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The Digital Economy and New Quality Productive Forces: A Literature Review

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Abstract: Whether the digital economy can foster the development of new quality productive forces depends not only on investment in digital technologies and infrastructure, but also on whether data and technology can be combined with conventional factors of production to create effective productive capacity. This article reviews the conceptual foundations and measurement approaches of the digital economy and new quality productive forces. It then synthesizes the literature on the overall effects of the digital economy, differences across levels of analysis, nonlinearities, and spatial spillovers, before examining the principal transmission mechanisms. The literature generally supports a positive relationship. The digital economy and new quality productive forces share close links in their technological foundations and factor composition. The central mechanism is the use of data to translate scientific and technological advances into productive capacity, supported by the recombination of production factors and the upgrading of industrial structure. The pace of this conversion, however, depends heavily on regional human-capital endowments and the ability to absorb frontier technologies. Digital infrastructure and an enabling legal and institutional environment are equally important. Future research should sharpen the conceptual boundaries of both constructs, improve the consistency and accuracy of measurement, examine linked mechanisms and cross-level transmission, and give greater attention to possible adverse effects. The use of multidimensional micro-level data would also strengthen causal identification.

Keywords: Digital Economy; New Quality Productive Forces; Measurement; Transmission Mechanisms.

1. Introduction

As the latest wave of technological revolution and industrial transformation gathers momentum, the conventional growth model based on large-scale inputs of capital, labor, and other resources faces a dual challenge: finding new sources of growth and restructuring the economy. New quality productive forces represent a contemporary form of productivity transformation and an important theoretical response to China's changing stage of development and its pursuit of high-quality growth. Hong Yinxing argues that their emergence rests on the integration of scientific and technological innovation with industrial innovation, and on the convergence of new technologies, new energy sources, and new industries under conditions of digitalization and intelligentization [1]. Viewed in the longer evolution of productive forces, the concept does not describe an abrupt departure from earlier forms of production. Rather, it refers to a qualitative upgrading of labor, means of production, objects of labor, and the ways in which these elements are combined. That upgrading, in turn, reshapes the organization of production and the broader logic of economic activity. The cultivation of new quality productive forces has therefore become a substantive issue in the transformation of economic development.

The digital economy provides important conditions for this transformation. As its scope has expanded, a new economic form has emerged in which data are a key factor of production, computing power is a critical engine, and digital platforms and infrastructure serve as principal carriers. Data and computing power extend the boundaries of conventional factors and create new possibilities for their combination, thereby enabling more innovative forms of resource allocation. At the same time, the deeper integration of digital technologies with the real economy accelerates knowledge diffusion and industrial convergence, supports the upgrading of traditional industries, and opens space for emerging and future industries.

A substantial literature has developed around both the digital economy and new quality productive forces. Research on the latter has focused on conceptual foundations, sources of formation, constituent elements, measurement, and development paths. A broad view has gradually emerged that scientific and technological innovation is the leading force, that the three basic elements of productivity undergo qualitative upgrading, and that a modern industrial system provides the principal carrier. Research on the digital economy, meanwhile, has moved beyond early questions of definition and scale to examine effects on green development, regional coordination, and other economic outcomes. Building on these strands, a growing number of studies assess whether the digital economy promotes new quality productive forces at the firm, industry, city, and regional levels, with increasing attention to factor allocation, industrial upgrading, nonlinearities, and spatial effects.

The evidence remains fragmented, however. Both concepts are broad and multidimensional, and studies differ considerably in their theoretical premises, indicator selection, and measurement methods. Some indicators also overlap, making it difficult to establish a common analytical standard. The links among the proposed mechanisms have not been fully clarified: each mechanism may be plausible in isolation, but it is less clear whether they form a coherent sequence. In addition, the effects of the digital economy may be conditioned by regional endowments and may display heterogeneity, nonlinearities, and spatial dependence, yet the literature has not reached a consistent conclusion on these features. Although most studies report a positive association, findings at different macro- and micro-levels have rarely been integrated systematically.

