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A Review of Research on the Digital Divide between Urban and Rural Areas in China

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ABSTRACT

In the era of the digital economy, the urban–rural digital divide-which stems from the urban–rural dichotomy-has become a key obstacle hindering the advancement of Digital China, rural revitalisation and common prosperity. Existing literature has conducted extensive empirical and theoretical research on the logic behind the formation of the urban–rural digital divide, its multidimensional impacts and governance pathways. Drawing on 10 key academic papers, this paper systematically reviews existing research across four dimensions: conceptual framework, influencing factors, positive and negative effects, and governance pathways. Firstly, it clarifies the historical evolution of the urban–rural digital divide through three progressive stages-access, usage and outcomes-and identifies five core driving factors: economic conditions, demographics, infrastructure, policy and digital literacy; secondly, it analyses the negative dampening effects of the digital divide on widening urban-rural disparities in income, consumption and industry, whilst also examining mitigation mechanisms such as digital village pilot schemes and government digital governance; it then integrates diverse bridging pathways, including hardware infrastructure, digital literacy development, resource decentralisation and intergenerational support; Finally, this paper highlights the limitations of existing research, including insufficient attention to regional heterogeneity, a lack of detailed analysis of the intergenerational digital divide, and the absence of a unified quantitative measurement system. It proposes that future research should strengthen empirical studies by sub-group and region, and expand research on governance mechanisms from the perspective of 'new-quality productive forces', thereby providing a theoretical framework for coordinating the balanced digital development of urban and rural areas.

KEYWORDS

Urban-rural Digital Divide; Digital Villages; Digital Literacy; Digital Access; Consumption Gap; New-quality Productive Forces.

1. INTRODUCTION

As digital technologies such as 5G, big data and artificial intelligence have become deeply embedded in both production and daily life, the uneven distribution of the digital dividend has given rise to an urban–rural digital divide, which has become a new and prominent manifestation of the imbalance in urban and rural development. In 2018, the Central Committee's Document No. 1 first proposed bridging the urban–rural digital divide, whilst the 'Outline of the Digital Rural Development Strategy' identified digital equity as a core lever for rural revitalisation; this has subsequently led to a wealth of related research in academic circles. A review of the literature reveals that domestic research has established a comprehensive research framework centred on the formation mechanisms, multidimensional negative impacts and mitigation strategies of the urban-rural digital divide: Yang Li et al. (2023), drawing on a digital interaction perspective, analysed the strategic value and practical

bottlenecks of digital divide governance[8]; Zhou Yijia (2025), approaching the issue from the angle of consumption inequality, empirically tested the amplifying effect of the digital divide on the urban-rural consumption gap[9]; Xu Chengming et al. (2025) utilised digital rural pilot schemes as quasi-natural experiments to quantify the policy's bridging effects and transmission mechanisms[7]; Tang Huimin (2023) focused specifically on the intergenerational digital divide within rural areas, filling a gap in research on demographic segmentation[4]; Wang Fengyu (2024) traced the historical evolution of the digital divide across four stages-from access to outcomes-and identified phased challenges in its governance[5]; The remaining studies respectively construct measurement indices, analyse spatiotemporal variations, and elucidate the dampening effects on urbanisation and agriculture-related industries, thereby forming a tripartite research framework encompassing theory, empirical evidence and policy recommendations.

Existing reviews tend to focus narrowly on either causes or policy responses, lacking an integrated analysis of the implications of stratification, impact mechanisms, heterogeneity and research on specific sub-groups, and failing to comprehensively cover the core arguments of the 10 studies reviewed here. This paper adopts a framework of 'conceptual evolution – influencing factors – effects and pathways – review and outlook' to systematically integrate the core conclusions of all the literature, clarify existing research consensus and divergences, and identify research gaps, thereby laying a literature foundation for subsequent empirical and policy research on the urban-rural digital divide.

