Industrial Integration: Empowering High-Quality Manufacturing in the Era of the Digital Economy

Yang Huixin[1], and Jiao Yong[2*]

[1] School of Management, Shandong University, Jinan, China

[2] College of Economics and Management, Shandong University of Science and Technology, Qingdao, China

Abstract: *This paper investigates China's industrial integration in the era of the digital economy, evaluates its manifestations, identifies barriers to and opportunities for developing high-quality manufacturing through industrial integration, and suggests policy measures. In the era of the digital economy, data is the most vital resource in industrial integration. Platform companies operate in a dynamic business ecosystem that emphasizes user-centricity and uses innovation as its main engine to drive industrial integration. Industrial integration facilitates the shift from comparative and latecomer advantages to competitive strength, accelerating demand-side upgrades and supply-side structural reforms for the expansion of high-quality manufacturing. Industrial integration is expected to support the development of high-quality manufacturing in five distinct ways: Through integrated development between modern services and advanced manufacturing; through industrial chain integration; through integration of the digital and real economies; through integration of primary, secondary, and tertiary industries; and through urban-rural, industry-city, and regional integration.*

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1. Introduction

Manufacturing is the cornerstone of a nation's progress and prosperity. A country's manufacturing capacity, innovation, and competitiveness form an economic pillar. The development of high-quality manufacturing is strategic and all-encompassing, and serves as the ballast for long-term macroeconomic performance. As General Secretary Xi Jinping stressed, "We should accelerate the development of a manufacturing powerhouse, develop advanced manufacturing, and integrate the internet, big data, and artificial intelligence into the real economy" (Xi, 2021). This comment sets the tone for China's development of high-quality manufacturing. China's large market and wide variety of manufacturing sectors have laid the groundwork for the country's rapid advancement toward excellence in manufacturing. In recent years, China has consistently expanded the development of high-quality manufacturing, and has consistently risen to the medium- and high-end links of global value chains,

* CONTACT: Jiao Yong, email: jiaoyong@sdust.edu.cn.

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showing desirable development resilience.

As shown by China's experience since reform and opening up in 1978, the development of manufacturing cannot be achieved without gains in efficiency in the industrial division of labor, and that the country has participated in and excelled at certain processes within the industrial division of labor thanks to its comparative advantage. Changing productive forces and the relations of production are crucial for the development of high-quality manufacturing in the new digital economy characterized by a shift from the industrial division of labor to industrial integration. While maintaining the advantages of a highly specialized division of labor, industrial integration can reduce supply chain risk, lower transaction costs, and boost operational efficiency by recombining existing labor chains and bringing previously outsourced activities back in-house, leading to an increased overlap between different manufacturing sectors, from which new types of industrial activity have emerged to propel the development of high-quality manufacturing. Rising sophistication during the transition from inter- to intra-industry division of labor has improved manufacturing efficiency, allowing manufacturers to provide consumers with low-priced, high-quality industrial products. This, however, has come at the price of sacrificing manufacturing heterogeneity. As a result of mass production geared toward satisfying broad customer demands, preferences for unique products have been ignored. However, in today's data-driven economy, businesses can better fulfill their customers' unique wants and needs thanks to data collected by digital applications. Industrial integration has become an important vehicle for the development of high-quality manufacturing. As such, it is important to examine the features of industrial integration in the era of digital economy, to determine its manifestations, how it aids in the development of high-quality manufacturing, and to propose relevant policy suggestions.

2. New Characteristics of Industrial Integration in the Era of Digital Economy

2.1 Data Factor: Critical Resource for Industrial Integration

In the past, labor, capital, and technology were considered key factors of production. In the era of the digital economy, an entirely new factor of production, the digital factor, assumes center stage. Complete integration of the data factor with other production factors has magnifying, overlapping, and multiplying effects. One distinguishing feature of industrial integration at the microscopic level is the amalgamation of data and other production factors to generate enabling effects on a massive scale.

The data factor facilitates industrial integration through the implementation of intelligent and automated manufacturing processes, which enable the production of a wide variety of products at a modest cost in fulfillment of specific customer demands. The data factor ensures the timely and accurate delivery of products to users by matching supply and demand, eliminating information asymmetry between producers and consumers. Data-enabled industrial integration, particularly integration between traditional and data-generating businesses, has displayed significant development momentum, revolutionizing the development concept, business model, and industrial landscape (Ren, 2023). For instance, based on consumer data, Kutesmart[1], a manufacturer of custom apparel, has implemented an intelligent matching system to replace laborious apparel design. In this case, data has become a strategic asset in the context of industrial integration.