Against this background, this article reviews the literature on the digital economy and new quality productive forces. It first summarizes research on the direct effects of the digital economy, then identifies the principal channels through which those effects may arise, and finally evaluates the existing evidence and outlines directions for future research. The aim is to provide a clearer basis for both academic inquiry and policy practice concerning the digital economy's role in fostering new quality productive forces.

2. The Impact of the Digital Economy on New Quality Productive Forces

2.1. Direct Effects

The digital economy and new quality productive forces are closely connected. Supported by data, computing power, digital platforms, and infrastructure, the digital economy changes how information is transmitted, resources are allocated, and organizations coordinate production. New quality productive forces, by contrast, emphasize the qualitative upgrading of labor, means of production, objects of labor, and their combinations under the leadership of scientific and technological innovation. The digital economy is therefore more than an external technological condition. It contributes to the formation of new factors of production, the upgrading of production tools, and the restructuring of industrial systems. Research has accordingly moved from theoretical interpretation to empirical analysis at the firm, industry, city, and regional levels, while also examining regional differences, threshold effects, and spatial spillovers.

2.1.1. Overall Promotional Effect

Most studies conclude that the digital economy promotes new quality productive forces, but explanations of this relationship have broadened from simple technological empowerment to the restructuring of the production system. One starting point is the transformation of data into a factor of production. Zhu Haihua and Chen Liuqin argue that data factorization, digital technological innovation, and digital industrialization jointly reorganize production factors and deepen industrial transformation [2]. From the perspective of factor reconfiguration and growth-driver conversion, Wang Yan et al. identify data-driven development, digital-real integration, and the replacement of old growth drivers with new ones as the central routes through which the digital economy gives rise to new quality productive forces [3]. Together, these studies point to at least two parallel processes: the creation and use of new factors, and the transformation of existing production and industrial systems.

The relationship also extends to the industrial ecosystem and the policy environment. From an industrial-ecology perspective, Lang Yuanke et al. identify digital innovation, more efficient factor allocation, and industrial upgrading as three main pathways. They further find that supply-side policies are more effective than demand-side policies and that policy mixes generally outperform isolated measures [4]. This suggests that new quality productive forces cannot be generated by market expansion alone; digital infrastructure, technological supply, industrial organization, and institutional support must work together. Zhang Ao and Sun Jiuwen similarly regard data, algorithms, and computing power as the central elements of the digital economy's influence. In their account, technological progress alters the allocation of resources and ultimately prompts changes in production relations and institutional arrangements [5]. The overall effect therefore reflects the interaction of technological change, factor recombination, and institutional adaptation.

Different components of the digital economy perform different functions. Jiao Yong and Qi Meixia emphasize data factors, the iterative upgrading of digital technologies, digital infrastructure, and digital governance. At the micro, meso, and macro levels, the corresponding drivers are technological innovation, deeper industrial integration, and improvements in the mechanisms of social and economic operation [6]. Yao Shujie and Wang Jiefei approach the issue from the joint perspective of technological innovation and institutional optimization, arguing that frontier technology clusters represented by the digital economy and artificial intelligence can nurture new quality productive forces only when technological progress, institutional coordination, and factor collaboration reinforce one another [7]. Thus, the positive effect of the digital economy cannot be reduced to a single technological variable; it arises from the combined operation of new factors, frontier technologies, infrastructure, and governance arrangements.

A broad consensus has consequently emerged: by bringing data into production, the digital economy deepens the integration of digital technologies with traditional industries, accelerates innovation and industrial upgrading, and supports the formation of a modern industrial system. This consensus still requires refinement. Some contributions remain largely theoretical and do not compare the marginal contributions of different dimensions of the digital economy. In some empirical studies, indicators of the digital economy overlap with those used to measure new quality productive forces. Future work should therefore establish clearer conceptual boundaries and more consistent measurement standards, and should identify the specific stages through which the digital economy affects productive capacity and the magnitude of each contribution.

