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Construction of the new development dynamic and development of digital economy: internal logic and policy focus

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Abstract

Purpose – The integration of the digital economy and the real economy has been a key focus in promoting digital economic development. It denotes a comprehensive digital transformation of national economic activities regarding technological infrastructure and production modes, which is crucial for establishing a modern economic system, advancing industrial infrastructure and modernizing industrial chains.

Design/methodology/approach – Firstly, the study delves into the internal logic behind the emergence of the new development dynamic resulting from digital technology's evolution. Secondly, it explores the mechanism of mutual promotion and support between the new development dynamic and the digital economy based on China's shift in focus from international engagement to the domestic economy during different stages of industrialization. Subsequently, it analyzes the characteristics and critical factors of digital economy development and examines the macro-, meso- and micro-level constraints on these factors. Finally, the paper explores approaches to promoting digital economy development while constructing the new development dynamic and provides relevant policy suggestions.

Findings – The construction of the new development dynamic and the development of the digital economy are inextricably linked, and only by mutually reinforcing each other can they provide an inexhaustible impetus for China's high-quality economic development.

Originality/value – The new development dynamic and the digital economy development form an indivisible whole. The new development dynamic creates the necessary conditions for digital economy development and promotes the formation of digital production modes. In turn, the development of the digital economy should strive to improve the mainstay position of the domestic economy, enhance the synergy between the domestic economy and international engagement, upgrade value chains while improving the supply and the industrial chains in China and ensure a parallel increase in labor income alongside improved productivity.

Keywords New development dynamic, Digital economy, Techno-economic paradigm, The real economy

Paper type Translated paper

1. Introduction

Following the significant propositions put forward at the 19th CPC National Congress, such as "promoting further integration of the Internet, big data, and artificial intelligence with the real economy to foster new growth areas," and regarding data "as a new factor of production" at the Fourth Plenary Session of the 19th CPC Central Committee, the Fifth Plenary Session of the 19th CPC Central Committee proposed building an internationally competitive digital

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industry cluster by promoting deep integration between digital economy and the real economy (Xinhua, 2020). According to the *Outline of the 14th Five-Year Plan for National Economic and Social Development (2021–2025) and Long-Range Objectives through the Year 2035*, released by *Xinhua News Agency* on March 13, 2021, China did not set a GDP growth target for the first time but introduced a new economic indicator in the innovation-driven category – the value-added share of core industries in digital economy as a percentage of GDP – and planned to increase this figure from 7.9% in 2020 to 10% by 2025. On June 3, 2021, the National Bureau of Statistics released the Statistical Classification of the Digital Economy and Its Core Industries (2021). From the selection of industries to the emphasis of data as a production factor to the adjustment of statistical dimensions, the importance of developing digital economy has been fully demonstrated.

The integration of the digital economy and the real economy has been a key focus in promoting digital economic development. Starting with the "deeper integration of informatization and industrialization" proposed at the 17th CPC National Congress in 2007, to the "integration of advanced manufacturing and modern service industries" proposed by fifteen ministries and commissions in 2019, there have been significant changes in state guidelines for integrating digital and real economies, with a particular emphasis on the depth and breadth of integration. The concept of "deep integration" requires that digital technology not only has a strong substitution effect but also achieves large-scale penetration, which should foster new business forms and improve productivity across all sectors, including livelihood services such as take-out industry and e-commerce, producer services and manufacturing. It denotes a comprehensive digital transformation of national economic activities regarding technological infrastructure and production modes, which is crucial for establishing a modern economic system, advancing industrial infrastructure and modernizing industrial chains.

In line with the objectives of the 14th Five-Year Plan (2021–2025) and guided by the principles of the Fifth Plenary Session of the 19th CPC Central Committee, promoting digital economy development is consistent with China's overall orientation to a new development dynamic and high-quality development. This involves leveraging domestic and international resources and markets to promote the digital economy development while enhancing synergy between the domestic economy and international engagement through the digital economy and improving the value chains and developing the domestic supply and industrial chains. From the perspective of high-quality development, the modern industrial system built on the deep integration between the digital economy and the real economy should provide an impetus for the development of new industrialization while reflecting innovation, coordination, greenness, openness and sharing, meeting the people's ever-expanding and deepening needs for a better life beyond material and cultural needs and helping China achieve the goal of per capita GDP to be on par with that of a moderately developed country by 2035. How to make digital economy development meet the above objectives? It is necessary to discern distinct characteristics and pivotal factors of digital economy development at micro, meso and macro levels amidst intricate and ever-evolving digital technologies and phenomena and devise-related policies based on China's reality for realization approaches.

The paper's outline is structured as follows. Firstly, it delves into the internal logic behind the emergence of the new development dynamic resulting from digital technology's evolution. Creating a new development dynamic is inevitable as an active adaptation to digital technology's development trends. Secondly, it explores the mechanism of mutual promotion and support between the new development dynamic and the digital economy based on China's shift in focus from international engagement to the domestic economy during different stages of industrialization. Subsequently, it analyzes the characteristics and critical factors of digital economy development and examines the macro-, meso- and micro-level constraints on these factors. Finally, the paper explores approaches to promoting digital economy development while constructing the new development dynamic and provides relevant policy suggestions.

2. Development of digital technology and formation of the new development dynamic

The choice of development strategy for the digital economy has historical coherence in policy. The deep integration between the digital economy and the real economy, proposed at the Fifth Plenary Session of the 19th CPC Central Committee, is a historical extension of previous guidelines, including "vigorously promoting the informatization of national economy and society" put forward by the 15th CPC National Congress, "driving industrialization with informatization and promoting informatization through industrialization" by the 16th CPC National Congress, "vigorously promoting the integration of informatization and industrialization" by the 17th CPC National Congress, and "promoting the deep integration of informatization and industrialization" by the 18th CPC National Congress. It is worth noting that although the CPC Central Committee's Proposals for Formulating the Outline of 14th Five-Year Plan for National Economic and Social Development (2021–2025) and the Long-Range Objectives Through the Year 2035 proposed the deep integration of digital economy and the real economy in Article 15 of Part IV, "Accelerating the Development of Modern Industrial System and Advancing Economic Optimization and Upgrade," in the guidelines and primary objectives for economic and social development during the 14th Five-Year Plan period, it has been clearly stated that "accelerating the construction of the new development dynamic in which domestic economy is the mainstay and the domestic economy and international engagement provide mutual reinforcement" as the guideline and objective; besides, in the sixth principle to follow for economic and social development during the 14th Five-Year Plan period, it has also been clearly stated that "taking both the domestic and international situations into account and balancing development and security imperatives." It has been made clear that the deep integration between the digital economy and the real economy, an important way to develop the modern industrial system, must be subject to the objective of "accelerating the construction of the new development dynamic in which the domestic economy is the mainstay and the domestic economy and international engagement provide mutual reinforcement."

From the strategy of extensive international engagement of "putting both ends of the production process overseas," namely, importing raw and semi-finished materials and exporting finished goods, to create a new development dynamic with the domestic economy as the mainstay and the domestic economy and international engagement reinforcing each other, the change in the national development strategy is China's inevitable choice in responding to the new requirements of development and changes in international and domestic conditions. The transformation is driven by two factors. Firstly, the strategy of extensive international engagement has become unfeasible due to various reasons, such as the shortening of global value chains, the resurgence of manufacturing industries in Western countries and the prevalence of protectionism and unilateralism. The effectiveness of offshoring both ends of the production process overseas in terms of the market and resources has been diminishing in terms of promoting the upgrading of the economy and transferring and absorbing surplus labor. Secondly, the domestic economy strategy is already viable. With China's GDP per capita exceeding USD 10,000, China has become the most promising consumer market in the world, boasting tremendous potential for growth. Also, China is the only country with a full range of industrial categories and robust market demand. By fully leveraging its domestic mega-market advantages, boosting the domestic economy and smoothing the domestic economic process, China's economic development will gain momentum and promote global economic recovery.