2.2 Innovation: Primary Driver of Industrial Integration

Innovation provides the means to achieve industrial integration. Smartphones, as an example,

[1] Kutesmart has transitioned from custom apparel to intelligent customization services, and upgraded to creating a C2M industry internet platform ecosystem, providing personalized customization solutions for intelligent manufacturing, and digital governance providers. It is a typical case of industrial integration in the era of digital economy.

constitute an ecosystem comprising software applications, content services, operating system, and hardware components. All these elements are critical for facilitating the various application scenarios and delivering a variety of content services. Likewise, intelligent cinematographic features have revolutionized the culture industry. In terms of box office earnings, Wandering Earth and Wandering Earth II ranked fifth and tenth, respectively, in the history of China's film industry, with sums in excess of 4.68 billion yuan and 4.02 billion yuan[2]. This success would not have been possible in the absence of a sophisticated film industry. The film series features, among other high-tech effects, extensive virtual production, age-altering AI, and virtual locations. AI applications have inspired innovations within the film industry, creating new possibilities for artistic manifestation. In another instance, internet applications have revolutionized the automotive sector through the transformation of conventional vehicles into intelligent ones equipped with man-machine interfaces, varied usage scenarios, and exciting innovations.

2.3 User-Centric Approach: Fundamental Concept of Industrial Integration

"People's desire for a better life is what we aim to achieve" (Xi, 2023). The term "good life" has different connotations at different times. Advances in productivity have contributed to the increased sophistication of manufacturing processes. As a result, businesses are better positioned to meet the varied preferences of their customers. This is where user-centric industrial integration becomes an important factor. For consumer-facing light industries, the user-centric approach is important to meet the growing demand for customized products and services. Within the textile industry, Kutesmart collects individualized customer requirements using intelligent tools and compares them to clothing big data. The utilization of the man-machine interface enables the tailoring of garments according to consumer specifications. By leveraging AI-driven applications and big data, technology-industry integration offers a viable way to meet the individualized needs of consumers.

Industrial integration fulfills user requirements in three ways. First, it fulfills composite user requirements. For example, diverse industrial forms have been blended in the composite business sector of culture and tourism. One such blend is the combination of agriculture with tourism and culture. Second, industrial integration facilitates the fulfillment of specific needs and preferences. In numerous industries, the digital economy has revolutionized business operations by providing a way to meet specific requirements via customized manufacturing. The arrival of digital applications has transformed the way in which consumers make a purchase. Intelligent and customized recommendations address consumers' specific needs and preferences. Third, industrial integration at the highest level may create a brand-new market. Consumers often find it difficult to precisely define what they want until a new service or product enters the market. On the eve of the invention of smartphones, for instance, consumer demand for telecom devices was basically limited to voice and messaging. Overnight, new features of smartphones sparked an unprecedented surge in consumer interest. In this situation, a new type of consumer demand emerged as a result of industrial integration.

2.4 Platform Companies: Implementing Agencies for Industrial Integration

Traditional industrial integration is displayed in the form of systematic integration at the industry level, in most situations entailing the integration of two or more industries that have common characteristics. An example is the digital integration of telecom, TV and internet networks (Zhou, 2003). Platform companies, which connect both ends of a network-based platform in the shape of a dumbbell, facilitate industrial integration in the era of the digital economy. Nowhere is this phenomenon more striking than in the industrial internet. There are more than 240 industrial internet platforms in

[2] Source: "Total box office of Cat's Eye films", https://piaofang.maoyan.com/mdb/rank.

China that produce integrated applications[3]. With the accumulation of massive user data as a result of their day-to-day activities, platform companies have evolved into a conduit for industrial integration. The data factor has become the most valuable asset of platform companies in fostering cross-sectoral integration. COSMOPlat is an example of new channels for the integrated development of conventional sectors, propelling the evolution of technological paradigms through data analytics. At the same time, participants in the platform ecosystem have established mutually beneficial associations with platform companies, as the latter are able to coordinate diverse resources within their value chains. Due to their market dominance and supply chain advantage, platform companies are able to coordinate upstream and downstream businesses and direct all participants toward integrated development.

