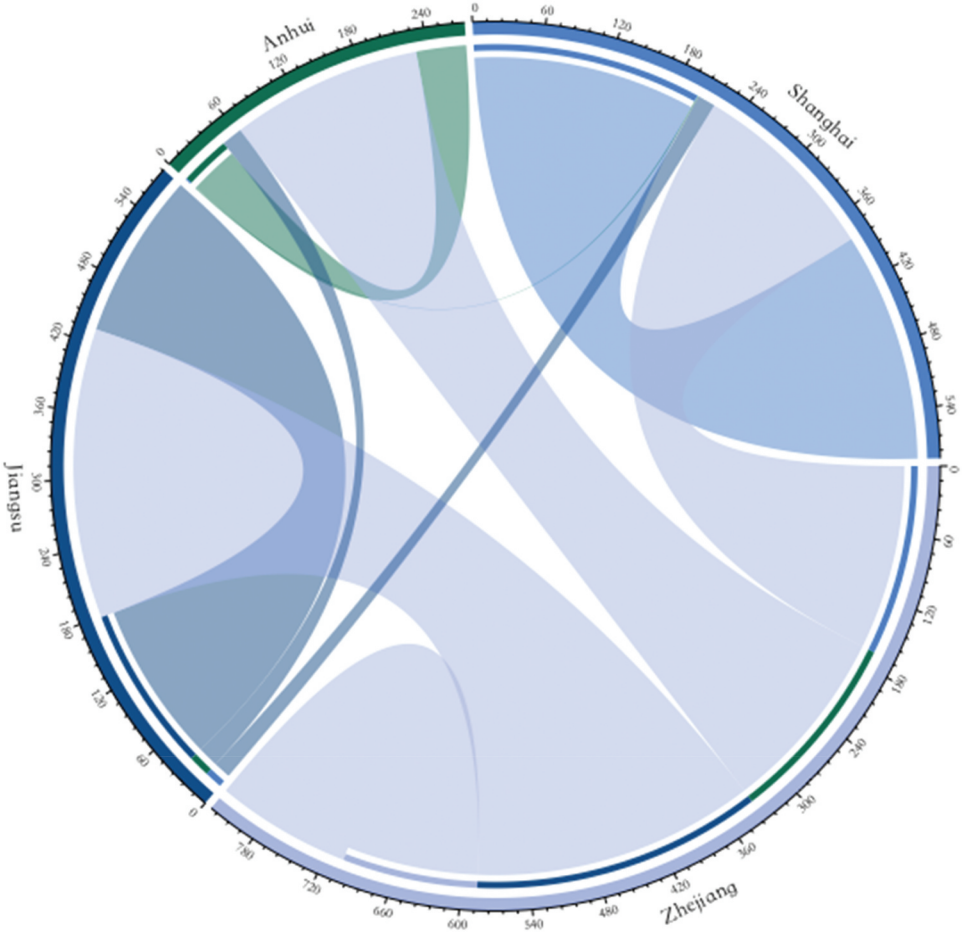
Most cities set up one-to-one collaboration with another city, while others prefer alliances in surrounding areas for inter-local public service delivery, such as the intercity service alliance in Nanjing Metropolitan Area, the interprovincial service window in the demonstration zone of green and integrated ecological development of the Yangtze River Delta, and others. Service delivery methods now include online processing platforms, virtual service windows, and off-site manual handling. As of mid-2024, the region supports 148 inter-local public service items – including newborn household registration, first-time ID card applications, and marriage registration – and has processed over 6.42 million online cross-jurisdictional service cases via its integrated digital platform.

3.2 Data Source

The data on inter-local public service delivery contains several sources, such as the official website of the government services in the YRD region, offline special windows, agreement texts, and governmental organ news reports. First, we input keywords such as "inter-provincial" and "intra-provincial" in the data source to extract reports on inter-local public services delivery. Second, due to the multiplicity of data sources, the same agreement may appear in different search channels, therefore, we remove duplicate records. Third, the database contains some reports on collaboration information from provinces and cities outside YRD region, and these reports are also excluded.