In terms of the development of digital technology, the shift in strategic focus from extensive international engagement to the domestic economy as the mainstay is also a consequence of the information and communication technology (ICT) revolution that has reshaped the global labor division and trade order. While there are various internal and external factors to consider, including rising labor costs, low-end value chains that may hinder long-term development, as well as protectionism and unilateralism, this strategic shift is an inevitable choice for China as a mega-economy to adapt to the development trend of digital technology and better utilize the growth potential inherent in the digital technology revolution, thereby facilitating a new type of industrialization. In other words, in the era of the first generation of digital technology, represented by the Internet and computers, an extensive international engagement strategy was inevitable and feasible for China. However, in the era of the second generation of digital technology, characterized by artificial intelligence, big data and the Internet of things (IoT), such a strategy is no longer applicable in China; instead, China must focus on its domestic economy, which is feasible.

According to Baldwin's "three-cascading-constraints" theory, the spatial unbundling of production and consumption is the main characteristic of economic globalization, which also determines the spatial layout of production and consumption, as well as the scale and mode of resource flows. The spatial unbundling of production and consumption is subject to three costs: the costs of moving goods, ideas and people. In Baldwin's view, this kind of unbundling has occurred three times since the Industrial Revolution: The first was the globalization of local economies (from 1820 to around 1990) due to the reduction in the cost of moving goods, which led to the spatial separation between industrial production and consumption; the second was the globalization of factories (since 1990), which resulted from the further spatial separation of the production chain due to the reduced cost of transferring ideas caused by the ICT revolution; and the third unbundling is emerging, characterized by the spatial separation between production and consumption in the service sector, as technological advancements such as artificial intelligence, robotics, 5G and VR/AR dissolve the "face-to-face" nature of services, while remote services greatly reduce people moving costs. "Telemigration" and "telerobotics" are the primary manifestation of the third unbundling, enabling the vast majority of services to be outsourced offshore (Baldwin, 2016).

In addition, Baldwin indicated that each spatial unbundling of production and consumption implies a transformation in the dynamics of globalization corresponding to a distinct development model for developing nations. The first unbundling was an extensive and prolonged commodity price arbitrage by the developed nations (referred to as the "North"), capitalizing on the geographical separation of production and consumption, while the developing nations (the "South") were "exploited" into exporting raw materials and primary manufactured goods; thus, this unbundling was essentially an era of "Great Divergence" characterized by North-South growth disparities. The second unbundling refers to exploiting the labor cost gap between developed and developing nations by combining advanced technologies in developed nations with low wages in developing nations. While capital in the developed nations reaped the most benefits from this process, developing nations have gained access to technology and management knowledge at a reduced cost of moving ideas, accumulated capital for development and realized labor transfer. Therefore, the second unbundling can be called the era of "Great Convergence." The third unbundling refers to the international wage arbitrage of labor in the service sector through digital technology, which is still a "Great Convergence." Unlike the second unbundling that mainly relied on manufacturing, this convergence depends on the service sector, when developing nations can take advantage of their much lower labor costs in services than developed countries to achieve employment and economic growth.

It is not coincidental that China's extensive international engagement strategy was implemented during the second unbundling era, which was characterized by the globalization of factories. Since the early 1970s, the ICT revolution has gone through a period of computerization, namely, the "officization" of factories. The technological progress during this period was primarily demonstrated by the enhancement of electromechanical integration, which established the technical basis for intricate packaged products, equipment and modular production. However, neither the degree of modularity nor the management activities of organizing and supervising production supported large-scale unbundling of production processes at that time, and intra-product division of labor and trade did not occur on a large scale either. Even for products with sufficiently mature technology, high-income economies persistently maintained their comparative advantage over the 20 years, from 1970 to 1990 (Proudman and Redding, 2020). The Internet era, which commenced in the 1990s, has achieved a reduction in conceptual costs as described by Baldwin, which has two implications: firstly, products containing complex knowledge can be disassembled into modular components; secondly, with the aid of Internet-based information transmission, the spatial unbundling of production management and sites is possible, thus enabling the remote coordination of complex tasks at a relatively low cost. This transformation facilitates the division of labor processes and intra-product trade within the products, thereby significantly promoting globalized manufacturing.

During this period, China became the leading country in global manufacturing outsourcing due to possessing three unique conditions that other developing countries lacked: firstly, a preexisting comprehensive heavy chemical industry system established before the reform and opening-up provided the necessary infrastructure for the manufacturing sector; secondly, an almost inexhaustible supply of labor; thirdly, the state-owned land system facilitated the swift establishment of a lot of industrial parks. With these conditions, China quickly integrated into the global division of labor and trade order system, becoming the largest, fastest growing and most comprehensive manufacturing hub in the era of globalized manufacturing. From 1995 to 2011, China's ascent as a manufacturing powerhouse was particularly evident through its status as the world's largest exporter of labor-intensive traded goods (in terms of export value added), fourth-largest exporter of medium-skilled innovative products and the largest exporter of high-skilled innovative products (Hallward-Driemeier and Nayyar, 2017).

However, the applicability of extensive international engagement strategy is diminishing with the development of a new generation of digital technologies, the improvement of China's industrial system and rising income levels. The McKinsey Institute has shown that although the absolute value of output and trade continues to increase, the trade intensity (i.e. the ratio of total exports to total output) has decreased in nearly all commodity production value chains, with this decline being particularly significant after 2011. The decrease in trade intensity can be attributed to three factors. First, the rise of domestic demand in developing countries, particularly China, and the continuous expansion of their home markets have enabled these nations to consume more domestically manufactured products without relying on exports. McKinsey predicts that by 2025, emerging markets will account for almost two-thirds of global manufactured goods consumption, with China being the largest consumer, and the decline in trade intensity of China is irreversible due to the increasing sales of Made-in-China products within China. Second, the rise of domestic supply chains in emerging economies has also decreased global trade intensity. Although China remains the world's largest producer of labor-intensive products, it has progressed beyond merely assembling imported raw materials into finished products. China has produced many intermediate products by relying on domestic supply chains and investing heavily in research and development. The improvement of China's domestic supply chains has facilitated the domestic production of many intermediate inputs, decreased imports of intermediate products and mitigated the global trade intensity. Third, if the first-generation digital technologies reduce transaction costs and facilitate more trade flows, the emerging wave of digital technologies is likely to hinder global trade in goods while continuing to promote trade in services. The impact of new technologies on manufacturing is primarily reflected in the reduction of the importance of labor costs through automation and intelligent production, which makes it more cost-effective to establish industrial chains near sales locations; the significant advantages of 3D printing offer significant advantages in the production of prototypes, replacement parts, toys, shoes and medical devices that shorten supply chains for these industries. McKinsey predicts that by 2030, automation, artificial intelligence (AI) and 3D printing will reduce global trade in goods by 10%. Meanwhile, the development of digital platforms, logistics technologies and data processing techniques will further facilitate e-commerce, logistics and service automation to promote trade in services (McKinsey Global Institute, 2019).