2.1.2. Effects at Different Levels of Analysis

The impact of the digital economy can be observed at the firm, industry, city, and regional levels, but each level highlights a different question. Firm-level studies examine how digital transformation, digital policies, and technological absorptive capacity change production activities. Industry-level studies focus on coordination along industrial chains and the development of a modern industrial system. City- and region-level studies place greater emphasis on the combined effects of innovation resources, infrastructure, policy, and spatial linkages.

Firms are the micro-level carriers through which digital resources are converted into productive capacity. Using data on Chinese A-share listed firms, Feng Jialin et al. find that digital-economy policies enhance firms' new quality productive forces, but the effect depends on the level of digitalization within the same industry and region. Policy effects become markedly stronger only after the external digital environment crosses a threshold [8]. The implication is that firm-level outcomes depend not only on a company's own investment in digital technologies, but also on whether the surrounding industrial and regional ecosystem supplies the necessary technologies, data, and opportunities for collaboration. Using national green data centers as a policy setting, Xiong Lingyun et al. further show that the effect of digital infrastructure is subject to a double threshold in firms' technological absorptive capacity [9]. External digital resources can be internalized only when firms possess sufficient human capital, research foundations, and organizational learning capabilities.

At the industry level, the mechanisms become more visible. Hong Yinxing and Wang Kunyi argue that digitalization and intelligentization can improve the coordination, resilience, and controllability of industrial and supply chains [10]. Luo Shuang and Xiao Yun find that the agglomeration of core digital-economy industries promotes urban new quality productive forces not merely by increasing the number of digital firms, but also through knowledge spillovers, specialized division of labor, and the sharing of innovation resources [11]. These findings indicate that the digital economy does not act on firms in isolation. It operates through upstream-downstream coordination, the circulation of innovation factors among organizations, and changes in industrial organization, allowing productive capacity to develop across a wider network.

The relationship between the digital economy and the modern industrial system provides another perspective on industry-level effects. Wang Lianghua places the digital economy, new quality productive forces, and the construction of a Chinese-style modern industrial system within a single framework, arguing that the digital economy contributes to industrial modernization by strengthening new quality productive forces [12]. Yu Donghua characterizes computing power itself as a form of new quality productive force in the digital era and stresses its role in generating new business models and releasing new potential [13]. Ma Rong finds that new digital infrastructure promotes structural upgrading and economic efficiency through technological, allocation, and structural effects [14]. Zhang Sen and Wen Jun develop a framework covering demand, supply, and the enabling environment, and argue that the digital economy strengthens new quality productive forces by advancing disruptive innovation and expanding strategic emerging industries [15]. Taken together, these studies show that industry-level effects stem both from the development of digital industries themselves and from the broad support that digital infrastructure and technologies provide to traditional, emerging, and future industries.

City- and region-level studies focus more strongly on the overall environment created by the digital economy. Xu Aiting and Chen Jingru find that the joint development of the digital economy and technological innovation produces a synergistic effect on urban new quality productive forces and generates spatial spillovers through the movement of scientific research factors [16]. Research at these levels captures the combined influence of digital infrastructure, research resources, industrial structure, and policy institutions. It is also more vulnerable, however, to confounding from regional economic conditions, innovation capacity, and the non-random placement of policies.

Across levels of analysis, the effects of the digital economy expand from micro-level conversion to macro-level transformation. Firm-level work asks whether digital technologies can be absorbed and converted into productive capacity. Industry-level work asks whether digitalization improves chain coordination and supports a modern industrial system. City- and region-level work captures the combined effects of innovation resources and policy experimentation. These findings are not interchangeable. A higher regional level of digital development does not imply that every firm in the region benefits equally, and improved digital capability within individual firms does not necessarily amount to an economy-wide upgrading of the industrial system. Future research should therefore examine transmission within the nested firm-industry-region structure.

2.1.3. Regional Heterogeneity

The effects of the digital economy vary substantially across regions. Differences in digital infrastructure, human capital, innovation resources, and industrial capacity shape the extent to which digital inputs can be converted into new productive capacity. Eastern China generally has more complete digital infrastructure, denser innovation resources, and more mature markets, making it easier to turn digital technologies into effective production. Central and western regions may enjoy latecomer advantages and policy support, but often face constraints in infrastructure, skilled labor, and industrial absorptive capacity.