2.5 Vibrant Ecosystem: Cornerstone for Industrial Integration

The integration of conventional industries is relatively simple, and tends to take the forms of technology integration and business integration. Industrial integration has not transformed the fundamental rationale of traditional industries. For instance, the integration of telecom, TV and internet networks is undergirded by different network technologies, which are essentially channels of information transmission. Integration does not change the technology pathways for those sectors, nor does it create a complex industrial ecosystem. In the era of the digital economy, integration has become more complex, involving the digital economy and other sectors. The digital economy has blurred the boundary between sectors and expanded their scope, creating brand-new business modes. The participants, corporate clusters, competition-cooperation relationships, and the external environment have become more complex, generating vibrant industrial ecosystems.

First, a greater variety of business entities have taken part in the business ecosystem. Industrial integration involves platform, backbone and application enterprises at different positions of the business ecosystem. Second, business clusters have developed a distinctive dumbbell structure, in which upstream supporting and downstream application industrial (business) clusters comprise both ends of the dumbbell and platform companies comprise the bar. Third, business entities form an ecosystem with an orientation of meeting user requirements. Lastly, complexity has increased in the external environment. In the past, enterprises could gain access to market with their comparative advantages, but in the era of the digital economy, they must have unique competitive strengths in order to be admitted to an ecosystem. In other words, the competitive relationship has shifted from one between enterprises to one between ecosystems. Businesses share their destinies with an ecosystem. The cost of failure in competition means the failure of an entire ecosystem. In the worst circumstance, it may result in a systematic exit from the market.

3. Manifestations of High-Quality Manufacturing Development Driven by Industrial Integration

3.1 New Concept of Industrial Integration: Key Aspect of High-Quality Manufacturing Development

The new development concept refers to innovative, coordinated, green, inclusive and shared development. It is a major strategy by which China promotes high-quality economic development in the new normal. More importantly, it sets the tone for a major transformation of China's overall development. In this sense, in its development, high-quality manufacturing should be innovative, coordinated, green, and inclusive with shared benefits. Industrial integration accompanies the new development concept. Specifically, in its development, high-quality manufacturing is characterized by innovation and by being coordinated, green and inclusive for shared benefits.

[3] Source: 52nd *Statistical Report on China's Internet Development*, https://www.cnnic.net.cn/n4/2023/0828/c88-10829.html.

Innovation, a new feature of industrial integration in the era of the digital economy, is the main driver of integrated industrial development. The process of integration will stimulate multiple innovations in the domains of 5G, big data, and cloud computing. These innovations will have a profound effect on current business models and accelerate institutional and regulatory changes. Furthermore, industrial integration may result in the restructuring and optimization of resource factors, particularly the incorporation of digital and data technology into conventional production factors, in order to improve compatibility and efficiency, facilitate coordination among industries, and enable dynamic industrial upgrading via technological advancement. In addition, industrial integration will reduce repetitive investment on generic technologies. One example is the integration of telecom, TV and internet networks. The result is a more inclusive network that avoids redundancies and promotes environmentally sound practices. Industry integration is conducive to the collection of various resources, especially innovation resources, for inclusive and shared development and competitiveness. Inclusive access to value chains and ecosystems results in more efficient factor combinations and manufacturing modes, facilitating the rise of global value chains under the condition of global openness. Lastly, industrial integration has commonalities with the shared economy. Integration is an intrinsic attribute of shared development, and shared development lies at the heart of integration. Both the consumer internet and the industrial internet are products of integrated development and "quasi-public goods", which share common characteristics and assure manufacturing excellence.

3.2 Transition from Latecomer Advantage to Comparative and Competitive Advantages

From reform and opening up in 1978 to the present time, China has made great efforts to grow into a global manufacturing powerhouse. "It took China decades to complete an industrialization journey that developed nations required centuries to complete", as the adage goes[4]. China showed tremendous vitality during this phase of development in which human capital, institutional reform, and a massive consumer market were utilized. China used its comparative advantage to participate in the international industrial chain division of labor and used its latecomer advantage to advance reform and opening up. Obtaining such "low-hanging fruit" will become increasingly difficult in the future. China has transitioned from being a follower to becoming a parallel runner in certain sectors, such as high-speed rail, ultra-high voltage power transmission, and photovoltaic energy. This transformation has been greatly influenced by industrial integration.