If the shortening of value chains and the regionalization of supply chains shift China's manufacturing sector to the domestic economy, can China rely on the service sector to continue the extensive international engagement? According to Baldwin, emerging technologies, such as AI, robotics, 5G and VR/AR, will lead to the third unbundling of production and consumption by significantly reducing the cost of "moving people," similar to how logistics costs and coordination/management costs have been reduced due to goods transportation and information and communication technologies. The dramatic reduction in "the cost of moving people" suggests that workers in one country can perform tasks in another country without physical movement, which implies that the migration model in development economics has the potential to replace the industrialization model [1]. Just as Baldwin (Baldwin and Forslid, 2020) indicated, ". . . instead of developing-nation workers having to embed their labor in a product and then export that product to exploit this advantage, they will increasingly be able to export labor services directly. This should keep the emerging-market miracle going and allow it to spread," and he even suggested the sustainability of China's development path: "Since success in the service industry is based on quite different factors than success in manufacturing, development strategies and mindsets may have to change." and ". . . the globotics transformation is likely to disable the traditional manufacturing-led development 'journey' of the type China is taking, while enabling the service-led development journey of the type India is following."

Baldwin's view is representative. With the increasing trend of service-oriented manufacturing and manufacturing-based services, many scholars believe that the service sector will replace manufacturing as a new economic growth engine. Drawing comparisons between India and China, economist Kharas (2011) with Brookings Institution describes the service sector as a "new vessel" for developing countries to catch up. The post-1990s economic growth in countries such as India, Costa Rica and the Philippines is generally attributed to the expansion of services activities – finance, information technology, business process outsourcing and other business services – which means that even not depending on manufacturing production needs, the "independent" service industries, such as tourism, healthcare, finance, software and other business outsourcing, can serve as "escalators" for development (McMillan *et al.*, 2016).

Proponents of the service sector as a new economic engine argue that the manufacturing sector's job creation and productivity spillover effects are waning and that the trend toward less labor work during production and processing is irreversible due to advancements in automation and intelligence. The service sector will become the primary source of employment and is becoming a promising alternative source of economic growth with advantages in both productivity and job creation, as the productivity spillover effect of emerging service industries such as finance, telecommunications and e-commerce has surpassed that of manufacturing (Hallward-Driemeier and Nayyar, 2017). Furthermore, new-generation digital technologies have transformed the conventional service sector's "in-person" and "simultaneous presence in the same location" attributes. "Given the falling cost of manufacturing products, the rapid expansion of bandwidth, and the reduction in latency that will come with 5G, it would seem to be only a matter of time before the face-to-face and face-to-machine constraints are relaxed" (Baldwin and Forslid, 2020), this creates the technological possibility for remote deployment of the workforce – telemigration. Also, the new-generation digital technologies have significantly enhanced the tradability of the service sector. With improved tradability, the service sector can achieve economies of scale and efficiency, like the manufacturing sector, by relying on the huge export demand without being constrained by the domestic market. This is the primary reason Nicholas Kaldor argued that manufacturing was the engine of economic growth, and William Baumol claimed that the service industry was stagnant.

However, although the third spatial unbundling of production and consumption and the trend of telemigration in the service sector are irreversible, and the service sector is getting closer to and even surpassing the manufacturing sector in terms of employment absorption and productivity spillovers, the strategy of continuing extensive international engagement based on the service sector through "telemigration," which Baldwin and scholars have given high hopes, is not feasible for China. The reasons for this are:

For one thing, the impact of the technical revolution varies across countries due to differences in their technical capabilities, industrial structures and resource endowments. Just as the second unbundling did not result in the rise of all emerging economies, the third unbundling, even if it occurs, will exhibit significant national heterogeneity in terms of both means and content. Due to the lack of comparative advantages in high-end producer services and livelihood services, developing countries can only engage in the "Great Convergence" through trade in low-end livelihood services and producer services (referred to as telemigration by Baldwin), but this requires three conditions: a sufficiently large difference in labor costs between countries, a similar language and cultural tradition and a similar time zone. Baldwin and Forslid (2020) indicated, "It is easy to imagine that Africa would tend to provide services to Europe, Latin America, and North America, while Southeast Asia concentrates more on Northeast Asia since time zones are a more critical factor for service delivery." China is hard to meet all the above three conditions regarding low-end livelihood and producer services. Compared with international telemigration, domestic inter-regional labor remote services in China have more price, culture and time advantages. For example, remote nursing and remote elderly care have experienced rapid growth in recent years.

For another, since low-end service industries have been employment stabilizers in developed Western countries, penetrating the various protectionist barriers in these economies will pose significant challenges for international trade in such sectors. In the era of globalized manufacturing, developed Western countries have generally undergone a process of deindustrialization. During this period, they hollowed out the manufacturing sector and rapidly increased the share of the service sector. Developed Western countries mainly rely on high-end service industries such as R&D, design and consulting to achieve control over the manufacturing value chain while creating employment through many non-stable, low-skilled positions in service industries. This has resulted in two characteristics observed in developed Western countries, a jobless recovery following the recession and the coexistence of income and employment polarization. As a result, after the 2008 financial crisis, Western nations began to reflect on the role of manufacturing in social and economic stability, successively launching plans for manufacturing resurgence and revitalization. In Baldwin's third unbundling, the low-end service industries in developed countries will undoubtedly experience a greater impact. This is because, in the two-way trade of services, the advantages of developed countries mainly lie in high-end services, for which developing countries have limited demand, whereas developing countries possess an edge in low-end livelihood services and producer services – both of which are routine jobs requiring low-skilled labor that can be automated [2], for which developed countries have a greater demand. Telemigration and telerobotics will have a more significant impact on the low-end job market in developed Western nations, which currently serves as the primary employment absorption channel, since through a combination of 5 G/VR technology and remote robots, workers located abroad can compete in local service industries, and the advancements in AI technology, such as voice recognition and image recognition, are broadening the range of application of telerobotics. As a result, conventional cognitive tasks like those performed by bank tellers and junior lawyers can be automated. Only by protecting these low-end service industries can developed countries avoid the social upheaval caused by a significant shock.

China is unlikely to continue extensive international engagement in high-end producer services in the short term, since it faces stiff competition from developed Western countries. High-income countries hold a dominant position in the trade of high-end producer services, such as R&D, design and consulting, as well as high-end public services like healthcare and education, where China currently lacks the technology, talent reserves, innovation capabilities and intellectual property rights necessary to compete. During the deindustrialization and reindustrialization in developed Western countries, the high-end producer service industry has played a crucial role in enabling these nations to maintain their dominant position within the value chain. In the new digital technology revolution, it is expected that this industry will continue to serve as an effective tool for developed Western countries to suppress and control China's rise due to its direct support for advanced manufacturing. The US Innovation and Competition Act of 2021, which the US Senate passed on June 8, 2021, outlines its primary objectives as taking the lead in strategic emerging cutting-edge technologies and competing with China, explicitly calling for the mobilization of all strategic, economic and diplomatic tools available to the US to compete against China. Therefore, as the manufacturing value chain shortens and the trade intensity declines, China cannot continue its extensive international engagement in the services sector, let alone achieve its goal of escaping the middle-income trap and joining the ranks of upper-middle-income countries.

3. Mutual support: digital economy development and construction of the new development dynamic

From the perspective of production and circulation, the development of the digital economy – whether digitalization of industry or digital industrialization – fundamentally involves a reconfiguration of production methods that emphasizes the production chain, and the combination of domestic economy and international engagement is related to circulation, which focuses on distribution, exchange and consumption. Regarding value production and realization, the digitalization of industry and digital industrialization correspond to creating value, and the domestic economy and international engagement correspond to realizing value. Although production determines distribution, exchange and consumption, as well as their relationship, it is also influenced by them in return. "A distinct mode of production thus determines the specific mode of consumption, distribution, exchange and the specific relations of these different phases to one another. Production in the narrow sense, however, is in its turn also determined by the other aspects" (Marx, 2009a, p. 23). From the perspective of the circulation of aggregate social capital, the comprehensive development of the digital economy and the construction of the new development dynamic form an indivisible whole because in the movement of the circulation of aggregate social capital, "(In form C' . . . C') the consumption of the entire commodity-product is assumed as the condition of the normal course of the circuit of capital itself" (Marx, 2009b, p. 108). Whether the circulation is smooth or not determines the realization and accumulation of value, which determines the investment and scale growth of industrialized digital and digitalized industrial sectors.