Regional heterogeneity is also reflected in the pathways through which the digital economy operates. Comparing the Yellow River Basin with the Yangtze River Economic Belt, Zhang Yuanyuan and Sun Yanfang show that different combinations of digital technologies, digital organization, and the digital environment can produce multiple routes to stronger regional new quality productive forces [19]. Evidence from policy pilots points in the same direction. Bai Yunpu and Zhao Hongyang find that national big-data comprehensive pilot zones significantly promote regional new quality productive forces, with a stronger effect in eastern China [18]. Digital policies therefore do not generate uniform outcomes. Their effectiveness depends on pre-existing digital foundations, industrial support, and innovation capacity. Policy can supply an external impetus, but local development conditions determine how efficiently that impetus is converted into productive gains.

The main contribution of this literature is to challenge the assumption that the digital economy has a homogeneous positive effect. Its influence depends both on the level of digital development and on regional industrial structure, innovation capacity, market conditions, and institutions. Future research should move beyond simple comparisons of average effects across eastern, central, and western China, or across northern and southern regions, and identify the distinct pathways operating in different local contexts.

2.1.4. Nonlinearity and Threshold Effects

The relationship between the digital economy and new quality productive forces need not be linear. At an early stage of digital development, infrastructure construction, the introduction of new technologies, and the redesign of organizational processes require substantial investment. Where firms or regions lack sufficient absorptive capacity and industrial foundations, digital investment may not quickly translate into productivity or innovation outcomes.

Firm-level evidence reveals this nonlinearity directly. Feng Jialin et al. find that the impact of digital-economy policies is constrained by threshold levels of digitalization in the relevant industry and region. Only after peer firms in the same industry or locality pass a certain threshold does the policy effect become substantially stronger [8]. A sufficiently mature external digital environment allows firms to obtain data more efficiently, share technologies, and participate in digitally coordinated networks. Bai Yunpu and Zhao Hongyang likewise find that big-data pilot policies have a stronger effect in eastern China [18]. This pattern can be interpreted as a regional foundation threshold: converting digital policy into new quality productive forces requires advanced infrastructure, strong innovation capacity, and a reasonably complete industrial system. Less digitally developed regions may still benefit, but the effect can be limited by shortages of talent and capital, weak industrial chains, and less supportive institutions.

Research on nonlinear and threshold effects shifts the question from whether the digital economy matters to when and under what conditions it matters most. The policy implication is that digital development cannot be reduced to expanding the quantity of infrastructure. It must be accompanied by stronger technological absorptive capacity within firms, more robust regional innovation systems, and closer industrial coordination. Otherwise, infrastructure may expand faster than the capacity to turn digital inputs into new productive forces.

2.1.5. Spatial Spillover Effects

Compared with conventional infrastructure, the digital economy is more strongly networked and more capable of operating across regional boundaries. Digital infrastructure and data platforms facilitate the movement and reallocation of innovation resources and production factors over larger geographical areas. Their effects may therefore extend beyond the locality in which investment or policy intervention occurs, reaching neighboring areas through talent mobility, industrial collaboration, knowledge diffusion, and policy demonstration. Spatial spillovers are thus essential to understanding the full impact of the digital economy.

Yang Peiqing and Wang Jing find spatial dependence in the coordinated development of the digital economy and new quality productive forces: stronger development in neighboring regions supports local improvement, whereas lagging neighboring regions can exert a drag [17]. Using a spatial difference-in-differences model, Ren Huiming et al. show that national big-data comprehensive pilot zones increase new quality productive forces not only within the pilot cities but also in surrounding cities through economic agglomeration and spatial linkages [20].