Industrial integration holds the key to unlocking China's strengths in a complete range of manufacturing sectors and an ultra-large market. Through technological integration, enterprises seek to match supply with demand. China's complete range of manufacturing sectors provides industrial integration with essential technologies and production factors. Its ultra-large market creates great potential for new products generated by industrial integration. According to the 52nd *Statistical Report on Internet Development in China*, China had 1.079 billion netizens in June 2023[5]. An integrated business mode or application may easily acquire tens or even hundreds of millions of users in China.

Furthermore, industrial integration has the potential to reduce expenses by leveraging data and technology factors. In the presence of network externalities, the "winner takes all" Matthew Effect will materialize. Through industrial integration, a limited number of participants will amass a lion's share of the market and obtain a competitive edge. Industrial integration will generate a multitude of new sectors, business models, and market segments, as well as fresh consumption scenarios and applications. As a result, economies of scale and comparative advantage will no longer be viable means of achieving success. Companies must actively pursue opportunities in niche markets to enhance their competitive

[4] Source: *Resolution of the CPC Central Committee on the Party's Major Achievements and Historic Experiences over a Century of Struggles*, The People's Publishing House, 2021.

[5] Source: *52nd Statistical Report on Internet Development in China*, https://www.cnnic.net.cn/n4/2023/0828/c88-10829.html.

advantage. The effects of industrial integration are interdependent and do not exist separately from one another. They work together in promoting industrial integration and facilitating the advancement of high-quality manufacturing through their support of the transition of manufacturing from one having a latecomer advantage to one based on comparative and competitive advantages.

3.3 Expediting Supply-Side Structural Reforms for the Development of High-Quality Manufacturing

"Supply-side structural reforms should focus on liberating and developing productive forces and expediting structural adjustment to reduce ineffective and low-end supply and expand effective and medium- and high-end supply" (Party Literature Research Office of the CPC Central Committee, 2017). It is through these avenues that industrial integration may assist supply-side structural reforms.

At the firm level, companies attempt to acquire business modules that maximize value and that are compatible with their current business models in order to align value creation and capture. For this to occur, corporate business lines need cross-departmental and cross-functional overlap. When companies broaden the scope of their business by integrating their products or services with those from other markets, the result is industrial integration, which is facilitated by innovation. The boundaries of industries that rely on generic technologies will diminish. Organizations must respond to market demands by diversifying their business lines along the curve of established technology and introduce new products or business models to foster industrial development.

At the industry level, industrial integration helps accelerate industrial restructuring, creates new business modes, and blurs sectoral boundaries through the integration of value proposition, technology and market (Hu and Xing, 2003). Such adjustment enables the optimization of the industrial structure for the improvement of supply-side total factor productivity (TFP), and helps increase supply. Specifically, industrial integration provides the means for conventional manufacturing to fully absorb advanced technology and concepts, and integrate factors of other industries for industrial transition, innovation and digitalization. As a result, conventional manufacturing as a share of the industrial system will continue to decline. Industrial integration will catalyze multiple new business modes and foster advanced manufacturing. For instance, industrial diagnostic systems arise from the application of medical systems in the industrial sector.

3.4 Propeling Demand-Side Upgrade for the Development of High-Quality Manufacturing

Industrial integration is production-side integration among industrial sectors. The fundamental concept of integration, however, is the user-centric approach. In other words, integration creates better goods and services to meet user requirements. Instead of the transfer of ownership rights, users wish to experience the utility of products or even the combination of products with different functions. This forces firms to broaden their business scope into sectors beyond the existing industrial boundary to strengthen their market positions. The blurred boundary among industrial sectors does not mean that those sectors become homogeneous over time. Instead, it signifies a growing degree of convergence and interdependence among formerly independent entities, such that industrial integration is propelled by the need for technological advancements. In the era of the digital economy, industrial integration has acquired new traits. New-generation information technology has catalyzed new business modes and use cases. As a result of business integration, new consumer demand has emerged to meet people's expectations for a better life in ways previously undreamed of. In the feature phone era, consumers used mobile phones primarily to make calls and send messages. By integrating mobile internet applications, smartphones have created myriad business modes and new demand with unprecedented user experiences. Demand-side industrial integration has blazed a new trail of manufacturing excellence.

