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A review of the exploration of the essence of digital economy and the research on quantitative evaluation framework

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Abstract

This paper focuses on the core role of the digital economy as an emerging growth engine of the global economy, and clarifies the basic scope and deep-seated connotation characteristics of the digital economy through a detailed literature review. The research shows that the digital economy not only shows strong value creation ability as a new factor of production, but also effectively promotes the improvement of industrial efficiency and the optimization and adjustment of economic structure through its mediating role. At the same time, as an important platform for global resource allocation, the digital economy has significantly promoted the precise docking and efficient integration of resource supply and demand. In terms of measurement strategies, this paper deeply analyzes the mainstream digital economy measurement methods around the world, including the index method, the value-added method and the satellite account compilation method, and systematically reviews and compares these methods. The study points out that due to the difficulty of basic data acquisition, the complexity of index system construction, and the diversity of theoretical perspectives, the current digital economy measurement methods have their own characteristics, but also face many challenges. Based on the above analysis, this paper puts forward the basic ideas and strategic suggestions for constructing a digital economy measurement index system in China. These suggestions aim to overcome the limitations of existing methods and build a scientific, systematic and forward-looking measurement system based on the actual situation of China's digital economy development, so as to comprehensively and accurately reflect the development status and trend of China's digital economy, and provide strong support for policy formulation, academic research and industrial practice.

Keywords

Digital economy; index measurement; Accounting Methodology.

1. Introduction

In the era of digital economy, digital globalization has become an irreversible trend. Xue (2021) [1]proposed that in the digital age, on the one hand, countries with strong digital capabilities are rapidly entering an "acceleration era". For this reason, government statistics institutions, top consulting organizations and Internet enterprise research institutions have been engaged in the measurement and assessment of the scale of the digital economy and digital ecology, aiming to accurately grasp the actual development level and hierarchy of the digital economy around the world. The measurement process of the digital economy involves multidimensional considerations, including but not limited to the clear definition of the digital economy category, careful selection of measurement tools and methods, and timely correction of measurement results. The digital economy is a very complex new economic form, and it is very difficult to objectively evaluate the development status and digital technology level of an economy. However, Zhang (2022)[2] proposed the concept of the "International Digital Ecology Index" and evaluated the level of digital economy and digital technology development of an economy using

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four indicators: digital foundation, digital capability, digital application, and digital regulation. There is currently no broad consensus on the profound understanding of the connotation of the digital economy, the broad definition of its radiation fields, and the determination of evaluation focus on a global scale. In this context, the digital economy measurement method advocated by the Organization for Economic Cooperation and Development (OECD) has set an important benchmark globally due to its scientific and comprehensive nature. At the same time, the European Union and the United States have accumulated valuable experience in promoting the practice of measuring the digital economy, providing useful references for the international community's related explorations. As far as China is concerned, although the practice of digital economy is flourishing, research on measuring digital economy is still lagging behind and has not fully matched the pace of development of digital economy. This situation calls for deeper academic exploration and practical innovation to promote the improvement and development of China's digital economy measurement system, so as to better serve the formulation and implementation of national strategies.

This article systematically reviews the historical evolution trajectory of digital economy measurement methods and indicator systems at home and abroad, aiming to deeply analyze the internal logic of digital economy measurement, extract the core elements and basic processes for constructing an effective indicator system. This study not only has significant practical significance as an important tool for monitoring the evolution trend of the national digital economy and enhancing global digital economy competitiveness, but also contains rich theoretical value, which helps to accurately evaluate the level of digital technology development in China and provide scientific basis for the key layout of digital economy investment strategies. Furthermore, it promotes the deep integration of the digital economy and the real economy, providing solid support and driving force for China's economic transformation towards high-quality development and the construction of a new development pattern.

2. Definition, Function, and Characteristics Analysis of Digital Economy

(1)The connotation of digital economy.