From an industrialization perspective, the relationship between the development of the digital economy and the construction of the new development dynamic is similar to the dynamics of China's economy in the planned economy era, which mainly relied on the domestic economy to build China's heavy chemical industry from scratch, and the development of the industrial sector "from small to large" based on extensive international engagement since the reform and opening up, especially after China joined the WTO, where the domestic economy and the international engagement are combined with a specific focus to create favorable conditions for the circulation of aggregate social capital. During this process, the realization of the aggregate social capital circulation involves not only value creation, value realization and capital accumulation but also the development of the division of labor, the level of technology, industrial capabilities and management capabilities. With the expansion of scale and continuous improvement of industrial capabilities, the "quality" and "quantity" of industrial capital will also change, leading to a transformation in the structure of the capital circulation. As a result, both the focus and content of the domestic economy and international engagement have shifted. The ultimate goal is still to adapt to the changes in industrial capital, which is conducive to value creation and realization. In other words, the focus on the domestic economy and international engagement is adjusted to the development of the industrial system, which will change the structure, direction and content of the domestic economy and international engagement.

Whether in the process of industrial development "from scratch," "from small to large" or "from large to strong," China's goal of establishing a great modern socialist country has remained unchanged. However, the choice between focusing on the domestic economy or the international engagement depends not only on industrial goals and basic conditions for achieving them, especially the relative scarcity of key industry inputs, including capital, labor and technology, but also on whether focusing on the domestic economy or on the international engagement can create the necessary conditions for achieving the set goals of industrialization. The significance of domestic economy and international engagement lies not only in acquiring crucial resources such as capital and technology, but also in supporting value creation and realization within the context of aggregate social capital movement.

Based on the level of technological content and the distance to consumer markets, Castellacci (2008) classified sectors into four major sectoral groups: advanced knowledge providers (AKP), mass production goods (MPG), infrastructural services and personal goods and services (PGS) (refer to Figure 1). Among them, the AKP sectors include

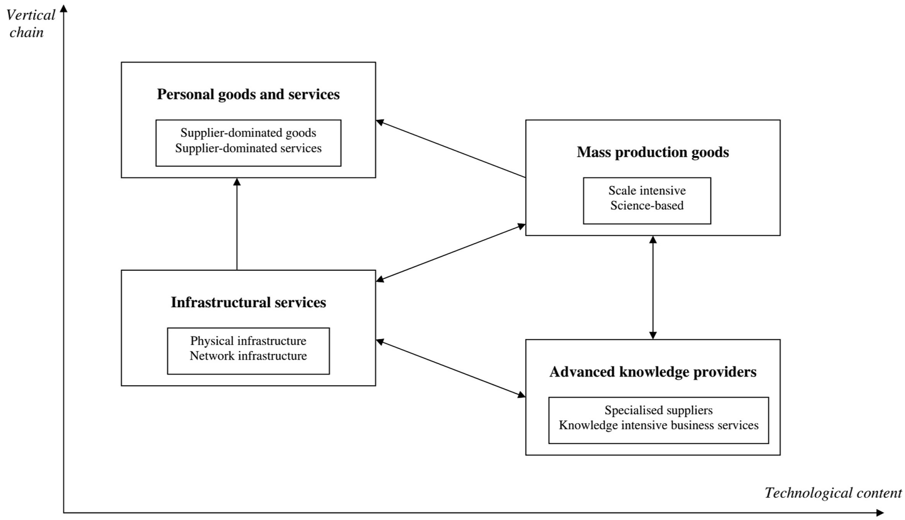

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Figure 1.
A new taxonomy of sectoral patterns of innovation in manufacturing and service industries

knowledge-intensive services (e.g. research and development (R&D) and design) and specialized supplier manufacturing sector (e.g. machine and equipment and instrument manufacturing); the MPG sectors include scale-intensive manufacturing sector (e.g. automotive industry and steel) and science-based manufacturing sector (e.g. electronic components); the supporting infrastructural services (SIS) sectors consist of network infrastructure sector (e.g. telecommunications and Internet industries) and physical infrastructure sector (e.g. transportation and logistics); and the PGS sectors, which are closest to the consumer markets, include supplier-dominated goods manufacturing sector (e.g. textiles and apparel industries) and supplier-dominated services (e.g. catering and accommodation industries). In this taxonomy, there exist mutually supportive and inter-sectoral relationships among the four sectoral categories. However, PGS does not provide feedback to the other sectoral categories, and AKP may indirectly impact PGS through MPG.

In the planned economy era, when the industrial sector was developed “from scratch,” the core task of China was to complete the basic construction of heavy industry and the national defense system. However, in the early days of the People’s Republic of China, capital and technology were very scarce (Jiang and Meng, 2021) [3], so if the country relied on international engagement to obtain capital and technologies, it would have to introduce or borrow a large amount of foreign capital, but this would inevitably lead to giving up a certain degree of autonomy. To achieve industrial infrastructure autonomy and low-cost construction at the same time, China must implement a planned domestic economy strategy to concentrate surplus resources on developing a heavy chemical industry system and achieve low-cost industrialization through the planned control of prices, materials and even urban population. The establishment of the heavy chemical industry system endowed China with highly independent industrial infrastructure. According to measurements, the average ratio of China’s international engagement to China’s domestic economy between 1955 and 1978 was 7.65% (Qiao and Wang, 2021), indicating that the impact of international engagement on China’s economy was relatively small during this period.

In 1978, China’s GDP was recorded at USD 149.541 billion, the overall scale of which was much smaller than that of today, and the proportions of primary, secondary and tertiary industries were 27.9%, 47.6% and 24.5%, respectively, with the primary industry accounting for an extremely high proportion [4]. According to Wang (2020a), corresponding to the composition of the four sectors, before the reform and opening-up, China’s industrial achievements were mainly reflected in the physical infrastructure in the infrastructure sector, such as railways and highways, as well as in the scale-intensive industries in the mass production sector, such as coal, electricity and steel, namely the heavy chemical industry system. The 156 key projects that established the foundation of China’s heavy chemical industry system were also mainly concentrated in five sectors: Ministry of Coal Industry (27 projects), Ministry of Electric Power (26 projects), Ministry of Heavy Industry (27 projects: including 7 in ferrous metallurgy, 13 in nonferrous metallurgy and 7 in chemicals), the First Ministry of Machinery Industry (29 projects) and the Second Ministry of Machinery Industry (42 projects), in addition to two in the Ministry of Petroleum and three in the Ministry of Light Industry. According to it, the scale of science-based manufacturing sectors and advanced knowledge providers at the top of the technology content was relatively small. Under the low-cost industrialization strategy orientation, personal goods and services closest to the consumer market experienced limited development. Therefore, inter-sectoral support and linkages mainly focused on physical infrastructure and scale-intensive production goods, which generated demand for each other, forming an inter-sectoral circulation within the system. In terms of industrial objectives during this period, focusing on developing China’s domestic economy as the mainstay was not only feasible but also consistent with the low-cost construction of an independent heavy chemical industry system.