4. Barriers to Industrial Integration in the Development of High-Quality Manufacturing

In the era of the digital economy, industrial integration has only begun to drive the development of high-quality manufacturing. At this stage, various barriers and problems still exist, including resource mismatch, need for technology upgrade, lack of regional coordination, insufficient human resources, and poor business climate. Industrial integration has yet to break free from the old constraints and establish new drivers of manufacturing development.

4.1 Industrial Integration: Insufficient Support for Breaking Free from Old Manufacturing Constraints

Great progress has been made in digitalization and internet application in the manufacturing sector. However, the transition from mass production to individualized customization is incomplete. Services account for a modest share of input and output, and offer limited support to the extension, permeation and integration of manufacturing. Progress has yet to be made in the service-based transition. Industrial integration has yet to transform manufacturing processes, reshape value chains, and generate innovative business modes. Consequently, manufacturers cannot create a diverse range of individualized goods and services to meet heterogenous customer requirements, which is essential to raise the user experience to a higher level. More work needs to be done to break free from old constraints and complete the transition to digital and service-based manufacturing across all value chains, ecosystems and full-lifecycle management processes (Yang and Sun, 2023).

Moreover, there has been insufficient integration between the manufacturing sector and upstream and downstream enterprises. Manufacturing enterprises cannot optimize resource allocation on a real-time basis in response to changing customer requirements and domestic and international environments. Without access to integrated information, companies are hampered in their attempts at providing additional services, and face barriers to the integration of service and manufacturing. The benefits of industrial integration's allowance of the free flow of data have yet to be fully realized. The fragmentation of data resources impedes the availability and application of data, and prevents the complete realization of data's value for the society.

4.2 Industrial Integration: Insufficient Impetus for Manufacturing Innovation

There has been great momentum in digitalization and the rise of strategic emerging industries. In this context, China's support of technological, corporate and industrial innovation has been inadequate.

At the technology level, manufacturing has yet to unlock the potentials of new technologies such as the internet of things (IoT), big data, and cloud computing. As a result of the limited penetration of new technology, barriers still exist between networks, equipment, systems, and data. New-generation information technologies have yet to be fully integrated into the manufacturing sector.

At the firm level, manufacturing enterprises are not commonly capable of digital customization to meet customer requirements. Due to the lack of internet applications, it still takes hefty channel investments for firms to perceive and meet customer requirements.

At the industry level, the relationship among manufacturing enterprises is characterized by both competition and cooperation. It takes time for a symbiotic relationship to form. Integrated information and technology solutions should be adopted to blur the boundary among industrial sectors, increase efficiency in resource allocation, and catalyze new business modes for the development of high-quality manufacturing.

5. Industrial Integration: Towards a High-Quality Manufacturing Powerhouse

In the era of the digital economy, a step-by-step approach to industrial integration is needed to promote manufacturing excellence. Policymakers should encourage integration between manufacturing

and services, industrial chain integration, and integration between digital and real economies, between primary, secondary and tertiary industries, encourage urban-rural, industry-city, and regional integration, thus promoting industrial integration..

5.1 Promoting Integration between Manufacturing and Service to Increase Manufacturing Competitiveness

The integration of manufacturing and service is not only the result of technological evolution, but also an important means for developing high-quality manufacturing, as shown in the emergence of new business modes, paradigms and paths. Specifically, there are two pathways for the development of the integration of manufacturing and service: Service-based and service-derived manufacturing. Service-based manufacturing refers to service applications in the manufacturing processes; service-derived manufacturing is led by platform companies that generate an ocean of consumer preference data and use such data to design new products for contract manufacturing.

As for specific types of industries, it is important to focus on core manufacturing sectors and promote all-round integration among material supply, consumer goods, and equipment and automobile manufacturing. Efforts should be made to extend, complement and strengthen manufacturing value chains. Manufacturers should expedite innovation, develop industrial software for assisted design and system simulation, and implement intelligent manufacturing processes. There are significant differences in the industrial foundation, inherent characteristics and development goals between light industry and heavy industry, leading to different paths of industrial integration. Light industries should create a modern service system combining product with content and a business ecosystem. Heavy industries should focus on a combination of industrial internet and professional services. Downstream manufacturing services should become greener, smarter and increase brand awareness to create superior services and concepts. Policymakers should encourage manufacturing-service integration in all dimensions, from internet applications to modern logistics, R&D and design, consumer services, and financial services.