2. THE CONCEPTUAL FRAMEWORK AND EVOLUTION OF THE URBAN–RURAL DIGITAL DIVIDE

2.1. Definition of Core Concepts

The urban–rural digital divide is a tangible manifestation of the urban–rural dichotomy in the digital age. Essentially, it refers to the systemic disparities between urban and rural residents, as well as between rural and urban areas, in terms of digital infrastructure, access to technology, digital skills, access to information resources, and the benefits derived from digitalisation. Wu Xiao'ou et al. (2014) proposed a standardised definition: comprehensive disparities exist among urban and rural populations across three dimensions-the environment for accessing and utilising information, individual digital awareness and capabilities, and the level of digital application[6]. This differs from mere disparities in device ownership and encompasses both technological and social equity attributes. Yang Li et al. (2023), drawing on the theory of digital interaction, defined it as a threefold disparity in urban-rural internet access, digital skills and the use of digital services, arguing that the digital divide is not merely a hardware issue but also a social problem concerning resource allocation and the equalisation of public services[8]. Liu Jianxian (2024) further broke this down into three fundamental dimensions: first, the access divide (disparities in devices and network hardware); second, the usage divide (differences in digital skills and application scenarios); third, the knowledge divide (disparities in information discernment and the ability to derive digital benefits)[2].

2.2. The Historical Evolution of the Three-Tiered Progressive Framework

Wang Fengyu (2024) [5]systematically charts the four-stage evolution of China's urban-rural digital divide, comprehensively illustrating the dynamic transition between the three tiers of the divide; this classification has been cited and corroborated by numerous academic works:

Stage One (early 1990s–early 2000s): The period dominated by the digital access divide. The internet and computers were highly concentrated in urban areas, whilst broadband and terminal device coverage in rural areas was extremely low. By 2000, the disparity in computer ownership per 100 households between urban and rural areas was nearly 20-fold. The core contradiction centred on the

availability of hardware, corresponding to first-generation research on the digital divide, which focused on disparities in network and terminal penetration. Yang Li et al. (2023) added that, during this stage, the skewed allocation of infrastructure investment between urban and rural areas, coupled with the geographically dispersed nature of rural communities which increased construction costs, were the core drivers of the access gap[8].

Stage Two (early 2000s – early 2010s): The digital usage divide emerged. Following the implementation of the 'Internet Access for Every Village' initiative, rural internet penetration rates increased; however, urban and rural digital applications became deeply polarised: whilst urban areas widely utilised online shopping, e-government services and digital finance, rural internet users primarily engaged with short videos and instant messaging. The digital skills gap thus became the primary contradiction, corresponding to the second-generation digital divide, which focuses on disparities in residents' digital literacy. Zhou Yijia (2025) found empirically that during this phase, the usage gap began to spill over into the consumption sphere, widening the urban–rural disparity in service-related consumption[9].

Stage Three (early 2010–2020): The digital usage divide deepened. Whilst the proliferation of mobile internet lowered the barriers to access, the purposes for which urban and rural residents utilised digital technologies diverged. Urban residents relied on digital tools for employment, financial management and educational enrichment, whereas rural residents used them primarily for basic entertainment. Differences in digital skills and educational attainment further widened the usage gap, with older rural residents and those with lower educational attainment becoming digitally disadvantaged groups. Building on this, Tang Huimin (2023) expanded the dimensions of the intergenerational digital divide in rural areas, which constitutes a sub-category within the usage divide: there are significant intergenerational differences between young and middle-aged adults and the elderly in rural areas regarding digital operations and information access; the 'learned helplessness' mindset among the elderly exacerbates the usage gap, constituting a secondary digital divide within rural communities[4].

Phase Four (2020 to present): The digital impact gap has emerged as a new challenge. Whilst rural broadband and 5G hardware are gradually becoming widespread, significantly narrowing the access gap, the disparity in digital benefits between urban and rural areas has become pronounced-representing the third tier of the digital divide. Urban areas feature a high proportion of the digital economy, with mature smart industries and digital public services, whereas rural areas suffer from insufficient provision of digital agriculture, digital healthcare and online educational resources. Consequently, under equivalent network conditions, the gap in income and welfare derived from the digital economy between urban and rural areas continues to widen. Xu Chengming et al. (2025) constructed a comprehensive measurement system based on the three-tier digital divide framework, quantifying the comprehensive urban–rural digital divide index through three major indicators-digital access, digital usage and digital capability-thereby refining the quantitative standards for the three tiers of the digital divide[7].

