

The Impact of Digital Economy on Regional Integration: A Case Study of the Yangtze River Delta

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Abstract. Regional integration has been a critical factor in promoting economic development and reducing disparities among cities, especially in rapidly urbanizing regions. This paper explored the role of the digital economy in promoting regional integration within the Yangtze River Delta (YRD) by examining the impact of modern digital technologies, such as big data, cloud computing, and artificial intelligence, on urban economic collaboration. It identified key mechanisms through which digital technologies enhanced regional cooperation, including cost reduction, industrial agglomeration, and governance innovation. A comparative analysis of cities like Shanghai, Suzhou, and Hangzhou highlighted how advanced digital infrastructures and comprehensive policy frameworks fostered economic integration, while peripheral cities faced challenges due to policy gaps and underdeveloped digital infrastructure. The study emphasized the need for tailored strategies to address the unique characteristics of different urban clusters and the importance of governance coordination to facilitate smoother regional integration. Furthermore, this paper suggested that future policies should focus on scaling digital governance platforms, enhancing human capital development, and bridging environmental and industrial policies with digital tools to ensure sustainable and inclusive growth across the region.

Keywords: Regional integration, Digital Economy, cost reduction, industrial agglomeration, governance innovation

1. Introduction

Regional integration is a crucial path to surmount traditional development constraints such as geographical boundaries and administrative barriers and promote the establishment of a national unified market. In China, taking the Yangtze River Delta as examples, significant achievements have been made in regional integration, and its development is constantly accelerating. With globalization and technological progress, regional integration is gradually developing towards a wider and deeper tier of diversified integration. The connotation of regional integration has expanded to multiple fields such as institutional cohesion, innovation coordination and ecological co-governance (Shen, 2024). By eliminating market segmentation and unifying institutional rules, regional integration can achieve efficient allocation of factors and sharing of public services, thus enhancing the competitiveness of the region. Especially in the Yangtze River Delta, Beijing-Tianjin-Hebei and other urban agglomerations of China, the strengthening of regional integration in multiple fields has significantly promoted the construction of cross domain collaborative governance and innovation network, providing a foundation for high quality development.

Through technological spread and restructuring of data as the production factor, the digital economy is one of the core driving forces for regional integration. The interconnection of digital infrastructure overcomes geographical restrictions and promotes cross-regional resource integration and industrial chain coordination (Zhang et al., 2021). The flow of data factors reduces transaction costs, promotes the formation of unified market rules, and helps break down local protection and administrative barriers. Through the connectivity of various subjects and innovation spillover effect, digital technology can strengthen regional knowledge sharing, accelerate the construction of technological proximity, and bridge the differences of urban tiers. Therefore, it is crucial to study and summarize the overall impact of the digital economy on regional integration. Regional integration has emerged as a critical strategy for achieving coordinated development in China's Yangtze River Delta (YRD), with digital economy serving as both a drive and structural force reshaping economic patterns. Recent studies have demonstrated that the construction of digital infrastructure significantly

enhances cross-regional connectivity, with Feng et al. (2024) revealed that digital infrastructure contributes over 40% to regional integration effects in the YRD through optimized capital and technology flows. This aligns with Wen (2024) found that digital technologies reconfigure industrial chains by reducing spatial transaction costs, which is evident in the YRD's specialized manufacturing clusters.

The YRD's experience highlights three critical dimensions of digital-driven regional integration. First, the development of platform economy has effectively weakened administrative boundary effects, as evidenced by Akhter et al. (2023) who observed the reduction in inter-city logistics costs through standardized digital payment systems. Second, the circulation of data factors shows asymmetric impacts, while core cities such as Shanghai achieve 15-20% productivity gains from data sharing (Han & Qin, 2023), peripheral regions face challenges in digital resource allocation. Third, institutional innovation plays a pivotal role, with Ge et al. (2025) emphasized that harmonized digital governance frameworks increase cross border investment compared to fragmented regulatory environments. The YRD's multiple scalar governance framework introduces unique cases. At the urban agglomeration tier, Xu & Li (2024) quantified a spatial spillover coefficient for digital economy impacts, suggested strong technology diffusion between cities. However, provincial tier analyses by Zhong et al. (2024) revealed persistent digital protectionism. This institutional friction partially explains why not all YRD cities achieved meaningful data interoperability. Emerging research emphasizes the influence of digital financial inclusion. Xu & Li (2024) identified a U-shaped relationship where digital finance initially suppresses then accelerates regional integration after reaching critical mass.