The distribution of inter-local public services delivery in YRD region from 2020 to 2024 is shown in Figure 1. Inter-local public service delivery is widely practiced among cities in YRD, occurring both within provinces and across provincial boundaries. Moreover, cities in Zhejiang Province exhibit the highest level of inter-local collaboration, engaging in over more than 780 initiatives with other cities in the YRD. Cites in Anhui Province show the lowest level of participation, with slightly more than 230 initiatives recorded. In particular, Zhejiang Province and Jiangsu Province share the highest number of cross-regional public service initiatives, which account for a total of 250.

Figure 1. The distribution of inter-local public service delivery in Yangtze River Delta



4. Methods

4.1 Model

This paper employs a gravity equation to investigate the above hypotheses. In international trade literature, the gravity equation is widely used to model trade flows between partners. It posits that the scale of trade is positively related to the scale variable and inversely related to the distance variable (Lewer and Van den Berg 2008). Recently, the gravity equation method has extended to political science and public administration, particularly in examining core-periphery relations (Smith and Sarabi 2022). Therefore, we adopt the following gravity equation:

$$Y_i = \alpha + \beta X_i + \gamma dist_i + \delta M_i + \varepsilon_i$$

where, i denotes an undirected city pair, reflecting the reciprocal nature of inter-local public service collaboration. When two cities sign an agreement, they typically establish reciprocal arrangements for sharing identical government services.

Y_i is the dependent variable, representing the count of bilateral public service delivery in city pair i. While previous studies have used binary indicators (capturing only the existence of agreements), we argue that such dummy variables fail to reflect intensity and quality of inter-local collaboration. To address this limitation, our study employs the count of bilateral public service delivery as dependent variable. X_i denotes the scale variable, measuring the product of digitalization degree of paired cities. A higher degree of digitalization is expected to correlate with greater inter-local public service delivery. $dist_i$ is the distance variable. This paper includes three distance variables: geographic distance, cultural distance, and investment linkage distance to comprehensively assess the impact of economic, social, and cultural exchanges on cross-regional public services delivery. M_i is a set of explanatory variables, and ε_i is the random error term.

Considering that the dependent variables are count variables, this paper uses the Poisson pseudo-maximum likelihood estimation (PPML) method to eliminate the effect of heterogeneity in estimation.

4.2 Variables

4.2.3 Dependent Variable. **The number of inter-local public services**: This paper uses the count of public services available for inter-local delivery between paired cities as the dependent variable.

4.2.4 Independent Variables. **Digitalization level:** This study posits a positive relationship between the digitalization level and the inter-local delivery of public services. The digitalization degree is measured using the PKU Digital Financial Inclusion Index (PKU-DFIIC).[5] This index captures digital financial inclusion through breadth of coverage, depth of usage, and digitalization level. Several studies have confirmed that the suitability of this index as proxy for local digitalization levels (Liu et al. 2021).

Differences in policy attention to digital government: Differences in attention between the two cities regarding the digital government will also influence the achievement of inter-local collaboration. Prior studies have demonstrated that government

attention can be quantified using textual data (Fan et al. 2023). Specifically, changes in the frequency of policy-relevant keywords in official documents can serve as an indicator of policy attention allocation. In the Chinese context, the local government work report is a key policy document that reviews the previous achievements and outlines future priorities. Accordingly, this study measures a city's attention to digital government by calculating the proportion of digital government-related keywords[6] to the total word count in its annual government work report. The policy attention difference is defined as the absolute value of the difference in digital government attention between paired cities.

Leadership transfer network: For paired cities, this paper sets the binary variable to characterize the leadership transfer network. It is assigned a value of 1 if the municipal party secretary or mayor of the paired city has held a position at the division level or above in the other city, and a value of 0 otherwise.

Differences in economic development: For paired cities, this paper employs the absolute value of the difference in GDP per capita to indicate economic heterogeneity, with smaller values suggesting a closer level of economic development between the paired cities.