2.3. Construction of a Multi-dimensional Measurement Indicator System

Wu Xiao'ou et al. (2014) established the earliest systematic measurement framework in China, divided into three primary indicators and 28 sub-indicators: ① Information access environment (broadband, base stations, terminals, tariffs); ② Information awareness and literacy (literacy rate, proportion of higher education); ③ Level of Information Utilisation (online shopping, online public services, multimedia teaching utilisation)[6]. The indicators adhere to the principles of scientific rigour, comparability and data availability, distinguishing between variables reflecting the manifestation of the digital divide and those representing its causes, whilst avoiding the confusion of influencing factors such as income and education as components of the digital divide measurement. Xu Chengming (2025) drew upon this framework and, by combining it with panel data from prefecture-level cities, optimised the indicators[7]. New economic-dimension indicators, such as

urban and rural e-commerce transaction volumes and the number of professionals in the information technology sector, were added to construct a comprehensive measurement model suitable for empirical analysis at the city level, thereby providing a tool for quantifying policy effects. Duan Jieran (2024), adopting a macro-level perspective across all Chinese cities and utilising the International Telecommunication Union's (ITU) IDI index to measure the regional digital divide, confirmed the spatial divergence between eastern, central and western regions, thereby indirectly corroborating the regional nesting of the urban–rural digital divide[1].

3. A STUDY OF THE FACTORS INFLUENCING THE URBAN–RURAL DIGITAL DIVIDE

This paper categorises the driving factors of the urban–rural digital divide into five major categories: the macro-environment, hardware infrastructure, stakeholder endowments, market supply, and policy and institutional frameworks. The empirical findings from various studies complement and corroborate one another.

3.1. Economic and Regional Macro-level Factors

Firstly, the level of regional economic development. Duan Jieran's (2024) spatial econometric study confirms that per capita GDP positively enhances a region's level of digitalisation. Eastern cities, with their robust economic foundations and ample capital, invest far more in digital infrastructure than rural areas in the central and western regions, creating a 'polarisation effect' whereby high-quality digital resources continue to concentrate in urban areas, thereby widening the urban–rural gap[1]. Zhou Yijia (2025) adds that economic disparities give rise to an income gap; rural residents have low disposable income and cannot afford smart devices or broadband charges, which directly widens the digital access gap, creating a bidirectional, mutually reinforcing 'economic–digital' negative feedback loop[9].

Secondly, location and geographical conditions. Xu Chengming's (2025) heterogeneity test reveals that in high-altitude and remote rural areas, the costs of constructing and maintaining infrastructure are high, leading to lagging 5G and fibre-optic coverage[7]; consequently, the digital divide is significantly wider than in low-altitude rural areas on the plains. In the eastern regions, the frequent flow of factors of production between urban and rural areas and the sharing of resources help to mitigate the digital divide, whereas in the central and western regions, the fragmentation of such flows between urban and rural areas exacerbates the divide. Duan Jieran (2024) points out that the Yangtze River Delta and Pearl River Delta in the east have formed high-value digital clusters, whilst the central and western regions are predominantly low-value areas; regional disparities, compounded by the urban–rural dual structure, amplify digital inequalities[1].

3.2. Disparities in the Supply of Digital Infrastructure

Yang Li (2023) identifies infrastructure gaps as the primary practical manifestation of the digital divide: urban areas, with their dense populations and low unit construction costs, enjoy full coverage of gigabit broadband and 5G base stations; rural villages, however, are scattered, rely predominantly on 4G, have an extremely low gigabit penetration rate, and suffer from insufficient provision of free public Wi-Fi and digital service points, with striking disparities in hardware quality[8]. Data from Wang Fengyu (2024) confirms that whilst broadband access has been extended to every administrative village, there remains a significant urban–rural disparity in the penetration rates of 100 Mbps and high-speed networks[5]. Network lag and unstable signals reduce rural residents' willingness to use digital services, thereby further widening the digital divide. Tests of mediating effects conducted by Xu Chengming (2025) demonstrate that the primary mechanism of action for

digital village pilot schemes is the improvement of rural digital infrastructure[7]; such improvements can directly narrow the three-tier digital divide.