2.2. Transmission Mechanisms

2.2.1. Activating Data as a Factor of Production

Data are a defining foundation of the digital economy and the starting point for most accounts of how it promotes new quality productive forces. Unlike conventional inputs, which are often rivalrous and subject to physical depletion, data can be copied, shared, and reused. Once transformed from a general information resource into a factor of production, data expand the range of objects that can be processed and alter how firms and regions organize production and allocate resources. This transformation is not automatic. Unclear property rights, privacy and security risks, and the absence of consistent statistical standards for data transactions, asset values, and utilization efficiency can all restrict circulation and productive use.

The literature has moved beyond treating data merely as a vehicle for information transmission. Timely collection and processing can reduce information asymmetries between producers and consumers, firms and governments, and actors along industrial chains, allowing decisions to rely less on experience and more on evidence. Li Jiesong and Liao Xingmiao argue that data release productive potential by improving resource allocation, reshaping production relations, and raising innovation efficiency [25]. In research on digital villages, Zhang Zhenyu describes a related sequence in which informatization improves governance, platforms facilitate factor mobility, and intelligent technologies reconstruct value creation [23]. Data circulation also integrates information that was previously dispersed across organizations and departments, improving demand forecasting and risk identification. As digital platforms and intelligent systems develop, these functions are likely to expand further.

2.2.2. Promoting scientific and technological innovation

Scientific and technological innovation is a central driver of new quality productive forces and a crucial stage in the conversion of digital resources into productive capacity. Using provincial panel data, Wen Jun et al. find a clear innovation-enhancing effect of the digital economy [26]. This empirical result is consistent with the broader theoretical literature.

Digital networks loosen the spatial constraints on knowledge exchange. Firms, universities, and research institutions can use platforms to obtain external technical information and engage in collaborative research across organizational and regional boundaries. Digital markets also provide faster feedback on product demand and the performance of new technologies, reducing uncertainty and helping innovators adjust research directions. In this way, the digital economy strengthens the links among knowledge creation, technological development, and market application, and shortens the path from scientific results to effective productive capacity.

The literature commonly considers digital technologies, factor combinations, and organizational innovation within the same analytical framework. Du Chuanzhong et al. argue that new quality productive forces emerge through the co-evolution of production factors, organizational forms, industrial systems, and technological innovation [21]. Innovation is therefore not an isolated input; it contributes to economic transformation by changing how factors are combined and how production is organized. Chao Xiaojing and Wang Qing further emphasize the spillover effects of innovation, which can reallocate factors, raise productivity, and support structural upgrading [24]. Technological breakthroughs are the starting point, but their economic significance depends on diffusion, reorganization, and productive application.

2.2.3. Improving the allocation of production factors

Traditional economic activity is often constrained by information asymmetry and market segmentation. Firms may be unable to observe changes in the supply and demand of labor, capital, and technology in a timely manner, while geographic and industrial boundaries impede mobility. The digital economy reduces search, matching, and transaction costs, allowing production factors to be reallocated over a wider area. Through data analysis and algorithmic matching, digital platforms connect suppliers and users more quickly and extend factor flows from individual firms to broader inter-industry and interregional networks.

Data have a dual role in this process: they are themselves allocated as an input, and they help improve the allocation of other factors. Li Zhiguo and Wang Jie find that the digital economy raises manufacturing productivity by improving the allocation and use of data [27]. The integration of digital technologies with the real economy further broadens the scope of reallocation. Jiang Song and Sun Yuxin provide empirical evidence that the digital economy has a positive effect on the real economy [28]. Digital technologies improve internal management, facilitate the movement of capital, technology, and talent among firms, and lower the barriers faced by small and medium-sized enterprises in accessing markets, finance, and technical services. Firms that were once peripheral to production networks can thereby participate in a wider division of labor.

These gains are not distributed automatically or evenly. Because digital platforms exhibit network effects and increasing returns to scale, capital, talent, and technology may become more concentrated in leading firms and central cities with stronger digital foundations. Where the efficiency gains from concentration exceed diffusion effects, the digital economy can widen disparities between regions and firms. The allocation mechanism thus contains both a positive matching effect and potential risks associated with platform dominance and the digital divide. Its net effect must be assessed in light of different actors' capacity to access and use digital resources.