In the late 1970s, developed Western countries were confronted with stagflation and profit margin crises following two major oil crises, and industrial capital sought to recover profit margins through spatial transfer, leading to a reconstruction of the global division of labor and trade order. The industrial transfer in the late 1970s and early 1980s had typical gradient characteristics: advanced knowledge-intensive and technology-intensive industries, such as electronic components, were mainly transferred from the United States and Japan to areas such as Taiwan, Hong Kong, Korea and Singapore (the technology-intensive industries had to transfer to areas with advanced technologies because modularization and the technology of remote coordination and division of labor were not yet mature, whereas the degree of electro-mechanization increased), while the Chinese mainland took over the labor-intensive industries transferred from Taiwan, Hong Kong, Korea and Singapore, including the processing of daily necessities, plastics and garment textiles, but this did not mean that China entered the stage of extensive international engagement. In fact, before the 1990s, China's economic development was typically characterized by the rapid development of township enterprises. From 1978 to 1988, the number of township enterprises increased twelvefold, and their gross domestic product grew nearly fourteenfold, with its share of GDP rising from 14% to nearly 50%. Their production capacity was mainly concentrated in light industry, especially the production of low-end consumer goods (Zeng, 2019).

In the 1990s, with China's clear objective of establishing a socialist market economy, China's integration into the international division of labor accelerated significantly. The rise of private enterprises and increased foreign investment in manufacturing led to accelerated growth in sectors closely linked to consumer markets, such as personal goods and services. With the maturity of modular technology, global production networks are replacing the traditional industrial gradient model. The ICT revolution has led to the dismantling of many advanced technology-intensive industries into labor-intensive industries based on modularization, and industries can be relocated to labor-intensive regions with broad markets. China then produced and processed a large number of scale-intensive and science-based products, such as electromechanical equipment and automobiles, in addition to supply-dominated goods (Jiang and Meng, 2021) [5]. Due to the abundant surplus labor, China has maintained its integration of low-cost labor into the global division of labor for a long time. The long-term existence of the low-cost advantage of labor indicates that the growth of domestic consumption demand is limited, lagging far behind the growth of capacity in the private goods and services sector, and domestic consumption of scale-intensive products and science-based products is also limited. The domestic market fails to absorb the huge capacity of these sectors, and extensive international engagement is inevitable. As a result, a global "dual-circulation" system has been formed, with China as the production link, developed Western countries as the consumer market and resource-based countries as the source of raw materials (Zhang *et al.*, 2017). Relevant calculations have shown that from 1978 to 2021, the relative scale of China's dual circulation, namely, the ratio of China's international transactions to domestic transactions, increased from an average of 7.65%–26.72% from 1955 to 1978, and the average proportion increased to 47.85% between 2001 and 2019 and remained above 60% between 2004 and 2008 (Qiao and Wang, 2021). In 1993, the degree of dependence on foreign trade increased from less than 10% in 1978 to about 32%, and in 2006, the degree of dependence on foreign trade climbed to a peak of 64.2%. Regarding the imports and exports of goods, China's total imports and exports amounted to USD 20.64 billion in 1978 and USD 3685.56 billion in 2016, an increase of 178.6 times over the past nearly 4 decades with an average growth rate of 14.6%. In particular, China's total export value surged from USD 9.75 billion in 1978 to USD 2,097.63 billion in 2016 at an average annual growth rate of 15.2% (Huang, 2018), which fully illustrates the positive impact of extensive international engagement during this period.

It is undeniable that extensive international engagement has played an extremely significant role in realizing the development of China’s industrial system “from small to large.” According to Ragnar Nurkse’s balanced growth theory, if a country simultaneously promotes the development of multiple industrial sectors, the continuous increase of demands among industries can form a domestic demand circulation and drive the growth of industrial scale and deepening of the division of labor and vice versa, forming a virtuous circle. However, the virtuous circle depends on continuous improvement in industrial productivity; sustained technological progress is a key factor in determining the size of the domestic demand market. Moreover, advancing the balanced growth model under closed conditions, no matter the growth of industrial demand or consumption demand brought by the increase of real wages, was relatively slow. The significance of extensive international engagement lies in bringing in capital, technology and management experience, providing a large amount of overseas demand in the short term, and absorbing a large amount of surplus rural labor in China. In terms of catching up and surpassing, extensive international engagement provides a mass market compatible with China’s development goal of achieving industrialization from small to large during this period.

Since 2010, the drawbacks of extensive international engagement have become increasingly prominent, mainly reflected in the integration of the bottom value chain into the global division of labor based on “offshoring” both ends of the production process overseas, curbing the increase of real wages and further domestic consumption demand, the degradation of resource and environmental conditions deviating from the goals of sustainable development and excessive reliance on external demand exacerbating macroeconomic and financial risks and economic instability. The domestic and international pressures on China’s economic transformation and upgrading are evident, with criticisms of its extensive international engagement continuing to mount (Jia, 2010). It is worth noting that China’s industrial structure and scale have undergone profound changes during this period. Firstly, both the expansion of industrial scale and diversification have progressed. Measurements indicate that, except for a decline in the product diversification index caused by the international financial crisis between 2007 and 2009, the export diversification of China’s secondary-industry products has steadily increased between 2000 and 2013 amidst fluctuations (Wu *et al.*, 2016). Secondly, the rapid expansion of export-oriented industries, such as the personal goods and services and mass production goods sectors, has also stimulated growth in advanced knowledge providers and infrastructural services sectors. The development of these export-oriented industries has generated a massive demand for energy, power systems and transportation infrastructure, not only continuously upgrading China’s heavy chemical industry system and infrastructure construction, overcoming bottlenecks in energy, transportation and communications infrastructure industries, but also leading to the great development of advanced knowledge-intensive industries such as precision instruments, electronic components and aerospace. Thirdly, while rapidly integrating into the international division of labor, China also valued the ICT revolution as a significant opportunity. According to measurements by Cai and Zhang (2015), in 1990, China’s ICT capital stock accounted for only 0.23% of the total capital stock; however, this share increased to 0.54 and 0.75% in 1995 and 2000, respectively. Moreover, between 1990 and 1995, the average contribution of ICT capital to China’s economic growth reached 2.3%, while it increased to 3.1% between 1995 and 2000, 8.5% between 2000 and 2005 and nearly 10% between 2010 and 2012 with the widespread application of mobile Internet technologies. This indicates that during the extensive international engagement, China made significant progress not only in the personal goods and services and mass production goods sectors but also in the advanced knowledge-intensive and technology-intensive sectors, such as large-scale production, driven by external demand and the demand of export-oriented industries.

With the full range of industrial sectors established and industrial capacity continuously accumulated, China's extensive international engagement strategy that offshores both ends of the production process is no longer suitable for China's industrial sector growth and economic development in this period. The reasons are as follows. Firstly, as China's share of global trade continues to increase, the international market can no longer be viewed as a given external condition. Rather, China's policies have become an integral part of the policies of the world economy (Yu, 2021). According to data, China's total trade imports and exports in 2018 amounted to USD 4.62 trillion (approximately CNY 30.51 trillion) with a YoY growth rate of 12.6%, accounting for 11.75% of total global trade volume, while the US, Germany and Japan accounted for 10.87%, 7.2% and 3.8%, respectively, leaving little room for China to expand its international market. Secondly, having undergone the stages of industrialization "from scratch" and "from small to large," China has evolved from a passive participant to a provider and driver in the global division of labor. Especially in East Asia's regional industrial and supply chains, China functions as an outsourcing and subcontracting hub for the manufacturing sector. With the relative change in factor endowments and the repositioning of China in global industrial chains, the weight of various costs in industrial chain layout has decreased. Labor-cost-sensitive, low-end fabrication segments have begun to "exit" rather than "enter" China [6]. From the perspective of the development of global production networks, three major production networks have been formed in North America, Europe and East Asia. Since 2013, intra-regional circulation has been strengthened, and the proportion of intra-regional trade to total global trade has grown rapidly. As of 2020, ASEAN has overtaken the EU as China's largest trading partner, and China has become the hub of production organization in Asia, as indicated by Wang (2020b). Thirdly, a new digital technology revolution accompanies the deepening of globalized manufacturing. The competition among countries for dominance in this technological revolution is intense, with trade barriers and value chain containment becoming the norm in high-tech fields. According to Lee (2016), China has gone through a technology inflection point and entered the field of short-cycle technology before 2010, as evidenced by the place of patent registration, application type and entities, and entering the field of short-cycle technology means that a country has entered an accelerated phase of technological catch-up. As a rising competitor in technology-intensive and knowledge-intensive industries, China will inevitably confront the siege and strangulation by dominators of the chain owners.