4.2.5 Control Variables. **Differences in environment complexity**: Environmental complexity is an important factor affecting public service delivery, and population size is commonly used to indicate the complexity of socioeconomic situation. Thus, this paper uses the absolute value of the difference in population size between paired cities as a proxy for the difference in environmental complexity.

Metropolitan area: Currently, the YRD region contains six metropolitan areas, including the Shanghai Metropolitan Area,[7] the Nanjing Metropolitan Area,[8] the Hangzhou Metropolitan Area,[9] the Hefei Metropolitan Area,[10] the Suzhou–Wuxi–Changzhou Metropolitan Area,[11] and the Ningbo Metropolitan Area.[12] If the paired cities belong to the same metropolitan area, the value is assigned to 1, otherwise 0.

Geographic distance: The data source for geographic distance is Baidu map API calculation. Geographic distance in logarithmic form is used in the regression equation.

Cultural distance: In this paper, we use dialect distance between paired cities to represent cultural distance. The calculation method is derived from the weighted average method based on population size used by Liu et al. (2021).

Investment linkage distance: We use the inverse of the frequency of firms investing in each other between paired cities in 2020 as the investment linkage distance. Data on the frequency of inter-local investment is drawn from Shu et al. (2025).

This paper highlights the variability in the factors influencing inter-local public services delivery for both core to peripheral cities and peripheral to peripheral cities. A key empirical challenge is defining what constitutes a "core city". As noted earlier, the YRD region contains six metropolitan areas, five of which are named after the largest cities in terms of economy and population within those areas. In the Su–Xi–Chang Metropolitan Area, the economic size difference between Suzhou and Wuxi is relatively small, leading us to treat both as central cities. As a result, we identified seven core cities: Shanghai, Nanjing, Hangzhou, Hefei, Suzhou, Wuxi, and Ningbo. Among them, Shanghai is a provincial-level municipality, Nanjing, Hangzhou, and Ningbo are sub-provincial cities, and Hefei is a provincial capital. Except for Suzhou and Wuxi, the administrative level of core cities is higher than that of peripheral cities. Economically,

Table 1. Mean difference in key variables

	Core-periphery pattern	Periphery-periphery pattern
The number of inter-local public service delivery	119.305	113.362
Digitalization level	872.565	768.842
Differences in policy attention in digitalization	0.706	0.396
Leadership transfer network	0.108	0.061
Differences in economic development	7.549	3.661
Differences in environment complexity	5.423	2.744
Metropolitan area	0.173	0.094
Geographic distance	288.001	325.239
Cultural distance	0.0253	0.0249
Investment linkage distance	0.0081	0.0636

these central cities also demonstrate disproportionate influence: in 2024, they accounted for 37 per cent of the total GDP and an even larger share – 69 per cent – of total fiscal revenue among all cities in YRD region. In the Chinese context, both administrative rank and economic or fiscal scale are critical indicators of a city's influence.

The results of the mean differences in key variables are presented in Table 1. Contrary to the expectations of a traditional core-periphery model, this study found no significant difference in the extent of digital public service delivery collaboration between core-periphery and periphery-periphery city pairs. Moreover, we calculated the difference in the number of inter-local public service collaborations between intra-provincial and inter-provincial city pairs for both the core-periphery and periphery-periphery patterns. As shown in Table 2, inter-provincial collaborations occur significantly more often than intra-provincial ones in the periphery-periphery pattern. By contrast, no significant difference is observed for the core-periphery pattern. According to the traditional view, inter-provincial collaboration entails higher transaction costs, and peripheral cities, constrained by limited resources and capacity, are less inclined to engage in such collaboration. However, our findings suggest that digital technologies may help reduce coordination and transaction costs, thereby enabling more frequent collaboration among peripheral cities, even across provincial boundaries.

Furthermore, significant differences in the means of control and distance variables were observed between the two network patterns, suggesting that core-periphery collaborations may be driven by motivations distinct from those underlying periphery-periphery collaborations.