Recent analyses revealed three paradoxes in digital enabled integration. Wen (2024) identified a productivity gap where digital transformation widens development disparities between advanced manufacturing bases and traditional industrial zones. Meanwhile, Zhong et al. (2024) demonstrated that while digital government construction reduces resource misallocation in core cities, it inadvertently creates new digital divides through uneven digital city investments. These findings echo warnings about the selective permeability of digital integration, where technology firms benefit disproportionately from regional cooperative mechanisms. Despite these results, three research gaps persist. First, existing studies predominantly focus on economic integration metrics while underrepresenting social and environmental dimensions. Second, the interaction between digital transformation and institutional innovation remains underexplored, particularly regarding cross-jurisdictional data governance. Third, most analyses employ provincial tier data, lacking granular examination of prefecture tier city dynamics where YRD's digital economy activities concentrate. These limitations highlight the need for micro tier investigations into the YRD's digital integration mechanisms.

The specific question of how digital economy technologies can be effectively integrated across cities with distinct development tiers and different administrative structures remains understudied. Past investigations have typically focused on uniform application or broad policy directives. Few studies address how digital technologies can be differentially deployed in leading, developing, and lagging cities to mitigate spatial inequalities, especially in large and diverse areas like the Yangtze River Delta. Little attention has been given to exploring customized, multiple scalar strategies that leverage digital tools and advanced infrastructure for inter-city synergy within unified or partially unified administrative systems. This multiple tier analysis is necessary for the development of China today. Building on earlier research findings, this paper set out to articulate how digital economic technologies can be systematically employed to promote deeper forms of regional integration. It aimed to propose a structured framework for aligning digital infrastructures, with local city needs and administrative priorities. Identified effective policy interventions and governance mechanisms through which distinct administrative tiers can collaborate more effectively by sharing data resources and applying digital solutions. Provided an evaluative basis for decision makers to refine multiple tier governance and to mitigate disparities among regions, ultimately accelerating cross-regional synergy and integrated development.

2. The Role of the Digital Economy in Promoting Regional Integration in the Yangtze River Delta

Recent studies have shown that modern digital technologies, including big data, cloud computing, and artificial intelligence, are not only restructuring production and service functions but also reshaping the collaborative mechanisms of cities (Zhang et al., 2021). The case analyses explore how the digital economy advances regional integration in the YRD by comparing typical cities, contrasting digital economy policy differences across city tiers, and examining micro tier digital technology application feedback.

At the macro scale, digital transformation in key central cities such as Shanghai, Suzhou, and Hangzhou have built the backbone of regional integration by forming robust digital infrastructure and platforms that facilitate efficient information exchange. These cities have established comprehensive digital ecosystems that serve as hubs for technological innovation, which in turn stimulate industrial restructuring and collaborative economic activities (Wen, 2024). For example, policies in these cities often emphasize the establishment of integrated data platforms and unified market environments, which enable both public and private actors to share resources and reduce transaction costs. In contrast, peripheral cities within the YRD face challenges in digital infrastructure and policy support, resulting in noticeable policy gaps and slower digital transformation. This divergence in technology application negatively impacts regional integration; therefore, the effective integration of the digital economy necessitates that even lower-tier cities adopt appropriate policy tools and digital strategies tailored to their unique conditions (Xu & Li, 2024).

A typical city comparison reveals that central cities in the YRD benefit from a higher degree of digitalization and more advanced technological application models. These cities often implement proactive digital policies that integrate financial, industrial, and technological elements. Their policies tend to emphasize comprehensive digital ecosystem development, including investments in digital infrastructure, research and development support, and coordinated governance mechanisms. In doing so, they attract high quality talent and facilitate seamless cross border connectivity with neighboring regions. For instance, policy instruments in these cities frequently include regulatory incentives and fiscal support measures that not only spur technology innovation but also encourage the spillover of digital economy benefits to adjacent regions. Conversely, lower tier cities tend to adopt more conservative digital economy policies, often focusing on incremental improvements in digital access and basic infrastructure. These policy differences underscore the tendency of central cities to opt for comprehensive digital transformation frameworks, while peripheral cities rely on simpler policy tools.

From a micro perspective, the application of digital technologies provides valuable feedback on their effectiveness in promoting regional integration. Firms in central cities that have integrated advanced data analytics and cloud based operational systems experience improvements in operational efficiency and market responsiveness. In contrast, micro businesses in peripheral cities report that, despite some progress in digital access, they still struggle with outdated digital management and governance (Zhong et al., 2024). This micro tier discrepancy indicates that digital transformation is not a one-size-fits-all process. The digital feedback from these diverse urban actors shows that while technological spillover has the potential to drive integration, its full benefits can only be realized when digital policies are tailored to regional characteristics and accompanied by effective implementation mechanisms.