While the feasibility of international engagement has decreased, the feasibility of the domestic economy as the mainstay is constantly increasing. The reasons are as follows. Firstly, with China's GDP per capita exceeding USD 10,000, the growth potential of domestic consumption demand is enormous, and the contribution of consumption to economic growth is increasingly prominent. The contribution rate of China's final consumption expenditure to GDP growth rose from 38.3% in 1978 to 58.6% in 2019, while China's dependence on foreign trade declined significantly from 57.61% in 2008 to 35.68% in 2019. Secondly, in the new digital technology revolution, China can leverage its position as the world's largest and most comprehensive industrial factory to create a virtuous circle of technological progress and innovation growth through economies of scale and sectoral synergies. A large market implies lower unit costs, which facilitates new technologies to gain market returns and further motivates enterprises to invest in R&D. The diversification of industrial sectors promotes technological coupling and complementary effects under the new techno-economic paradigm, advancing the diffusion of new technologies and the formation of techno-economic paradigms. Thirdly, there is tremendous potential for unleashing domestic demand through structural improvements. In terms of investment demand, not only does the transformation and upgrading of traditional industries require substantial investment, but the development gap between China's regions and urban-rural areas is still significant, and there is still ample room for investment required for urban-rural and regional coordination, such as infrastructure upgrades and industrial transfers. From the perspective of consumption demand, improving the income of the middle- and lower-income groups by optimizing the income distribution structure will significantly contribute to boosting domestic demand. A McKinsey study indicates that compared to the general increase in global value chains (GVC) in all trade goods fields from 2000 to 2007, the decline in GVC trade intensity between 2007 and 2017 was largely due to China's internalization of demand for intermediate and final consumer goods, which has demonstrated the feasibility of domestic economy as the mainstay.

4. How to couple: the key factors for the development of digital economy under the new development dynamic

In order to actualize the potential feasibility, it is crucial to establish a mutually supportive relationship between the development of the digital economy and the new development dynamic, with the domestic economy as the mainstay and the domestic economy and international engagement promoting each other so that the new development dynamic can provide a solid foundation for developing the digital economy and digital economy facilitates the creation of new development dynamic. The new development dynamic necessitates the enhancement of two types of demand: investment demand, which arises from a deepened division of labor and strengthened industrial synergy, and consumption demand, which results from increases in per capita disposable income to make the domestic market the main source of final consumption demand and investment demand, creating a higher-level equilibrium between demand and supply where each drives the other and ultimately contributing to high-quality development. To achieve this goal, the development of the digital economy should be oriented to deepened division of labor, improved industrial chains and productivity and increased real wages; to achieve high-quality and systematic development of the digital economy, new circular approaches must be adopted to address two prominent issues of digital industrialization and industrial digitization in terms of value creation and value realization: for one thing, to overcome the constraints and consolidate the resilience and strength of industrial chains and supply chains, and build a modern industrial system with a high degree of security, control and autonomy; the other is to remove bottlenecks, reduce various transaction costs in the circulation process, promote the "dual circulation" of commodity flow, capital flow and logistics, enable digital industrialization and industrial digitalization to achieve scale growth and efficiency improvement, ultimately achieving "technological advantage" over "cost advantage" through upgrading from "external dependence" to "domestic demand-oriented."

The digital economy takes center stage in enhancing the two types of demand and overcoming the constraints and bottlenecks. The development of the digital economy facilitates the creation of new organizational and business models while leveraging the penetration effect of digital technology, thereby enabling the labor division in the industries based on scale expansion and efficiency improvement and creating the demand for investment through more mutual demand between sectors. The increase in labor productivity brought about by the widespread application of digital technologies also provides a solid basis for the parallel growth in real wages, which can expand final consumption demand through higher income; for the constraints and bottlenecks existing in the circulation of the new development dynamic, digital technology can create the technical and economic conditions for complementarity and breakthroughs. For instance, the application of artificial intelligence in logistics can effectively reduce circulation time and enhance efficiency, while the huge demand for complex technical products resulting from the widespread use of digital technology can serve as a force to drive innovation and create favorable upstream and downstream synergy for complementing the constraints.

It is widely acknowledged that China's primary advantage in developing a digital economy lies in its scale, encompassing massive data-generating entities, diverse types of data provided by complete industrial categories and a vast domestic market. For example, the Statistical Communiqué of the People's Republic of China on the 2020 National Economic and Social Development issued by the National Bureau of Statistics of China shows 989 million Internet users in China at the end of 2020, including 986 million using cell phones. The annual mobile Internet traffic of Chinese users in 2020 was 165.6 billion GB, with a year-on-year increase of 35.7%. The primary bottlenecks hindering China's digital economy are core technologies and critical intellectual property rights. According to the Semiconductor Industry Association (SIA), global chip sales in 2020 were USD 439 billion, of which the Chinese market accounts for one-third of global semiconductor sales. However, a research report released by IC Insight, a semiconductor industry research firm, suggests that China's self-sufficiency rate in semiconductor chips may only reach a maximum of 20% by 2025, far behind the goal of 70%. Despite technological and industrial chain bottlenecks, appropriate institutional guidance is necessary to leverage the market scale advantages. To transform potentially favorable conditions into real competitive advantages and overcome technical constraints, examining China's specific goals and constraints based on the general laws of digital economy development for better-targeted policies is necessary.

At the macro, meso and micro levels, the development of the digital economy exhibits different manifestations and contents. At the macro level, it is characterized by forming a digital techno-economic paradigm (Lundvall, 2017), akin to previous paradigms such as mechanization, steam power and railroad, electricity and heavy engineering paradigm since the industrial revolution; at the meso level, the digital economy is characterized by the diffusion of general-purpose technologies (GPTs) (Bresnahan and Trajtenberg, 1995; Liao *et al.*, 2016), as well as the formation of new motive sectors, carrier sectors and induced sectors. At the micro level, the digital economy is manifested in the "digital transformation" of enterprises, which is the process of enterprise transformation and upgrading by "replication, linking, simulation, and feedback" through digital technologies to create new products, processes, business models and organizational structures (iResearch, 2021).

Although the digital economy at the macro, meso and micro levels is correlated, and the same attention is given to critical issues such as data and data infrastructure, the entities, goals and key issues addressed by the digital economy at the macro, meso and micro levels are not the same in terms of building the new development dynamic, and thus different conditions for institutional support are required. Regarding improving the two types of demand and overcoming the constraints and bottlenecks mentioned, the policy focus varies from macro, meso and micro levels. A hierarchical structural analysis of the integration issues not only helps to comprehensively and systematically understand the intrinsic mechanism of integration but also provides a basis for accurate and systematic policymaking.