Table 2. Inter-local public service delivery between intra-provincial and inter-provincial city pairs

	Core-periphery pattern		Periphery-periphery pattern	
The number of inter-local public service delivery	Intra-province 115	Inter-province 121	Intra-province 82.4	Inter-province 129

5. Empirical Results

Table 3 reports the gravity equation model result. Columns (1)–(3) present inter-local public service delivery between core and periphery cities, and columns (4)–(6) show the results for collaboration among peripheral cities. The coefficients for distance variables are significantly negative, whereas the coefficients for digitalization level are significantly positive. These findings align with the expectations of the gravity model, which posits a negative relationship with distance and a positive relationship with the scale variable. Besides, the positive coefficient for digitalization level provides strong evidence for hypothesis 1a.

The differentiated coefficients for government attention and economic disparity between two types of city pairs reveal distinct determinants of inter-local public service delivery. For core-periphery collaborations, the differences in policy attention to digitalization exhibit significantly negative coefficients, indicating that greater alignment in policy priorities promotes collaboration. This illustrates the hierarchical dynamics of core-periphery relations: when peripheral cities demonstrate

Table 3. Regression results on gravity equation model

	Core-periphery pattern			Periphery-periphery pattern		
	(1)	(2)	(3)	(4)	(5)	(6)
Digitalization level	0.0062*** (0.0009)	0.0057*** (0.0009)	0.0085*** (0.0010)	0.0076*** (0.0005)	0.0078*** (0.0005)	0.0083*** (0.0005)
Differences in policy attention	−0.2192* (0.1188)	−0.2836** (0.1223)	−0.3191*** (0.1136)	0.1768* (0.0970)	0.2214** (0.0989)	0.0527 (0.1101)
Differences in economic development	0.0082 (0.0157)	0.0138 (0.0164)	0.0087 (0.0149)	−0.0482*** (0.0106)	−0.0614*** (0.0111)	−0.0383*** (0.0116)
Differences in environment complexity	−0.0661*** (0.0092)	−0.0639*** (0.0095)	−0.0501*** (0.0096)	−0.0412*** (0.0138)	−0.0264* (0.0139)	−0.0112 (0.0146)
Leadership transfer network	0.2896** (0.1153)	0.3069** (0.1184)	0.2800** (0.1120)	0.2735*** (0.0873)	0.2692*** (0.0893)	0.1913** (0.0884)
Metropolitan area	0.6888*** (0.1407)	0.4241*** (0.1506)	0.5433*** (0.1148)	0.4875*** (0.0893)	0.3586*** (0.0879)	0.1872** (0.0832)
Geographic distance	−0.5119*** (0.1137)			−0.5951*** (0.0580)		
Cultural distance		−0.1865 (0.1353)			−0.5527*** (0.0671)	
Investment linkage distance			0.5433*** (0.1148)			0.1185*** (0.0281)
Intercept	−3.3573*** (1.1790)	−0.7219 (1.1183)	−1.0676 (0.8776)	−4.5360*** (0.5134)	−3.4137*** (0.4812)	−1.2385*** (0.4059)
Obs	238	238	238	561	561	561
R^2	0.5431	0.5179	0.5224	0.4653	0.4495	0.4554

Note: *<10 per cent, **<5 per cent, ***<1 per cent.

a commitment to digitalization comparable to that of core cities, transaction costs are reduced, enabling more collaboration.

However, using the absolute difference in government attention to digitalization to capture homophily may introduce error. Consider two cities in one pair, A and B: if both have a value of 10 in government attention to digitalization, the absolute difference is 0; likewise, if both have a value of 1, the absolute difference is also 0. Although in both cases the measure suggests two cities share comparable government attention to digitalization, the underlying conditions are clearly distinct. To address this bias, we calculate the average level of digitalization attention across the 41 cities, classifying those above the average as high attention and the rest as low attention. This results in 22 cities being categorized as high attention and 19 as low attention. Based on this classification, we group city pairs into three categories: high–high, low–low, and high–low (or low–high). For the core-periphery pattern, we observe 133 pairs are in the high–low (low–high) group, 126 pairs are in the high–high group, and none are in the low–low group. This suggests that the negative coefficients primarily reflect outcomes between high–high pairs and high–low (low–high) pairs. Consequently, the use of absolute differences in this context is unlikely to generate serious estimation bias.