5.2 Promoting Industrial Chain Integration to Reinforce Security and Stability

Countries should maintain the resilience and security of global supply chains as a quasi-public good while taking part in the international division of labor. Currently, advanced economies led by the United States have imposed restrictions on global supply chains, especially in strategic emerging industries, which present risks to supply chain stability and industrial sustainability. As far as China is concerned, supply chain stability is essential for businesses to survive and thrive. The more integrated supply chains are, the higher the level of security and stability. Supply chain integration is also a basic requirement for the development of high-quality manufacturing.

It is the responsibility of platform corporations, which dominate supply chains, to integrate the supply chain. Huawei, for example, has been committed to establishing sustainable, low-carbon, and environmentally friendly supply chains. Huawei specializes in the development of automotive operating systems and processors for smart vehicles. The chip product line comprises Kirin on-board chips and Ascend chips, while the operating systems comprise the intelligent driving operating system, smart vehicle control operating system, and Harmony cockpit operating system. Huawei is renowned in the smartphone supply chain for its exclusive Kirin processor and Harmony mobile operating system. It has put together a complete domestic supply chain including screen, RF chip, filter, optical camera, acoustic component, and battery module while establishing an ecosystem of software applications and content services[6]. The case of Huawei demonstrates that the dominant company in a supply chain determines the

[6] Source: *Huawei Investment Holding Co., Ltd. 2022 Annual Report*, https://www-file.huawei.com/minisite/media/annual_report/annual_report_2022_cn.pdf.

technological trajectory, the development concept, and the course of the industrial chain evolution, as well as advancing the integration of the industrial chain. In fact, the integration of an industrial chain is impossible without a multitude of suppliers providing auxiliary and supportive applications and content vital to the integration of the industrial chain. Finally, industrial chain integration is demonstrated through the integration of personnel, capital, information, and logistics flows.

5.3 Promoting Integration between Digital and Real Economies to Unlock Future Industrial Potentials

The real economy, particularly manufacturing, cannot flourish without the assistance of the digital economy, and the digital economy cannot advance in seclusion from the real economy. The digital economy has evolved from a supplementary factor to the primary arena of economic progress. It also serves as a significant arena for competition among global powers. Three points may be critical for advancing the integration of the digital and real economies.

First, the digital factor facilitates the growth of the real economy. The Chinese government has repeatedly recognized data as a factor of production. The commercialization of data, which is a crucial component of the integration of the digital and real economies, raises three fundamental concerns: Data security, data ownership, and data pricing. As evidenced by the current trend, manufacturing companies have maximized the utilization of big data generated by their day-to-day operations, as these data resources are considered proprietary assets exempt from concerns regarding pricing, security, and proprietorship. The key question is how to leverage user data and government data to facilitate the advancement of the real economy. In particular, user data raises addressable concerns regarding data privacy and security. For example, privacy computing[7] presents a new methodology for rendering data "accessible but imperceptible". However, establishing the proprietorship of user data presents a greater difficulty, as it necessitates both theoretical deliberations and practical application. Two varieties of government data exist: Information is disseminated by the government for public oversight, and substantial economic value to the data is provided by government departments at all levels, including climatic, traffic, and medical information. It is imperative to conduct proactive research regarding the ownership, pricing and security of data.

Second, applications of digital technology in the real economy. It is imperative to capitalize on the opportunities presented by emerging information technologies of the next generation, including big data, cloud computing, and IoT, in order to consistently achieve advances in cutting-edge materials, instruments, and software. A greater role should be given to artificial intelligence (AI) and 5G in supporting the real economy. It is necessary to develop high-performance and compatible industrial software to support industrial internet platforms.

Third, digital industrialization and the digitalization of industries. Based on the findings presented in the *Research Report on Digital Economy Development in China*, the digital economy in China amounted to 50.2 trillion yuan. Of this amount, industrial digitalization accounted for 41 trillion yuan, or 81.7%[8], while the digital industry comprised 9.2 trillion yuan, or 18.3% of the digital economy. Industrial digitalization results from the implementation of digital technology; the digital sector is a fundamental sector of the digital economy. They play complementary roles in advancing digital integration.

5.4 Promoting the Integrated Development of Primary, Secondary and Tertiary Industries under the Strategy of Countryside Revitalization

The success of the countryside revitalization strategy is contingent upon the flourishing of rural

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[7] Privacy computing refers to the collection of technologies that enable data analysis and calculation without the risk of raw data leakage. Through technological means, rendering data "accessible but imperceptible", ensuring data security and maximizing data value.