3.3. Digital Literacy Endowments of Residents

A consensus has been reached across multiple studies that differences in digital literacy between urban and rural residents constitute the core driver of the second-tier digital divide. Yang Li (2023) highlights the disparity in educational resources between urban and rural areas: rural primary and secondary schools suffer from a shortage of IT teaching staff and equipment, whilst residents generally have lower educational attainment and weaker digital learning capabilities[8]; in contrast, urban areas offer a wealth of regular digital training, and residents have frequent exposure to digital scenarios, enabling them to proficiently master advanced applications such as e-commerce and online administrative services. Data from Wang Fengyu (2024) shows that the proficiency rate for intermediate-level digital skills in rural areas is only 39.5 per cent, compared to 60.4 per cent in urban areas; this significant skills gap limits rural residents' avenues for increasing their income through digital means[5]. Tang Huimin (2023) focuses on intergenerational disparities in rural areas, pointing out that older rural residents have low levels of education and suffer from a sense of 'learned helplessness', making them apprehensive about operating smart devices[4]; the intergenerational digital divide has thus become a specific weakness within rural communities. Xu Chengming (2025) empirically verifies that the 'Digital Village' initiative-which enhances digital literacy by conducting digital training for farmers and cultivating a new generation of professional farmers-is the core intermediary pathway for bridging this divide[7].

3.4. Imbalance in the Supply of Market Products and Services

Tang Huimin (2023) argues that the profit-driven nature of the market exacerbates the urban-rural digital imbalance: products from digital hardware and software manufacturers are predominantly targeted at young urban populations, whilst there is a scarcity of age-friendly and user-friendly digital products for agriculture; consequently, there is an insufficient supply of products suitable for rural elderly people and farming households[4]. Furthermore, content on digital platforms is skewed towards urban consumption and entertainment, whilst resources related to agricultural technology and e-commerce for agricultural products are meagre, resulting in a significant urban-rural disparity in the quality of digital resources. Yang Li (2023) points out that whilst urban areas possess comprehensive systems for online education, digital healthcare and financial services, the provision of digital public services in rural areas is fragmented and of lower quality, with insufficient extension of digital resources to the countryside, thereby creating a quality gap in resources[8]. Liu Jianxian (2024) adds that the imbalance in digital logistics infrastructure between urban and rural areas-with a scarcity of logistics outlets in rural areas-constrains the development of rural e-commerce, which in turn reduces farmers' motivation to adopt digital technologies[2].

3.5. Policy and Institutional Factors

The skewed allocation of policy resources is a fundamental institutional driver. Yang Li (2023) argues that past digitalisation policies and fiscal investments have long favoured urban areas, whilst dedicated planning for rural digitalisation has been inadequate; this imbalance in resource allocation has entrenched the digital divide[8]. Zhou Yijia's (2025) moderation analysis demonstrates that the higher the level of attention paid to digitalisation by local governments and the more thoroughly digital rural policies are implemented, the less the urban–rural consumption gap is impacted by the digital divide; thus, top-level policy design can effectively mitigate digital inequality[9]. Xu Chengming (2025), using the national digital rural pilot scheme as a quasi-natural experiment, demonstrated that targeted policies narrow the digital divide through three pathways-infrastructure, digital literacy and industry-and that policy interventions possess a significant positive causal

effect[7]. Furthermore, new-quality productive forces can reinforce policy outcomes, forming a policy–technology synergy mechanism that empowers rural development.

4. THE IMPACT OF THE URBAN-RURAL DIGITAL DIVIDE AND PATHWAYS TO BRIDGING IT

4.1. Multidimensional Negative Effects of the Digital Divide

4.1.1. Economic Dimension: Widening the Income and Consumption Gap

Zhou Yijia (2025) reached the following key empirical conclusion: the digital divide significantly widens the urban-rural consumption gap, and there are two transmission mechanisms at play[9]. Mechanism One: the digital divide widens the urban-rural income gap, as rural areas are unable to increase their income through e-commerce and digital industries; Mechanism Two: It disrupts the integration of urban and rural markets, with digital barriers hindering the flow of agricultural produce into cities and consumer goods into rural areas. Stratified results indicate that the digital access gap exerts the strongest negative impact, and its effect on widening the gap in service-oriented consumption (education, healthcare, culture and tourism) is far greater than that on basic food and clothing consumption; given the high baseline level of digitalisation in the eastern regions, the consumption divergence caused by the digital divide is more pronounced there than in the central and western regions. Liu Jianxian (2024) argues that the digital divide inhibits the digital transformation of agribusinesses and family farms, hinders the implementation of digital inclusive finance, and creates financing difficulties for new types of agricultural operators, thereby impeding income growth in rural industries[2]. Wang Fengyu (2024) adds that the urban-rural gap in digital benefits continues to widen, with the share of rural digital economic output remaining far lower than that of urban areas, thereby constraining the advancement of common prosperity[5].