Conversely, for periphery-periphery collaborations, the coefficients for differences in digitalization attention are significantly positive. This suggests that when neither city occupies a dominant position, collaboration tends to emerge as one partner taking a leadership role. In such cases, a larger disparity in policy attention may signal clear initiative from the more proactive city, thereby facilitating consensus and coordination on joint issues. This mechanism aligns with core-periphery theory, which indicates that non-core actors often rely on structured interactions to compensate for positional disadvantages (Borgatti and Everett 2000). When one peripheral city exhibits noticeably higher policy attention, it effectively acts as an emergent hub – promoting alignment and guiding collaboration in the absence of formal dominance.

To further explore this mechanism, we divided periphery-periphery pairs into three subgroups: 285 high–low (or low–high) pairs, 105 high–high pairs, and 171 low–low pairs. We then estimated gravity regressions with geographic distance for each subgroup and compared the coefficients for differences in policy attention. This design allows us to compare city pairs with similar actual levels of policy attention, thereby isolating the effect of attention homophily on collaborative decision-making while controlling for the confounding influence of policy attention levels. The results are shown in Table 4. In the high–low group, the coefficient is significantly positive, suggesting that attention

Table 4. Subgroup regression for periphery-periphery pattern

	High–low	High–high	Low–low
Differences in policy attention	0.3729**	−0.2328	−0.2294
	(0.1451)	(0.2550)	(0.3181)
Other variables	Yes	Yes	Yes
Geographic distance	Yes	Yes	Yes
Obs	285	105	171
R^2	0.3825	0.3017	0.3184

Note: *<10 per cent, **<5 per cent, ***<1 per cent.

disparity facilitates collaboration. In contrast, the coefficients in high–high and low–low subgroups are both negative and not significant. This suggests that when both cities exhibit similarly high or low attention, the effect of policy attention homophily on collaboration is not significant. Overall, these results support hypothesis 1c, suggesting that in periphery-periphery city pairs, collaboration is driven by attention asymmetry and resource imbalance, particularly when one city assumes a leading role.

The coefficients for leadership transfer networks are significantly positive both in core-periphery and periphery-periphery patterns, indicating that leadership mobility promotes inter-local public service delivery. This supports hypothesis 2a. However, the magnitudes do not exhibit significant differences between the two patterns, failing to support hypothesis 2b.

The coefficients for economic development disparity are positive but not significant in Columns (1)–(3). In contrast, the coefficients are significantly negative in Columns(4)–(6). This difference indicates that smaller economic disparities are associated with a higher likelihood of collaboration among periphery actors. This result is consist with hypothesis 3b, reflecting the lower transaction costs and stronger alignment of policy needs that accompany similar levels of economic development, thereby facilitating inter-local public service delivery.

Finally, the coefficients for differences in environmental complexity are significantly negative. This result highlights that homogeneity in environmental complexity fosters collaboration, as cities with comparable socioeconomic profiles face fewer obstacles in aligning service frameworks and procedures. The positive coefficients for metropolitan areas reveal that metropolitan area membership exerts a significant influence on inter-local public service delivery. Cities situated within the same metropolitan region are more likely to establish collaborative arrangements with each other, as they share stronger socioeconomic and institutional linkages.

6. Conclusions

Using data from the YRD region, we empirically examine differences in the determinants of inter-local public service delivery collaboration in digital government between core-periphery and periphery-periphery city pairs, employing a gravity equation model. The results demonstrate that digital technologies are pivotal in fostering inter-local collaboration. Yet this baseline pattern diverges when we consider policy attention to digital government: in core-periphery patterns, greater alignment of digitalization priorities reduces transaction costs and smooths coordination; in periphery-periphery pairs, asymmetric attention signals leadership by the more proactive partner and actually promotes collaboration. Lower economic gaps among peripheral cities facilitate collaboration by aligning development needs and reducing coordination barriers. Leadership mobility, homogeneity in environmental complexity, and shared metropolitan governance further enhance trust and alignment, amplifying inter-local public service delivery. Overall, collaboration between core–peripheral cities is more concerned with policy and resource alignment, while collaboration between peripheral–peripheral cities is more dependent on a clear

leader city and similar levels of economic development. These differences highlight the varying motivations and needs for intercity collaboration, and also reflect the distinct dynamics of partner selection within the core-periphery structure in the context of digital governance.