[8] Source: The Chinese Academy of Information and Communication Technology (CAICT): *Research Report on the Development of China's Digital Economy 2023*, http://www.caict.ac.cn/kxyj/qwfb/bps/202304/P020230427572038320317.pdf.

industries. Rural industrial revitalization extends beyond agriculture, and is based upon the integration of agricultural value chains and those of the primary, secondary, and tertiary sectors. Agribusiness value chains should be extended and made more connected by combining farming operations with industrial development. This will encourage the intensive processing of farm produce. The rapid development of ready-to-eat meals is one example. The ready-to-eat meal market in China was valued at 419.6 billion yuan in 2022, as reported in the *White Paper on the Development of the Ready-to-Eat Meals Industry in China 2022*. This figure indicates that the market continued to expand at a rapid rate. The production, storage, transportation, processing, distribution, catering, and market consumption of ready-to-eat meals are all components of the food industry. In the primary, secondary, and tertiary sectors, integrated development is propelled by consumers' demand for ready-to-eat meals. The government ought to leverage advantageous aspects of the digital economy to foster digital application-based integration of the primary, secondary, and tertiary sectors. The penetration of the digital economy in China's primary industry is 10.9%, which pales in comparison with those of the secondary and tertiary sectors at 24.0% and 44.7%[9], respectively, as estimated in the *Research Report on the Digital Economy in China*. Thus, there are significant prospects for harnessing the opportunities presented by the advancement of the digital economy to digitalize agriculture and facilitate the integrated development of primary, secondary, and tertiary sectors. An additional approach to advancing rural industrial integration is to leverage the potential of emerging agribusinesses to facilitate the expansion, integration, and implementation of technologies along the industrial chain (Zhao et al., 2023).

5.5 Promoting Industry-City, Urban-Rural and Regional Integration

Integration of industries and cities, cities and rural areas, and regions are the three key types of industrial integration. Regional integration and industrial integration should be combined in order to reinforce one another. Variations in the degree of industrial and economic progress can be observed among different regions of China. Such regional disparities are reflected in the industrial integration-driven development of manufacturing. Policymakers should take a comprehensive approach to maximizing the synergy between industry and regional integration, establishing a national factor and product market, and lowering market friction costs. Only in this way can we speed up the free movement of different resources, boost the vitality of innovative factors, and set the stage for industrial and regional integration. It is recommended that the government establish institutional frameworks that facilitate multidimensional integration among regions, industries, cities, and rural areas, and also reduce transaction costs associated with institutions and eliminate barriers between regions and industries. In order to spearhead industrial integration, the government should expedite the growth of emerging industrial clusters, with a particular emphasis on digital economy clusters that are globally competitive. Localities ought to evolve into regional communities that possess distinct functionalities, in accordance with their individual technological and market development levels and competitive advantages.

6. Policy Recommendations for the Development of High-Quality Manufacturing Driven by Industrial Integration

6.1 Improving Resource Allocation

In order to facilitate the unrestricted flow of data, the government should establish data ownership rights at the legislative level along with efficient market mechanisms for data transactions. The digitalization of supply chain management should be promoted to decrease inventory expenses and improve the response rate of businesses. Establishing national manufacturing innovation centers in

[9] Source: The Chinese Academy of Information and Communication Technology (CAICT): *Research Report on the Development of China's Digital Economy 2023*, http://www.caict.ac.cn/kxyj/qwfb/bps/202304/P020230427572038320317.pdf.

strategic regions is imperative. The government should assist high-tech businesses and draw in resources by providing R&D subsidies, preferential loans, and tax credits. Businesses should increase their collaboration with universities and research institutions in order to enhance their manufacturing prowess. Financial institutions should be directed to establish industrial funds and promote the provision of financing options for the purpose of optimizing manufacturing processes and executing projects. To establish efficient flows of information, materials, and capital, businesses should build digital platforms within their respective industries, collaborate closely with global supply chains, and enhance their technology.