2.2.4. Promoting Industrial-structure Upgrading

Technological advances generated within the digital economy become new quality productive forces only when they enter production and are embedded in industries. Digital industrialization creates emerging sectors such as artificial intelligence and cloud computing, while industrial digitalization transforms traditional production toward networked, intelligent, and service-oriented modes.

Empirical studies generally examine two dimensions of industrial change: advancement and rationalization. Chen Xiaodong and Yang Xiaoxia find that the digital economy promotes industrial upgrading through the diffusion of digital technologies and adjustments within the industrial system [30]. City-level evidence reaches a similar conclusion, while also showing that effects vary with local economic foundations, technological conditions, and existing industrial structure [31]. Liu Yang and Chen Xiaodong argue that upgrading is reflected not only in a larger tertiary-sector share, but also in improved allocation relationships among industries [32]. Industrial upgrading therefore involves both the movement of production factors from less efficient to more efficient sectors and a more effective division of labor across stages of the industrial chain. Ren Baoping and Wang Ziyue maintain that digital new quality productive forces depend on digitalized, networked, and intelligent industrial development and on a modern industrial system capable of transforming the mode of economic growth [29]. When digital technologies are embedded in specific industries, they produce stable productive capacity: industrial digitalization raises the technological content and resource efficiency of traditional sectors, while digital industrialization continuously supplies new technologies and creates new sectors. At a more advanced stage, upgrading is expressed in the emergence of strategic industries and a modern industrial system. Shen Kunrong and Jin Tongyao emphasize that future industries can accelerate the formation of new quality productive forces, provided that frontier technologies are successfully industrialized [22]. Guo Han and Hou Xuehua similarly argue that technological innovation, emerging-industry development, and the transformation of traditional industries must be organized as an interconnected system [33].

2.2.5. Strengthening human capital and workforce skills

New quality productive forces require not only new production tools and new objects of labor, but also workers whose knowledge and skills fit digital and intelligent production. Although the digital economy replaces some routine work, it also creates positions in data analysis, algorithm development, intelligent manufacturing, and digital management. Labor demand consequently shifts away from general skills toward more complex, innovative, and digital capabilities.

Education and training are central to this transition. Jiang Zhaohui and Jin Ziwei argue that education can strengthen workers' innovative capacity and their ability to absorb technology, creating a linked mechanism of human capital, technological innovation, and industrial application [35]. From the perspective of industry-education integration, Li Yuqian stresses that closer coordination between educational and industrial systems can improve the targeted supply of highly skilled workers and connect education, talent development, and innovation [36]. The formation of a workforce suited to new quality productive forces cannot therefore rely solely on formal degree education; vocational education, continuing education, and firm-based training must also respond to changing technologies. From a labor-market perspective, Qi Yudong et al. find that the digital economy improves the employment structure and raises employment quality [34].

2.2.6. Improving digital infrastructure and the institutional environment

Data circulation, technological innovation, and industrial digitalization all depend on digital infrastructure. Better infrastructure lowers the cost of using data, algorithms, and platform services, and speeds the diffusion of digital technologies into traditional industries.

Within the new generation of digital infrastructure, computing power has become a critical link between data and algorithms. Mi Jianing et al. describe computing-power-driven new quality productive forces and argue that computing infrastructure supports the intelligent economy while also reshaping modes of national governance and economic organization [37]. Through calculation and analysis, raw data are converted into production decisions and innovative knowledge. The continued contribution of infrastructure, however, depends on whether institutions adapt to the characteristics of data and technological factors. Shi Jianxun and Xu Ling argue that the rapid formation of new quality productive forces requires policy coordination and institutional innovation, including stronger institutional provision in science and technology, finance, and industrial planning [38]. The digital economy changes data rights, market competition, and income distribution. Without clear rules for data ownership, fair platform competition, and effective privacy and security protections, data may not circulate fully and innovation may be constrained by monopoly and uncertainty.