When delving into the essence of the digital economy, we first need to construct a clear conceptual framework, which is an essential cornerstone for understanding its fundamental functions and specific features. Tapscott (1996)[3] systematically expounded the concept of digital economy for the first time in his groundbreaking work Digital Economy: Opportunities and Challenges in the Network Intelligence Era, defined it as an information and communication technology (ICT) as the core infrastructure, and developed diversified e-commerce models relying on this platform, showing the distinctive characteristics of the Internet economy. This statement emphasizes that ICT infrastructure serves as the cornerstone of digital economy operation, and various forms of e-commerce that emerge on this basis jointly promote the creation and exchange of value. Furthermore, as an indispensable component of the digital economy, data elements highlight the inevitable trend of deep integration between technology and economy. Brynjolfsson and Kahin (2002) [4] expanded the scope of the digital economy from the perspective of technology and application, covering multiple dimensions such as information and communication technology, e-commerce, digital delivery services, and software infrastructure, deepening the understanding of the technological foundation and application scenarios of the digital economy. Bukht and Heeks (2017)[5] provide a more comprehensive and detailed perspective on the definition of the digital economy through a three-level division. They pointed out that the core of the digital economy lies in the ICT sector that produces basic digital goods and services, including key areas such as hardware manufacturing and information services; At a narrow level, the digital economy encompasses various business models based on digital goods and services, such as e-commerce and platform

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economy; In a broad sense, the digital economy has penetrated into all economic fields, involving cutting-edge areas such as Industry 4.0 and algorithmic economy, demonstrating its extensive influence as an important driving force for economic transformation and upgrading. Sandberg et al. (2020) [6] used a more refined ABCD model (artificial intelligence, blockchain, cloud computing, big data) to summarize the core technology portfolio of the digital economy. This model not only highlights the innovation and cutting-edge of the digital economy, but also reveals its key role in promoting social and economic development. Jones et al. (2020) [7]-[8] proposed that with the support of new technological means, data can be used as a new type of production factor after being collected, cleaned, stored, and processed, and can be applied in production management, procurement and sales, research and development innovation, and other enterprise operation processes to improve the comprehensive operational efficiency and knowledge creation ability of enterprises.

In academic research and policy discussions, the definition of the digital economy has undergone continuous deepening and expansion. Of particular significance is the concept of digital economy proposed at the 2016 G20 Hangzhou Summit, whose profound impact is still widely recognized today. Wang Yu and Zhang Zhanbin (2021) [9] believe that people have a new understanding of the connotation of the digital economy based on the G20 Summit, and that the digital economy is a series of economic activities that combine the Internet platform (economic carrier), information and communication technology (driving force), knowledge and information (key production factors). This definition not only accurately captures the operational carrier of the digital economy - the network, but also profoundly reveals its inherent characteristics of deep integration and common development with advanced technology, providing a solid theoretical basis for understanding the digital economy. Based on this, scholars such as Li Xiaohua (2019) [10] further explored the emerging characteristics and driving mechanisms of the digital economy, emphasizing how the digital economy can use emerging technologies as engines to generate a series of new economic forms and growth drivers. These studies not only enrich the theoretical connotation of the digital economy, but also provide valuable reference for policy makers. Scholars such as Chen Xiaohong (2022) [11] have provided a more detailed characterization of the digital economy from three dimensions: resources, platforms, and technological innovation. They believe that digital economy is a new economic form with digital information as the core resource, Internet platform as the key support, and continuous innovation of digital technology as the powerful driving force.

Through a detailed literature review and comprehensive analysis, we can gain a profound insight into the multidimensional connotation of the digital economy, which not only covers the technological foundations that support its development, but also extensively involves a series of emerging formats and economic models that have emerged as a result. This comprehensive and in-depth understanding has laid a solid foundation for scientifically and reasonably measuring the scale of the digital economy. From the perspective of the economic functions of digital technology, its influence can be divided into three progressive levels: firstly, at the micro level, data and information, as emerging production factors, are increasingly penetrating into every corner of the production process, becoming a key force in reshaping the social division of labor pattern and improving resource utilization efficiency. Secondly, at the meso level, digital technology, with its powerful optimization capabilities, has reconfigured the combination mode and spatial layout of production factors, promoting the overall leap of industrial efficiency and the continuous optimization of economic structure. Finally, at the macro level, the complex network system constructed by digital technology, such as user networks, production supply chain networks, etc., crosses geographical boundaries and achieves efficient integration and optimization of resources on a global scale, greatly improving the matching accuracy between user demand and production supply, and bringing unprecedented convenience and efficient experience to consumers. Based on the above analysis, in order to accurately measure the

overall scale of China's digital economy, the primary task is to clearly define the core functions and potential influence of the digital economy in current and future economic development. This requires us not only to have a deep understanding of the specific mechanisms of the digital economy in promoting industrial upgrading and optimizing resource allocation, but also to proactively evaluate the future development trends and possible levels of digital infrastructure and digital ecological environment. On this basis, a digital economy measurement framework that is both realistic and forward-looking can be constructed, providing strong support for policy-making and academic research.