4.1.2. At the Industrial and Urbanisation Level: The Dampening Effect

Liu Jun (2013) uggests that the urban–rural digital divide exerts a dampening effect on new-type urbanisation: rural residents' insufficient digital literacy makes it difficult for them to secure online employment or access equitable public services, thereby hindering the process of migrant workers' integration into urban society[3]; the digital divide between urban and rural areas slows the two-way flow of factors of production, impeding urban–rural integration. Duan Jieran's (2024) spatial analysis revealed a polarisation effect in digitally affluent cities, which attract digital talent and industrial resources from surrounding rural areas, thereby further entrenching the urban-rural industrial gap and slowing the development of new rural sectors such as cultural tourism and smart agriculture[1]. Xu Chengming (2025) pointed out that the digital divide hinders the digital transformation of rural industries, limiting the proliferation of 'Taobao villages' and smart agriculture, and creating a marked digital disconnect in urban-rural industrial chains[7].

4.1.3. Social and Public Sector: Inequality in Public Services

Yang Li (2023)argues that the digital divide makes it difficult for online government services, telemedicine and online educational resources to reach rural areas[8]. Rural residents have limited access to high-quality public services, which exacerbates the disparity in public services between urban and rural areas and weakens participation in grassroots digital governance; the utilisation rate of online channels for villagers' deliberations and supervision of village affairs remains low. Tang Huimin (2023) focuses on the elderly population, noting that the intergenerational digital divide prevents rural older people from booking medical appointments or verifying social security online, leaving them trapped in digital life dilemmas and exacerbating inequalities in people's livelihoods within rural communities[4]. Liu Jianxian (2024) argues that the knowledge gap leads to disparities in cybersecurity awareness, making rural residents more vulnerable to online fraud and leaving their digital rights poorly protected[2].

4.2. A System of Diverse Pathways for Bridging the Gap

By synthesising the policy recommendations from the entire body of literature, five synergistic pathways have been identified: top-level policy, hardware infrastructure, stakeholder empowerment, industrial empowerment, and intergenerational and village-community support.

4.2.1. Coordinating Top-Level Digital Strategies and Strengthening Policy Support

Yang Li (2023) proposes improving top-down, coordinated national planning for urban and rural digitalisation; introducing differentiated digital support policies for rural areas[8]; establishing public-private partnerships to jointly develop rural digital projects; refining regulations on information accessibility (the Law on the Construction of an Accessible Environment); and strengthening data security and privacy protection systems to safeguard rural digital development rights. Zhou Yijia (2025) recommends that local governments prioritise digital governance, increase fiscal investment in digital rural development, and establish dedicated digital support funds for central and western regions to narrow the compound urban-rural digital divide[9]. Xu Chengming (2025) proposes promoting proven models from digital rural pilot schemes, adapting them to local conditions: the eastern regions should establish demonstration models, whilst central and western regions should focus on addressing infrastructure shortcomings, leveraging new-quality productive forces to drive the penetration of digital technologies into rural areas[7].

4.2.2. Improving Rural Digital Infrastructure and Promoting the Distribution of Resources

Yang Li (2023) and Wang Fengyu (2024) concur that ensuring basic hardware coverage is fundamental: increasing investment in rural 5G and gigabit fibre-optic networks, and installing additional communication relay stations in remote mountainous areas; deploying free public Wi-Fi in village committees, rural schools and health centres; establishing localised digital platforms for agriculture, and developing user-friendly agricultural technology and e-commerce systems for agricultural products[5,8]; telecom operators should introduce discounted broadband and smart device packages for the elderly and low-income farming households to reduce access costs. Wu Xiao'ou (2014) proposed the balanced allocation of digital educational and government resources between urban and rural areas, enhancing the service functions of grassroots websites at township level to narrow the quality gap in public digital resources[6].