Furthermore, the evidence from spatial analyses conducted within the YRD reinforces the notion of significant spatial spillover effects: digital technology innovations tend to be spatially clustered in core areas such as Shanghai and southern Jiangsu, yet innovative activities are gradually diffusing to surrounding areas (Xu & Li, 2024). However, the degree of digital technology innovation remains uneven. Higher tier cities not only secure the largest share of innovation outputs but also influence the digital transformation paths in neighboring regions, either by acting as conduits of market integration or by creating an agglomeration zone that can siphon off resources from smaller cities (Wen, 2024). Hence, the regional digital economic policies must consider such spatial dynamics, ensuring that integration strategies are adaptive and inclusive of varying local capacities.

The digital economy has demonstrated a considerable impact on regional integration in the Yangtze River Delta. Major cities leverage advanced digital infrastructures and comprehensive technological innovation policies to create strong digital ecosystems that drive not only local growth but also broader regional synergy. At the same time, differences in policy orientation and tool selection between high tier and lower tier cities reveal that successful integration depends on a balanced approach, one that advances centralized digital strategies while also addressing the unique challenges faced by peripheral cities. Complementary micro-observations highlight that user feedback and firm-level digital adoption are critical for refining these policies. Moving forward, regional integration strategies need to emphasize tailored policy initiatives that enhance technology diffusion, reduce regional disparities, and foster a collaborative digital economy environment. Such holistic digital policy coordination can ultimately transform the YRD into a highly integrated, competitive, and sustainable regional economic zone (Wang et al., 2024).

3. Operational Mechanisms of the Digital Economy in Facilitating Regional Integration within the Yangtze River Delta

Digital economy has direct and indirect influences, reshapes factor flows, industrial linkages, and governance structures. Drawing on multiple recent studies, the following analysis examines four interrelated mechanisms: cost reduction and resource mobility; industrial agglomeration and value chain restructuring; governance innovation and collaborative networks; overarching spillovers for sustainable and inclusive development.

A primary mechanism by which the digital economy drives integration is the substantial decrease in transaction and coordination costs. Wen (2024) reported that standardized digital payment systems helped reduce logistics expenses across major YRD cities. Concurrently, improvements in broadband and 5G infrastructure have accelerated data flow and coordination efficiency, enabling local firms to expand beyond traditional administrative boundaries (Feng et al., 2024). This seamless connectivity facilitates the swift relocation of production inputs and professional services. Digitalization fosters real time matching between supply and demand, whether in e-commerce, ride-sharing, or smart logistics. Through these platforms, smaller municipalities can break into regional markets, bridging the urban-rural divide (Xu & Li, 2024). By optimizing the use of road networks and digital tracking tools, trade barriers have been gradually eliminated, contributing to a more interconnected and interdependent regional economy (Han & Qin, 2023).

Beyond reducing costs, the digital economy reshapes industrial clusters, thereby reinforcing cooperation among cities. According to Zhong et al. (2024), core YRD cities boasted a digital industry agglomeration that is over four times greater than in peripheral areas. However, these more developed digital hubs generate positive spillovers for surrounding municipalities by sharing knowledge and enabling industrial upgrades. The advanced manufacturing sectors benefit especially from industrial internet platforms, which improve supply chain coordination, reduce idle capacity, and speed up innovation cycles (Wen, 2024). Simultaneously, digitalization paves the way for bundling high-end services, such as cloud computing, AI-supported design, and big data analytics, with conventional manufacturing. This bundling can expand local value chains and promote a more specialized division of labor (Wen, 2024). As a result, several YRD corridors have experienced an increase in co-located advanced manufacturing and productive service industries, which enhance each other's competitiveness.

A third mechanism centers on governance reform, as heightened digitalization prompts intergovernmental coordination and unified policy frameworks. Owing to integrated governance platforms and integrated government services, decision makers can streamline administrative approvals and enhance cross border project coordination. Big data analytics aid in the detection of duplicative investments and environmental externalities, thereby encouraging joint action on pollution control, industrial safety, and infrastructure expansion. In this sense, the digital economy acts as an overarching tool for conflict resolution between jurisdictions. Cities can now negotiate or

share data in real time, leading to flexible, network-based partnerships. The establishment of regional environmental monitoring alliances in parts of the YRD demonstrates how digital platforms enable more efficient cooperation on priority issues such as emissions reduction and ecological restoration. Advanced technologies can promote eco-efficiency and green growth via cleaner production processes and reduced resource wastage. By accelerating the shift from polluting industries toward high tech sectors, the digital economy aligns with the YRD's ambition for sustainable regional integration. Moreover, cross-industry data sharing can spark new business models, such as green finance and low carbon logistics, amplifying collective environmental benefits.