From the techno-economic paradigm at the macro level, the development of digital economy is a long-term transformation process of the dominant technological structures, forms of production organization, business models and institutional frameworks of the whole economy. Its focus is on promoting and synergizing the formation of a digital techno-economic paradigm through an appropriate socio-political paradigm, and whether the socio-political paradigm is conducive to the construction and expansion of the techno-economic paradigm lies in the ability to "share" the dividends of technological progress among members of society while maximizing the economic efficiency of new technologies and avoiding technical feudalism (Lundvall, 2017). From this criterion, the first generation of digital technologies, represented by computers and the Internet, performed poorly in developed Western countries since the mid-1970s, with an evident decoupling of the socio-political paradigm from the techno-economic paradigm, typically manifested as the failure to ensure parallel growth in productivity, wages and accumulation rate, the failure to share the technological dividend and acceleration of financialization and inequality in developed Western countries (Dosi and Virgillito, 2019).

In promoting the development of the digital economy, it is crucial to steer it within the socio-political paradigm and prevent technological feudalism in the digital techno-economic paradigm, as this will determine whether final consumption demand can provide sustained support for the domestic economy as the mainstay. In terms of the properties of digital technology, the new generation of digital technology, represented by artificial intelligence and big data, has a short-term strong substitution effect on labor, particularly unskilled labor. Moreover, data are characterized by high initial input costs but zero marginal costs, which facilitates the formation of data monopolies through agglomeration. Without appropriate socio-political paradigm guidance, the digital economy will easily cause platform monopolies, data monopolies, employment polarization and income polarization while creating new business forms and models, which is not conducive to increasing the labor share of income and improving the income distribution structure. Studies have shown that since the ICT revolution, technological progress has been significantly and positively correlated with increased market concentration and declining labor share of income (Autor *et al.*, 2020). In essence, the emerging second generation of digital technologies possesses a more distinctive "smart" and "green" character than the first generation of digital technologies represented by computers and the Internet. This results in a significant transformation of the socio-political paradigm adapted in terms of property rights and distribution from "possession" to "access," ranging from data to products (Perez and Leach, 2018).

Now many countries compete for dominance in the digital economy and attach great importance to data legislation and robot taxes [7]. In recent years, China has also implemented many policies and regulations to address platform monopolies and curb disorderly capital expansion, whose significance is evident. From the perspective of the socio-political paradigm, legislation on data elements in the digital economy, including the definition of property rights, the distribution of benefits and taxation and regulation of new economic forms, is as crucial to the digital techno-economic paradigm as legislation related to land, capital and intellectual property; however, it is more intricate – data have substantive significance for the production and circulation processes of the real economy only when they have been transformed from data resources to formatted storable data to exchangeable data to ideas or blueprints (Jones and Tonetti, 2020) since raw data originate from the actions and choices of all economic entities but must undergo processing to become usable data. Data serving as resources and data eventually utilized for production carry distinct technical and economic implications, and legislation in the digital economy era faces the challenge of protecting the privacy and safeguarding the rights and interests of data resource providers while promoting innovation and input from data users, which differs from legislation for traditional production factors.

From the meso perspective, the essence of digital economy development is to form complementary investments related to the diffusion of general-purpose technologies, thereby reconfiguring the motive, carrier and induced sectors and creating synergies among them. The key lies in investing in general-purpose technologies to generate self-stimulating growth in inter-industry demand, thereby triggering self-enhancing effects in each technology system. In terms of the generality of the general-purpose technologies, there are apparent vertical and horizontal externalities of technological progress in the GPT sector, and the return on investment in research and development in this sector is often lower than the social return. Therefore, innovation in the GPT sector should receive appropriate policy support, and accelerating the diffusion and dissemination of GPTs requires giving full play to the general-purpose characteristic of GPTs and increasing investment in GPT products and services so that the upstream and downstream sectors of GPTs can quickly form support. In regard to the specificity of GPTs in the digital economy, given the intricacy of economic and technological systems, GPTs in the digital economy era are often not single but rather a group (Hogendorn and Frischmann, 2020), and their corresponding key inputs (e.g. historically cheap and widely needed products such as iron, electricity, oil, chips and memory) are often composite. For example, the primary input in the AI era is no longer single but instead a key composite consisting of "algorithms + data + chips" (Yang, 2018).

Undoubtedly, investing in the general-purpose characteristic of GPTs to induce synergistic investment and self-stimulating growth among industries is the key to enhancing inter-industry investment demand and thus improving the position of the domestic economy as the mainstay from the meso perspective; this synergistic process is also a pivotal link to identify and complement the constraints and unclog the bottleneck. In light of the general characteristics of GPTs, it is possible and necessary to promote independent innovation in key areas constrained, such as chip manufacturing and design, driven by the demand of GPT sectors to overcome the constraints of the supply and industrial chains. Especially in the sensing, industrial control and industrial software, the links currently constraining the development of intelligent manufacturing, China's advantages in industrial data scale and diversity as the world factory should be given full play to complement the constraints with full consideration of technology autonomy and safety. According to the Industrial Development Report 2020—Industrializing in the Digital Age, released by the United Nations Industrial Development Organization, a country's advanced digital production (ADP), technology- and digital-intensive (TDI) industries (such as computer, electronics, machinery and transportation equipment industries) and knowledge-intensive business services (KIBS) are closely related: TDI industries are the largest users of ADP technology, and the more advanced the ADP technology adopted, the deeper the integration of KIBS with the manufacturing sector. Therefore, taking advantage of the large scale of China's TDI industry is feasible to boost the development of ADP and KIBS. According to the composite characteristics of GPTs in the digital economy era, gaining autonomy and security in a single GPT or key input product is not equal to complementing the constraints of supply chains. For instance, even if a complete data industry chain has been established to address issues of the collection, acquirement, storage and exchange of data resources, it is still challenging to transform data resources from "underdeveloped resources" to "available inputs" in the case of laggard chips and algorithms. Given this composite feature, innovation policies should leverage the existing institutional advantages to systematically overcome the bottlenecks in interdependent GPTs and key input products.

From the micro perspective, the development of the digital economy is reflected in the digital transformation of enterprises, whose essence is digitalizing the processes from production to distribution by enterprises. During this process, enterprises need to reconfigure their supply and distribution chains besides reevaluating and reconfiguring internal processes. Therefore, they need to not only complete fundamental investment in digitalization but also consider costs for transformation, such as sunk costs, overlapping investments and business separation. Whether to invest in digital transformation depends on the cost-benefit expectations of enterprises on digital transformation investments. Studies have shown that the cyclical nature of technological revolutions is closely related to whether enterprises adopt a digital strategy. During the initial phase of a technological revolution, the economic system exhibits greater inclusivity toward low-productivity enterprises, resulting in enterprises' few incentives for digital transformation. However, as the expansion phase approaches and new technologies become more widely adopted, lower-productivity enterprises will face increased competition and be more motivated to undergo digital transformation (van Ark *et al.*, 2016). However, for a single enterprise, the cyclical nature of technological revolutions is given. Thus, the findings of this study may not have direct policy implications; however, this correlation indirectly highlights two external factors that influence digital transformation within enterprises: the competitive market environment and the technology ecosystem of the enterprises. First, low-productivity enterprises may not undergo digital transformation in the initial stage because they can achieve satisfactory profitability without investing in transformation at a certain level of competitive intensity. Second, the proliferation of digitally transformed enterprises in the expansion phase is driven not only by intensified competition, but also by changes in the upstream, downstream and user environments resulting from the increasing number of such enterprises, forcing enterprises to undertake process transformation to integrate into established technology ecosystems. Otherwise, enterprises may face the risk of being eliminated in terms of production management efficiency and fail to interface with their upstream and downstream enterprises regarding product components, technology modules and other aspects.