4.2.3. Cultivating Digital Literacy at Different Levels to Bridge the Capability Gap among Users

Firstly, digital training for all farmers: Yang Li (2023) recommends establishing digital training centres within villages, communities and schools to regularly deliver courses on e-commerce, online administrative procedures and fraud prevention, as well as organising digital skills competitions and establishing a training feedback mechanism to dynamically optimise the curriculum[8]. Xu Chengming (2025) proposes incorporating digital skills into the training system for new-type professional farmers, and bringing in university lecturers and science and technology specialists to deliver lessons in rural areas[7].

Secondly, specialised age-friendly adaptations for the elderly in rural areas: Tang Huimin (2023) proposes comprehensively advancing age-friendly adaptations for mobile apps and smart devices, standardising simple, user-friendly interfaces for older people; simplifying online administrative procedures; and establishing offline digital support desks to address the digital challenges faced by the elderly from both software and hardware perspectives[4].

Thirdly, addressing digital shortcomings in rural education: introducing additional information technology courses in primary and secondary schools; ensuring adequate provision of computers and multimedia equipment; and balancing the distribution of digital teaching staff between urban and rural areas to prevent the intergenerational transmission of low digital literacy among young people.

4.2.4. Empowering through the Digital Industry to Narrow the Digital Outcomes Gap

Xu Chengming (2025) demonstrates through intermediary effects that industrial digitalisation is the core pathway to bridging this gap: vigorously developing rural e-commerce and live-streaming sales, and fostering 'Taobao Villages' and digital agriculture bases; leveraging Beidou and the Internet of Things to create smart farming and smart livestock breeding systems; and using digital technology to enhance the added value of agriculture and broaden channels for farmers to increase their income through digital means[7]. Liu Jianxian (2024) proposes improving urban-rural digital logistics systems, establishing delivery hubs in villages and towns, unblocking online distribution channels for agricultural products, and unlocking the dual potential of rural digital consumption and production[2]. Wang Fengyu (2024) recommends developing rural digital cultural tourism and inclusive digital finance to enrich rural digital business models and narrow the urban-rural digital economic income gap[5].

4.2.5. Collaboration between Villages, Communities and Households to Bridge the Intergenerational Digital Divide in Rural Areas

Tang Huimin (2023) proposed a three-pronged micro-level support mechanism:①Digital support from families, encouraging children and young people to provide hands-on guidance to the elderly on using smartphones, utilising everyday tools such as WeChat for bite-sized lessons;②Peer support, establishing digital learning communities for the elderly to foster psychological support among peers and create an atmosphere of mutual learning;③Party-led guidance at the village and community level, with social workers and village officials providing regular one-to-one digital support to overcome the psychological barrier of 'learned helplessness' among older people and bridge the intergenerational digital divide within rural communities[4].

5. LITERATURE REVIEW AND OUTLOOK

5.1. Summary of Existing Research Consensus and Findings

Firstly, the theoretical framework has been progressively refined. The academic community has reached a consensus on the three-tiered progressive definition of the urban-rural digital divide (access–usage–impact), established standardised multi-dimensional measurement indicators, identified five core influencing factors-economy, infrastructure, digital literacy, market and policy- and comprehensively elucidated the multiple negative effects of the digital divide on income, consumption, industry and public services. This has resulted in a complete theoretical chain spanning from concept - causes - impacts - countermeasures, building upon the theoretical research of Yang Li (2023) and Wang Fengyu (2024), whilst drawing quantitative support from empirical studies by Zhou Yijia (2025), Xu Chengming (2025) and others.[5,7,8,9]

Secondly, empirical methodologies continue to innovate. Existing research has employed a variety of econometric tools-including the Thiel Index, locational entropy, dual machine learning, spatial panel SDM, and mediation and moderation models-to conduct analyses across multiple levels, from the provincial and prefectural city levels down to the micro-household level; Xu Chengming (2025) utilised the 'Digital Village' pilot scheme as a quasi-natural experiment to precisely identify the causal effects of policy[7]; Zhou Yijia (2025) deconstructed the differentiated impacts of three types of digital divides and two categories of consumption in a stratified manner, quantifying heterogeneous characteristics and significantly enhancing the rigour of the empirical analysis[9].