Future efforts to strengthen integration will likely revolve around three strategic thrusts. Scaling up shared digital governance platforms can alleviate intercity transaction frictions and bolster policy coordination. Promoting inclusive digital finance and high-quality human capital development can catalyze productivity across different city tiers. Bridging environmental and industrial policies with digital tools will be integral to enhance eco-efficiency, thereby consolidating the YRD's role as a model for high quality, innovation driven growth.

4. Approaches of the digital economy in promoting regional integration among various types of urban clusters

To fully harness the power of the digital economy in promoting regional integration among various types of urban clusters, policymakers and stakeholders must develop tailored strategies that reflect the unique characteristics and needs of each urban grouping.

The unified and robust digital infrastructure is fundamental. Governments should accelerate investments in next-generation communication networks, data centers, and cloud platforms to ensure widespread, high-speed connectivity across all urban clusters. As Feng et al. (2024) highlighted, improving information flow and resource allocation efficiency are critical to overcoming traditional administrative and geographical constraints. Major urban clusters, which typically include core cities with well-established infrastructure can take the lead by implementing pilot projects that integrate Internet of Things (IoT), big data, and artificial intelligence within production and service sectors, thereby setting standards that can later be extended to medium-sized and small urban clusters.

Not all urban clusters are the same. According to the classification in the uploaded city grouping data, urban clusters can be divided into major, medium-sized, and small groups. For major urban clusters that include global hubs such as Shanghai, Beijing, and Guangzhou, policies should focus on deepening the integration of advanced digital technologies into the core industries, enhancing cross-regional governance, and fostering growth of innovation. For medium sized clusters, such as those centered around cities like Xi'an and Chengdu, emphasis should be placed on building digital platforms that facilitate regional collaborations and support economic diversification. Small urban clusters, which may be more peripheral, require targeted interventions to upgrade basic digital infrastructure, foster local entrepreneurship via e-commerce and digital services, and establish partnerships with larger clusters to benefit from technology spillovers. Differential policy design ensures that each cluster's digital transformation is aligned with its economic base and developmental potential (Xu & Li, 2024; Zhong et al., 2024).

Successful regional integration relies on overcoming institutional and administrative barriers. It is crucial to establish a collaborative governance framework that spans national, provincial, and local governments. Tools such as Internet plus Government Services platforms can be used to standardize public services, enabling seamless data sharing and resource allocation among clusters. As Ge et al. (2025) demonstrated in the context of breaking interprovincial trade barriers, digital technologies can diminish the regulatory and administrative frictions that often segment the market. Therefore, policies should promote inter-cluster dialogue, collaborative digital transformation projects, and the establishment of industry alliances to ensure that best practices and innovations are shared among urban clusters, irrespective of their size.

The digital economy offers a unique opportunity to restructure traditional industries through innovative technology. In the YRD, digital integration has led to greater industrial synergy by enabling real time supply chain adjustments and interactive platforms, which in turn lower production and transaction costs (Wen, 2024). For various types of urban clusters, this entails encouraging local industries to embrace digital technologies that facilitate automation, remote collaboration, and data-driven decision-making. Major clusters can pioneer smart manufacturing initiatives, while medium-sized and small clusters might focus on digitally transforming traditional sectors, such as agriculture, small scale manufacturing, or local tourism to improve efficiency and competitiveness. Encouraging collaborative research and development projects and shared digital platforms helps in transferring technology from high resource regions to underdeveloped ones, thereby easing regional disparities.

Leveraging the digital economy for regional integration requires a multi-faceted strategy that emphasizes infrastructure upgrades, differential policy design tailored to various urban clusters, coordinated governance, industrial synergy, and the establishment of a unified digital wholesale market. With targeted interventions tailored to the unique strengths and deficiencies of major, medium-sized, and small urban clusters, the digital economy can serve as a powerful catalyst in bridging regional divides, spurring innovation, and achieving high-quality, coordinated development.