(2)The basic functions of the current digital economy.

With the rapid development and deep integration of information and communication technology (ICT), it is intertwined with various fields of society, economy, and life, giving birth to numerous emerging formats and business models, injecting strong impetus into the vigorous development of the digital economy. Goldfarb (2019) [12] pointed out that the integration of information digitization and the Internet constitutes a general technology paradigm, providing diversified combination possibilities for the economic system. In the second decade of the 21st century, the Internet economy has ushered in a peak of development. The deep integration of online platforms and offline life has led to the birth of a variety of products and services based on the Internet platform, such as mutual entertainment, e-commerce, we media, etc., which shows the remarkable characteristics of rapid iteration of information and communication technology and full penetration of social and economic life. Acemoglu (2018) [13] believes that digital technology, as a production factor with high penetration and strong information gathering capabilities, has increasingly highlighted its potential for market value creation and has become a core incubation source for promoting market value growth. The practice of multiple countries has also shown that the digital economy is essentially an economic activity based on modern information technology, which creates value through the widespread application of various information and digital technologies.

Robots (2020) [14] pointed out that while the digital economy is expanding comprehensively, the widespread application of information infrastructure and information technology has effectively improved total factor productivity by promoting coordination and integration among various factors. Authoritative agencies such as the US Department of Commerce emphasize that computing power and communication technology are not only the cornerstone of the development of the IT industry, but also the key factors driving productivity improvement in non IT industries. Elibin (2014) [15] believes that digital technology, through its cost saving effect, network connectivity effect, and value creation effect, on the one hand reduces the costs of production, circulation and communication, trade, institutions, etc., and on the other hand achieves close connections in production, supply, manufacturing, consumption and other links worldwide, promoting the deep integration of industrial chains, supply chains, and innovation chains, enhancing industrial competitiveness, promoting inclusive growth and sustainable development, especially for developing countries, which is of great significance.

The platform effect of the digital economy is one of its important features. Unlike the internal implicit effects of media effects, Schmid (2016) [16] believes that the platform effect is more reflected in the externalized global impact. The United Nations Conference on Trade and Development points out that data and digital platforms are the core driving forces for the development of the digital economy, with trading platforms serving as "intermediaries" to facilitate the provision of information services and the achievement of transactions, even venturing into the production and sales of digital knowledge products, breaking industry boundaries, and achieving efficient supply-demand matching of digital products and services on a global scale. The innovation platform, through its "agglomeration" function, breaks through the boundaries of technology, industry, and geography, builds a multi center, multi-dimensional symbiotic, co built, and shared ecosystem, promotes technological innovation and industrial

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upgrading, achieves deep integration of global production factors, user demand, and production manufacturing, and becomes a key force leading industrial upgrading and reshaping the world competition pattern.

(3)Analysis of the main characteristics of the current digital economy.

At the current stage of development, the ecosystem of the digital economy exhibits three core characteristics. Xu Heng (2020) [17] proposed that these characteristics not only define its unique operating mechanism, but also indicate a new trend in future economic development: first, deep integration. The digital economy, with its powerful penetration, has crossed the boundaries of traditional industries and achieved deep integration with various economic forms. This process promotes precise integration and efficient collaboration between online platforms and offline processes, laying a solid foundation for the explosive growth of industrial economy in the region. This feature significantly demonstrates the outstanding ability of the digital economy as an emerging production factor in optimizing resource allocation and stimulating economic vitality. 2、 Synergy and efficiency enhancement. Thorhildur (2019) [18] believes that the effective operation of the digital economy highly depends on the improvement and efficient operation of information infrastructure. It achieves effective cost control and maximizes network effects by strengthening the construction of information networks and the synchronous development and utilization of information resources. Unfortunately, some countries and regions are facing the challenge of "technological lag" due to their failure to fully utilize the information dividends brought by information technology and digital technology, which hinders the development pace of their digital economy. 3、 Cross disciplinary innovation. Chihiro (2018) [19] believes that, unlike traditional production factors, digital technologies represented by big data, cloud computing, and the Internet of Things have become key forces driving industrial upgrading and transformation. Especially with the widespread application of artificial intelligence algorithms, the boundaries of computing power have been greatly expanded, surpassing human cognitive and computational limits. This cross-border integration not only reshapes the structure and layout of the global industrial chain, but also opens up unprecedented new paths for the transformation and upgrading of the global economic system.