Thirdly, complementary breakthroughs have been achieved in specialised sub-fields. Tang Huimin (2023) specifically examined the intergenerational digital divide within rural areas, filling a gap in research on demographic segmentation[4]; Duan Jieran (2024) analysed regional divergence from a macro-spatial perspective of Chinese cities, revealing the differentiated characteristics of the digital divide across urban and rural areas in the east, centre and west; several studies distinguished between

moderating variables such as ‘digital villages’ and ‘new-quality productive forces’, enriching the perspectives on governance mechanisms[1].

Fourthly, a collaborative framework for governance pathways has been established. Existing research has collectively formulated a multi-faceted, collaborative governance scheme comprising ‘infrastructure as the foundation, literacy as the enabler, industry for income generation, policy coordination, and micro-level support’. This approach balances macro-level institutions with micro-level contexts such as households and village communities; the policy recommendations are practical and provide a reference for the development of digital villages across different regions.

5.2. Limitations of Current Research

The measurement framework remains inconsistent. Whilst Wu Xiao’ou (2014) developed a comprehensive set of indicators[6], subsequent empirical studieshave reduced the number of indicators based on data availability. As the calculation criteria vary across studies, it is difficult to make cross-sectional comparisons, and there is a lack of standardised measurement criteria applicable nationwide.

Insufficient research on demographic heterogeneity. Most literature focuses on overall urban–rural disparities, whilst research into the differentiated causes of the digital divide and governance strategies for specific vulnerable groups-such as rural elderly people, left-behind women, left-behind children and households that have emerged from poverty-remains limited; Tang Huimin focused solely on intergenerational differences, with few empirical studies on other demographic subgroups.

Regional comparisons lack depth. Existing research merely divides the country into eastern, central and western regions, failing to conduct detailed analyses of heterogeneity based on geographical types-such as plains, mountainous areas and plateaus-or industrial types, such as major grain-producing regions and specialised agricultural zones; there is insufficient discussion of differentiated governance strategies for central and western regions and remote rural areas.

Research integrating new perspectives remains weak. Although Xu Chengming (2025) tentatively introduced the moderating effect of ‘new-quality productive forces’, most literature fails to analyse digital divide governance through the lens of cutting-edge concepts such as new-quality productive forces, digital inclusive finance and generative AI[7]. There is a research gap regarding the new forms of the digital divide (gaps in smart devices and AI applications) brought about by the iteration of digital technologies.

Micro-level analyses tend to be qualitative, whilst long-term empirical tracking studies are scarce. Existing empirical studies predominantly utilise cross-sectional or short-panel data, lacking multi-year continuous tracking surveys; this makes it difficult to reveal the long-term dynamic evolution of the digital divide and the sustained impact of governance policies.

5.3. Prospects for Future Research

Firstly, a unified and standardised measurement system for the urban-rural digital divide should be established. By integrating multiple sets of indicators developed by researchers such as Wu Xiao’ou(2014) and Xu Chengming(2025), and taking into account both macro-level statistical data and micro-level survey questionnaires, a universal measurement index suitable for the national, provincial, municipal and county levels should be constructed. Standardising weightings and calculation methods will enhance the comparability of different studies[6,7].

Secondly, research into the heterogeneity of specific demographic groups and across different regions should be deepened. Specialised surveys should be conducted targeting rural elderly populations, left-behind groups and low-income farming households, distinguishing the causes of the digital divide in mountainous, plain and eastern and western rural areas; differentiated policies to bridge the digital

divide should be formulated in accordance with different types of rural industries to enhance policy precision.

Third, expand interdisciplinary research on cutting-edge theories. Incorporate new elements such as new-quality productive forces, artificial intelligence, digital inclusive finance and age-friendly renovations into the analytical framework; explore the mechanisms by which new technologies give rise to new forms of the digital divide, whilst investigating pathways through which cutting-edge technologies can help bridge the divide, thereby enriching the theory of digital rural governance.

Fourth, expand long-term dynamic tracking empirical studies and case studies. Utilise multi-year balanced panel data and field survey tracking data to analyse long-term trends in the evolution of the digital divide; conduct case studies in typical pilot counties for digital rural development across the country to identify replicable models for bridging the digital divide.