5. Conclusion

This study demonstrated that modern digital technologies, such as big data, cloud computing, and artificial intelligence, are not only transforming traditional production and service functions but are also reshaping the collaborative mechanisms between cities in the YRD. As a result, key cities like Shanghai, Suzhou, and Hangzhou have leveraged advanced digital infrastructures to build robust ecosystems that act as hubs for technological innovation, thereby driving both local growth and broader regional integration. However, the integration process has not been uniform across the region. The peripheral cities in the YRD continue to face challenges in terms of underdeveloped digital infrastructure and slower policy implementation. This divergence in technological capabilities has led to noticeable policy gaps, hindering the region's overall integration. While central cities are able to capitalize on advanced digital systems and comprehensive policy frameworks, smaller and more peripheral cities struggle to catch up, thus perpetuating regional disparities. To address these challenges, this paper emphasized the importance of adopting tailored digital policies that account for the unique needs and conditions of different cities within the YRD.

One of the key insights from this study is that digital integration requires more than just technological advancement; it also demands effective governance frameworks. The success of digital technologies in fostering regional integration largely depends on the alignment of regional governance structures, policy coordination, and collaborative decision-making. The paper outlined how digital platforms could streamline administrative processes, enhance cross-border coordination, and enable real-time data sharing among cities, thereby facilitating smoother interactions between urban centers. Moreover, the digital economy has the potential to foster cooperation across industries by enabling the development of shared platforms for innovation, research, and development. This fosters industrial synergy, allowing various sectors, such as manufacturing, technology, and services, to complement one another in a way that enhances competitiveness and supports sustainable growth.

Moving forward, there is a clear need for comprehensive, region-wide digital strategies that prioritize inclusivity and equity. While the focus has primarily been on enhancing technological infrastructure and governance coordination in major urban clusters, there must also be more attention paid to bridging the digital divide between cities of different tiers. The integration of digital finance, investments in high-quality human capital, and a focus on developing green and sustainable industries are essential in ensuring that all cities within the YRD can benefit from the region's digital transformation. The digital economy offers a powerful means of promoting regional integration, but achieving this potential requires thoughtful, adaptive policies that take into account the diverse needs of urban clusters at various stages of digital development. By fostering a collaborative digital

environment and addressing the unique challenges faced by peripheral cities, the YRD can create a more interconnected, competitive, and sustainable regional economic zone. Future research should focus on refining these strategies by incorporating more robust data analysis, comparative studies, and long-term projections, while also considering the broader social, political, and environmental impacts of digital transformation.

References

- [1] Akhter, N., Rafiq, S., Bibi, Z., & Manj, M. S. 2023. Application of real-time data processing system of Internet of Things based on blockchain technology in the financial field of Yangtze River Delta urban agglomeration. *Soft Computing* 27(14): 10121-10131.
- [2] Feng, C., Gan, Q., & Li, H. 2024. New Infrastructure Construction and Coordinated Development of the Regional Economy: The Empirical Evidence from the Yangtze River Delta Region in China. *Sustainability* 16(24): 10846.
- [3] Ge, T., Yu, Y., Zhong, X., & Jiao, Y. 2025. Cross-Provincial City-Regionalism in China: Evidence from Smart Planning and Integrated Governance of the Yangtze River Delta. *Land* 14(1): 156.
- [4] Han, Q., & Qin, Y. 2023. Promoting data element circulation for urban digital economy development. Trends in Computer Science and Information Technology. *Science and Information Technology* 8(3): 055-060.
- [5] Shen, X. 2024. Research on How the Yangtze River Delta's Integration Policy Affects the Modernization of the Area's Industrial Structure. *Highlights in Business, Economics and Management* 39: 820-825.
- [6] Wang, H., Wang, H., & Guan, R. 2024. Digitalization of industries and labor mobility in China. *China Economic Review* 87: 102248.
- [7] Wen, Y. 2024. The Driving Mechanism and Computational Analysis of Digital Transformation in the Transformation of Traditional Industrial Spatial Structure in the Yangtze River Delta Economic Belt. *The Journal of Combinatorial Mathematics and Combinatorial Computing* 123(1): 149-160.
- [8] Xu, Y., & Li, D. 2024. The Impact and Spatial Spillover Effect of the Digital Economy in the Yangtze River Delta on the Income Gap between Urban and Rural Residents. *International Journal of Global Economics and Management* 5(2): 256-263.
- [9] Zhang, W., Zhao, S., Wan, X., & Yao, Y. 2021. Study on the effect of digital economy on high quality economic development in China. *PLoS ONE* 16(9): e0257365.
- [10] Zhong, H., Wang, B., & Zhang, S. 2024. Spatial analysis of digital economy and its driving factors: A case study of the Yangtze River Delta City Cluster in China. *PLOS ONE* 19(5): e0300443.