Digital infrastructure and the institutional environment thus provide, respectively, the hard and soft foundations of the transformation. Infrastructure determines how data are transmitted, stored, and processed; institutions determine whether data can circulate, whether innovation is rewarded, and how the gains from digital development are distributed. Existing research has devoted considerable attention to the economic effects of digital infrastructure, but less to complementarities among different types of infrastructure and to the way institutional quality conditions their effects. Future analysis should bring networks, computing power, platforms, and data institutions into a common framework and examine the interaction between hardware investment and institutional provision.

The mechanisms can be summarized as an interconnected sequence. Activating data provides a basis for knowledge production and resource allocation. Scientific and technological innovation converts data and digital technologies into new tools and capabilities. Better factor allocation directs innovation resources toward more productive firms and sectors. Industrial upgrading embeds these changes in a modern industrial system. Human capital determines whether workers can master and apply new technologies, while digital infrastructure and institutions support the entire process materially and organizationally.

3. Conclusion and Future Research

3.1. Conclusion

The digital economy and new quality productive forces are important analytical categories for understanding digital transformation and high-quality development. The digital economy treats data as a key production factor and relies on digital technologies, infrastructure, and platforms to change information processing, resource allocation, and organizational coordination. It thereby shifts economic activity away from a model dominated by conventional inputs toward one increasingly driven by data and innovation. New quality productive forces represent a contemporary development of Marxist productivity theory under the new technological and industrial revolution. Their defining feature is the qualitative upgrading of labor, means of production, and objects of labor under the leadership of scientific and technological innovation, together with systemic changes in factor combinations, industrial structure, and development functions. The two concepts are closely linked in their technological foundations, factor composition, and industrial carriers, making the digital economy an important force in their formation and development.

Measurement of the digital economy has largely followed two approaches: value-added accounting and composite-index evaluation. The former focuses on defining statistical boundaries and estimating economic scale, while the latter uses indicators of digital infrastructure, digital industries, industrial digitalization, and digital applications to compare development across regions. Measurement of new quality productive forces is less settled. Researchers adopt different conceptual perspectives and use a range of methods, including entropy weighting, TOPSIS, and obstacle-degree models. The unit of analysis has expanded from the national and provincial levels to cities, industries, and firms, but direct comparison remains difficult because indicator choices and conceptual boundaries differ substantially across studies.

The effect of the digital economy is not produced by a single mechanism. The development and circulation of data reduce information gaps in production and support more accurate decisions, innovation, and factor allocation. Digital technologies lower the costs of knowledge acquisition, collaborative research, and commercialization, allowing new technical results to enter production more quickly. Yet the conversion of technology into productivity still depends on workers' knowledge and skills, the quality of digital infrastructure, and the effectiveness of relevant institutions.

Overall, the literature supports the proposition that the digital economy promotes new quality productive forces. The different strands of research are not yet fully connected, however. Some studies emphasize theoretical logic but provide limited empirical identification; others establish a statistically significant positive effect without adequately explaining its magnitude, boundary conditions, or variation across regions and economic actors.

3.2. Future research

Future research should refine the conceptual definitions and measurement systems of both the digital economy and new quality productive forces. Measurement of the digital economy needs clearer boundaries between digital industrialization and industrial digitalization, while research on new quality productive forces requires a more standardized and broadly accepted framework. Indicator systems should be linked across, but also tailored to, different scales of analysis, improving comparability among national, provincial, county, industrial, and firm-level results. Causal identification is another priority. Many studies rely on composite indices and panel regressions, even though both variables may be jointly shaped by regional economic conditions, innovation capacity, and policy environments; reverse causality is also plausible. Greater use of exogenous policy or infrastructure shocks, combined with diverse identification strategies, would strengthen causal interpretation. Mechanism research should move beyond isolated mediators toward linked processes and cross-level transmission. More detailed analysis is also needed of heterogeneity, nonlinearities, spatial dependence, and potential adverse effects. As data sources and analytical tools improve, combining conventional regional statistics with firm-level, patent, recruitment, platform, transaction, and text data may provide a more timely and reliable account of digital transformation and its productive consequences.

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