The findings offer three key insights for advancing theory and practice. First and foremost, this comparative study investigates the role of digital technologies in collaborations by comparing network formation between core-periphery and periphery-periphery city pairs. Based on this, practitioners can design and promote inter-local public service delivery in a targeted manner. Second, investing in digital capacity – upgrading networks, cloud platforms, and local digital industries – ensures consistently high levels of digitalization. This shared technical foundation strengthens both core-periphery linkages and peer-to-peer service networks, reducing transaction costs and enhancing the reliability of inter-local platforms. Third, strengthening policy alignment across jurisdictions accelerates unified service rollout. Such synchronization of policy priorities and resource allocation minimizes administrative fragmentation, streamlines decision-making, and creates the coordinated environment necessary for seamless, citizen-centered public service delivery.

Beyond the YRD region, these findings also provide useful insights for shaping national strategies in regional governance. In particular, lessons on digital capacity building and policy coordination can inform initiatives such as the Beijing–Tianjin–Hebei integration or the Greater Bay Area development. Furthermore, for less-developed regions where the digital divide remains more pronounced, prioritizing investments in digital infrastructure and capacity is critical to avoid exacerbating existing disparities. Tailored approaches that account for uneven technological readiness can help ensure that digital government initiatives promote inclusive, balanced regional development rather than reinforcing inequalities.

There are several limitations to this study. It relies solely on data from China's Yangtze River Delta region, which constrains the validity and generalizability of our findings. Future research should broaden the scope to include other major clusters – such as Beijing–Tianjin–Hebei, the Pearl River Delta, and Chengdu–Chongqing – to deepen our understanding of the mechanisms driving inter-local collaboration in public service delivery. Nonetheless, this study makes theoretical contributions to the literature on e-government collaboration by adopting a comparative perspective and delineating the role of digital technologies within the core-periphery structure.

Notes

1. Source: https://news.cgtn.com/news/2023-12-06/Yangtze-River-Delta-aims-for-integrated-high-quality-development-1phMV0umGVq/index.html?utm_source=chatgpt.com.
2. Source: https://export.shobserver.com/baijiahao/html/278306.html.
3. Source: https://m.thepaper.cn/kuaibao_detail.jsp?contid=26207894.
4. Source: https://m.thepaper.cn/kuaibao_detail.jsp?contid=26207894.
5. More detail is shown in https://en.idf.pku.edu.cn/docs/20190610145822397835.pdf.
6. E-government keywords: Big data, data mining, virtual reality, cloud computing, Internet of Things, cloud platforms, blockchain, digital currency, artificial intelligence, machine learning, 5 G, 6 G, industrial internet, smart manufacturing, digital supply chain, e-commerce, quantitative finance, digital government, digital economy, intelligent city, government service platform.
7. This area encompasses Shanghai, Suzhou, Wuxi, Changzhou, Nantong, Jiaxing, Ningbo, Zhoushan, and Huzhou.

8. This area encompasses Nanjing, Zhenjiang, Yangzhou, Huaian, Maanshan, Chuzhou, Wuhu, and Xuancheng.
9. This area encompasses Hangzhou, Huzhou, Jiaxing, Shaoxing, Quzhou, and Huangshan.
10. This area encompasses Hefei, Huainan, Lu'an, Chuzhou, Wuhu, Ma'anshan, and Bengbu.
11. This area encompasses Suzhou, Wuxi, and Changzhou.
12. This area encompasses Ningbo, Zhoushan, and Taizhou.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the National Social Science Fund of China [Grant No. 24BZZ081].

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