Policies should focus on competition and public goods supply policies to fully stimulate enterprises' motivation for digital transformation and develop their positive investment expectations for digital transformation. In terms of competition policy, market segmentation, administrative monopoly and unfair competition should be broken, and an effective competitive screening mechanism for inefficient enterprises should be formed to stimulate the motivation for datafication through external pressure. The provision of public goods is significant not only in terms of its direct impact on the enterprises' cost of digital transformation but also in creating the conditions for the formation of a technology ecosystem within the industry, which will further drive enterprises' momentums of digital transformation. The public goods include not only hardware infrastructure, especially new infrastructures such as information infrastructure, converged infrastructure and innovation infrastructure, but also institutions such as data standards and industry norms.

Specific policy support is also needed for the digital transformation of small and medium-sized enterprises (SMEs). Currently, the digital transformation in China is mainly focused on mega and large enterprises, which are large in scale, strong in capital, abundant in talent reserves and have better expectations for digital transformation. However, many SMEs still have little investment in digital transformation and account for a large proportion of the output and employment of Chinese enterprises. In terms of the environment of competition, SMEs lack the impetus for digital transformation as they can still maintain acceptable profit margins. From the environment of technological ecology, the ecological pressure on SMEs for digitalization is relatively low due to their position in less complex value chains, and most of their upstream and downstream enterprises are also labor-intensive. Thus, it is economically rational for many SMEs, particularly those in labor-intensive industries, to lack motivation for digital transformation.

A significant feature distinguishing the digital economy from traditional economies is the complementary and non-rivalrous nature of data. Data complementarity means that different types, sources and entities of data can be mutually reinforcing, leading to an incremental payoff of data elements without increasing the marginal costs. The non-rivalrous nature of data means that data can be accumulated, replicated and utilized by all entities at a minimal cost. The use of data by an entity does not affect the use by other entities; on the contrary, the shared use of multiple entities enhances the reliability and quality of data. Small enterprises' lack of motivation for digital transformation is rational in terms of the individual; however, it is suboptimal in terms of total social output and efficiency improvement. Digital transformation is uneconomic for individual SMEs but is economic for the whole production system because, unlike the value chain and supply chain constructed through closed ecosystems by enterprises in the industrial economy, the value and supply chains of enterprises in the digital era are open and complex, and only in such open and complex systems can information access and information production be realized promptly to achieve cross-enterprise multi-entity cooperation. If the data of SMEs are not fully mined and utilized, the large amount of data generated by their production and circulation processes cannot be utilized by society. In the long term, the lag of SMEs in datafication hinders the improvement of their competitiveness and, more critically, undermines the efficiency of the entire economic system due to the loss caused by the complementarity and non-rivalrous nature of data. Furthermore, the lagging of SME's datafication can impede the backlinks between large enterprises with a high level of datafication with SMEs, making it difficult to cultivate the large enterprises' own supply chains.

From this perspective, it is evident that there is an externality in the digital transformation of SMEs. The economic benefits of data spillovers are socialized, while the costs of digital transformation have to be borne by SMEs. Compared with large enterprises, especially mega ones, SMEs in digital transformation are constrained by not only the weak stock of digital assets and lack of talents but also hard to obtain general-purpose solutions like large enterprises due to the overhigh costs for solving personalized needs for the lack of scale effect regarding industries and products. Therefore, more accurate and comprehensive public goods should be provided to systematically and effectively reduce the costs of SMEs. For example, unify data and industry standards to address the issue of inadequate high-quality services for SMEs' digital transformation. Regarding fiscal taxation policies, multi-level guidance funds can be established to direct fiscal and social capital at all levels to increase investment in digital transformation within traditional industries.

5. Conclusion

The transition of national development strategy from extensive international engagement to a new development dynamic reflects not only the changes in the major issues, principal contradictions and implementation approaches in China's economic and social development, especially in the process of industrial system transformation, but also the transformation process of digital technology since the 1970s. Just as the integration into the international division of labor and trade order through computers and the internet forms a pattern of extensive international engagement, the further development of the ICT revolution also requires changes in production methods to adapt to the development of productivity. In this sense, building the new development dynamic is also a proactive adaptation to the reshaping of the global division of labor and trade order by the new generation of digital technology, and China's established industrial system and industrial capacities provide a solid foundation for creating the new development dynamic.

The construction of the new development dynamic and the development of the digital economy are inextricably linked, and only by mutually reinforcing each other can they provide an inexhaustible impetus for China's high-quality economic development. The formation of the new development dynamic necessitates continuous enhancement of domestic demand and the full utilization of external demand through digital industrialization and industrial digitization; the development of digital economy should provide technical and economic support to complement the constraints in the industrial chains and overcome the bottlenecks in both the domestic economy and international engagement. Given the long-term and systematic nature of digital economy development, policy supply should comprehensively identify key issues in the digital economy at the micro, meso and macro levels to provide institutional support for restructuring digital production modes. At the micro level, the key is to promote the power of digital transformation of enterprises through competition policy and supply of public goods; at the meso level, the key is to promote the diffusion of general-purpose technologies and the corresponding sectoral restructuring through industrial synergy; and at the macro level, the key is to ensure the full realization of economic growth's effectiveness within the new techno-economic paradigm while simultaneously distributing the dividends of technological progress among members of society through appropriate socio-political paradigms.

Notes

1. According to the big propulsion theory of Rosenstein-Rodan (1943), there are two basic development models: directing surplus labor flow toward capital (i.e. the migration model) or facilitating capital flow toward surplus labor (i.e. the industrialization model). Given the impracticality of free global migration, the industrialization model is deemed more feasible.

2. Depending on the content of the labor, Acemoglu and Autor (2011) used routine and non-routine as well as cognitive and manual as the main distinguishing dimensions to form a combination of four skill categories: routine cognitive, routine manual, non-routine cognitive and non-routine manual. Routine skills, whether cognitive or manual, are fundamental competencies that can be readily substituted and trained, requiring the ability to read, follow instructions and adapt to procedural tasks, while non-routine cognitive and manual activities, which cannot be translated into procedural activities, are still highly dependent on the worker's initiative and creativity.
3. According to Jiang and Meng, at the beginning of the reform and opening-up, China's factor endowment was extremely imbalanced, with several important production factors accounting for unusually high or low proportions in the world, among which labor was extremely rich, accounting for 22.4% of the world's total labor force in 1980; however, there was a severe shortage of funds and technology in China, with total capital formation accounting for only 1.8% of the world's total capital formation, and R&D investment accounting for only 0.5%.
4. Data source: https://www.kylc.com/stats/global/yearly/g_service_value_added/1978.html
5. Regarding the proportion of processing trade in foreign trade and exports, the development of processing trade in the 1990s was significantly more rapid than in the 1980s. The processing trade in China accounted for more than half of total foreign trade and over 55% of total exports over many years.
6. Between 2009 and 2018, the share of China's processing trade in foreign trade decreased significantly from 41.18% to 27.41%. The share of processing trade exports decreased from 48.84% to 32.04%; the share of processing trade imports decreased from 32.04% to 22.01% (Jiang and Meng, 2021).
7. For instance, in late 2020, the European Union officially proposed drafts of the Digital Market Act and the Digital Services Act; in January 2021, the 10th amendment to the German Act Against Restraints of Competition published finally approved the GWB Digitalization Act; in October 2020, the U.S. House of Representatives Judiciary Committee released the Report on Competition in Digital Markets, which accused the four giants, Google, Facebook, Amazon and Apple, of abusing their dominant positions in the markets and recommended that they be unbundled; in February 2021, Amy Klobuchar, chair of the Senate Judiciary Committee's Antitrust Subcommittee, formally proposed the Competition and Antitrust Law Enforcement Reform Act (Sun, 2021).

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