Fifth, refine research into micro-level collaborative governance mechanisms. Strengthen empirical research into collaborative mechanisms involving diverse stakeholders-such as digital support from households, mutual aid within villages and communities, social organisations, and agriculture-related enterprises-quantify the actual effectiveness of multi-stakeholder collaborative governance, and construct an integrated governance system that balances macro-level policies with micro-level household dynamics.

6. CONCLUSION

This paper systematically reviews the core literature on research into the urban–rural digital divide in China. By integrating existing research findings across four key dimensions-conceptual definitions, influencing factors, mechanisms of impact, and pathways to bridging the divide-the following main conclusions have been drawn:

Firstly, the urban–rural digital divide is a dynamic, multi-layered and complex issue. Its nature has evolved from the early, singular‘access divide’to a composite divide comprising three progressive layers:‘access’,‘usage’and ‘outcomes’. Currently, with the rapid roll-out of digital infrastructure in rural areas, the contradiction regarding the‘availability’of hardware is easing; however, the‘usage gap’driven by digital skills disparities and the ‘outcome gap’ resulting from the unequal distribution of digital benefits are emerging as the primary contradictions. This indicates that the policy focus for bridging the digital divide must shift from‘laying networks and distributing devices’to‘fostering digital literacy and promoting income growth’, whilst remaining vigilant against deep-seated inequalities masked by low-level access.

Secondly, the urban-rural digital divide is the result of the interplay of multiple factors. A weak economic foundation, geographical constraints, imbalances in digital infrastructure between urban and rural areas, disparities in residents’digital literacy, the profit-driven bias in the provision of market-based services, and the long-standing inertia of urban-rural dualistic policies collectively constitute the underlying logic behind the persistent existence of this divide. These five factors do not operate in isolation but form a vicious cycle:‘economic backwardness→inadequate infrastructure→lack of digital literacy→market failure→ineffective policy compensation→further economic backwardness’. To break this deadlock, we must shift from interventions targeting individual links to systematic governance across the entire chain.

Thirdly, the negative effects of the urban-rural digital divide have permeated the economic, industrial and social public spheres. At the macro level, it widens the urban-rural income and consumption gap by stifling farmers’ digital income growth and disrupting the integration of urban and rural markets; at the industrial level, it hinders the digital transformation of rural industries, slowing the two-way flow of factors between urban and rural areas and the process of new-type urbanisation; at the social level, it exacerbates inequality in access to public services, trapping digitally vulnerable groups-such

as the rural elderly-in a‘digital living dilemma’. The digital divide has evolved from a technological gap into a social equity issue with far-reaching implications for the overall goal of common prosperity.

Fourthly, existing research has established a consensus on a systematic, ‘five-pronged’ approach to bridging the divide. It is widely recognised in academic circles that bridging the urban-rural digital divide requires the coordinated advancement of top-level policy support, the extension of digital infrastructure to rural areas, tiered digital literacy training, the empowerment of the digital industry, and micro-level intergenerational support at the village and community levels. This collaborative governance framework balances‘addressing hardware shortcomings’with‘enhancing software capabilities’, and‘macro-level institutional design’with‘micro-level support at the household and village community levels’, providing an actionable guide for the implementation of digital rural development across the country.

Overall, domestic research on the urban-rural digital divide has established a comprehensive theoretical framework spanning conceptual definitions, measurement tools, causal analysis, impact assessment and pathway design; empirical methods are becoming increasingly rigorous, and studies on demographic segmentation and spatial heterogeneity have begun to emerge. However, in the face of new forms of the digital divide spurred by the rapid iteration of emerging technologies such as artificial intelligence and generative AI, and the deepening intergenerational digital challenges brought about by the accelerating ageing of the rural population, existing research remains inadequate in terms of analysing the integration of cutting-edge technologies, conducting long-term dynamic tracking, and developing differentiated governance strategies for specific groups and regions. Future research should focus on establishing a unified, standardised measurement system; strengthening interdisciplinary research at the intersection of new-quality productive forces and cutting-edge digital technologies; deepening empirical studies on heterogeneity across different population groups and regions; and exploring long-term mechanisms to bridge the digital divide. This will provide a more robust theoretical foundation for the balanced digital development of urban and rural areas under the dual objectives of‘Digital China’and‘common prosperity’.

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