6.2 Focusing on the Integration of Industrial Technology

It is recommended that the government encourage manufacturing enterprises to embrace advanced technologies, including machine learning and AI, in order to achieve complete or partial automation. The implementation of big data, AI, and IoT could be leveraged to enhance manufacturing efficiency. Adopting real-time IoT analysis and tracing tools is essential for optimizing supply chain management. Proactive measures should be taken to establish high-quality networks in critical areas to facilitate IoT operations. The adoption of big data analytics by manufacturing enterprises for the purposes of product design, market analysis, and quality control should be promoted to strengthen data analytics and provide decision-making support, and industry data transaction platforms should be established to facilitate the unrestricted exchange of data between government agencies and businesses. It is necessary to provide support for virtual simulation and remote collaboration, implement cloud computing and virtual reality (VR) in the manufacturing sector, and establish platforms for cross-enterprise and cross-regional remote collaboration. This will enable small and medium-sized enterprises (SMEs) to leverage the resources of large enterprises and research institutions. Adopting big data analytics would increase the precision of the identification of consumer behavior and market demand, allowing for a quicker response to market shifts. When engaging in technology cooperation and exchange, it is crucial to establish a rational correlation between the proportion and distance between in-house technology research and development and technology imports. Placing emphasis on independent innovation, businesses ought to strike a balance between technology importation and independent innovation. Businesses should transition from “know how” to “know why” when importing mature technologies, engage in exogenous technology assimilation, absorption, and re-innovation, acquire critical technology, know-how, and technical expertise and transition to independent design and manufacturing with indigenous intellectual property rights.

6.3 Coordinating Regional Development

Establishing regional industrial alliances would facilitate the exchange of resources and information among manufacturing enterprises, universities, research institutions, and government agencies in neighboring regions. This would generate spillover effects that would benefit neighboring areas and contribute to the improvement of internet, logistical, and transportation infrastructures. Policymaking should be based on the location and resources of each region in order to support regional industries and make sure that less developed regions have equal development opportunities. The circular economy and green manufacturing should be promoted through economic mechanisms including environmental taxes, carbon trading, and subsidies. Assessment criteria need to be established for corporate social responsibility (CSR) to provide incentives, such as tax credits, for CSR performance. Policy coordination should be undertaken by regions to prevent discrimination, bolster market participants’ confidence, and establish a policy environment that is stable, equitable, transparent, and predictable.

6.4 Cultivating a Talent Echelon

Talent is essential for industrial integration and the development of high-quality manufacturing. The brightest minds solve complex problems and propel innovation. Greater efforts should be made by the government to reform talent incentives and foster an environment conducive to talent. Talent concentration and mobility should be encouraged in order to maximize talent distribution. A more

intimate collaboration among the government, businesses, and universities is required to cultivate talent for "little giant" enterprises, which are specialized and sophisticated producers of novel and distinctive products, as well as industry leaders. It is advised to develop a distinguished expert system and a high-end talent attraction program. Prestigious universities and research institutions should support the development of a constellation of scientific research professionals, and flexible systems for fostering talent should be built with broad coverage at all levels. The cultivation of technology development experts ought to be undertaken in collaboration with engineering research centers and key laboratories. Additionally, training should be provided for technicians who possess practical experience in order to construct a multifaceted and varied framework of innovation talent.

6.5 Creating a Pro-Business Environment

To foster an environment conducive to competition, the government must abstain from unnecessary intervention and withdraw from competitive markets. It is suggested to deepen reforms of administrative devolution, management, and services. This could involve reducing the number of items requiring administrative review and approval, implementing ex-post supervision for non-decisive and unnecessary matters, and enhancing the operational efficiency of service-related issues to facilitate market access of the manufacturing industry at a lower cost, as well as encouraging enterprises to prioritize cross-sectoral innovation. It is recommended that the government streamline the decentralized review and approval process for administrative matters across multiple departments and establish one-stop services that efficiently and promptly attend to the requirements of businesses. An interim and ex-post regulatory framework should be established, while fostering a business environment that is standardized, lawful, and globalized. Safety assurance for corporate R&D and manufacturing activities can be achieved through the following measures: Protect intellectual property rights, clamp down on counterfeits and infringements, increase law enforcement cooperation, report infringements on credit reports, and strengthen penalties for infringements. The government ought to cultivate amicable and legitimate relations with businesses, enhance the transparency of policies, establish fresh competitive advantages, augment appeal to foreign capital and talent, and support the development of high-quality manufacturing and industrial integration through institutional innovation and the improvement of the business environment.

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