When exploring the multidimensional features of the digital economy, in addition to its significant ecological attributes, attention should also be paid to its social characteristics such as economies of scale, technological drivers, and dynamic governance. As a new type of production factor endowment, the digital economy exhibits a unique phenomenon of increasing returns to scale compared to traditional static factors. Liu Yang (2020) [20] proposed that in the field of e-commerce, data platforms can aggregate massive user preference data, and with the help of intelligent manufacturing systems, build flexible and efficient production networks, accurately connect with personalized consumer needs, and achieve unprecedented market matching. The digital economy relies on the continuous advancement of information and communication technology, continuously promoting the refinement and efficiency of the supply chain through subtle product iterations and user experience optimization, and thereby expanding market share. In addition, Qiu Zeqi (2016) [21] proposed that the mobility of digital technology and digital elements significantly reduces the limitations of geographic space, enabling data governance decisions to cross geographical boundaries and generate extensive "spatial spillover effects" and "temporal diffusion effects". This characteristic endows the dynamic governance of the digital economy with distinct attributes.

Given the complex and profound characteristics of the digital economy, accurately measuring it has become a highly challenging task. This requires us to maintain a high degree of scientificity and rigor in the selection of evaluation subjects, measurement objects, standards, and methods, while ensuring the validity and applicability of measurement indicators. Therefore, multiple economies and organizations around the world have conducted extensive and in-depth

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exploration and practice from different perspectives, aiming to build a comprehensive, objective, and dynamic digital economy measurement system to better grasp the development pulse of the digital economy and guide the formulation and implementation of future policies.

3. The Evolution of Macro Measurement Index System for Digital Economy

The limitations of the current macroeconomic statistical indicator system are becoming increasingly prominent, making it difficult to fully capture the multidimensional characteristics of the digital economy. This situation poses significant challenges to the precise quantification of the scale of the digital economy on a global scale. In view of this, this article deeply analyzes the mainstream digital economy measurement methods at home and abroad, aiming to tailor a set of scientific and reasonable measurement framework construction guidelines for the actual situation of China's digital economy. This guide will focus on how to objectively and accurately reflect the profound impact of the digital economy on China's social development, not only limited to the expansion of economic scale, but also covering its changes in various aspects such as industrial structure, employment forms, and social governance. Through this effort, this article aims to lay a solid theoretical foundation for promoting the effective implementation of China's digital economy strategy, and to promote the deep integration and mutual promotion of theory and practice.

Charles (2020) [22] believes that there are currently three mainstream methods in the field of macro measurement of the digital economy: firstly, the index compilation method led by the European Statistical Office (Eurostat) and the Organization for Economic Cooperation and Development (OECD), which focuses on evaluating the relative ranking of the digital economy among countries and regions. However, its limitation is that it is difficult to accurately quantify the absolute size of each subject's digital economy. Secondly, the value-added measurement algorithm, represented by the Bureau of Economic Analysis (BEA) of the US Department of Commerce and the China Academy of Information and Communications Technology, measures the total digital economy through a unified standard, promoting consistency in international scale comparisons. However, due to differences in statistical standards, it may lead to deviations between actual scale and statistical results, thereby weakening its universal applicability and international comparability. Thirdly, the digital economy satellite account compilation method promoted by the OECD is built on a solid theoretical logic and a massive data foundation. Yang Zhongshan (2019) [23] believes that although its data collection process poses challenges for most institutions, once the system matures, it can provide a standardized horizontal comparison platform for countries and regions, showcasing its unique advantages. The above three methods each have their own advantages and together constitute the diversified pattern of macro measurement in the current digital economy.

(1)Digital Economy Index Compilation Method.

The index compilation method, as a comprehensive evaluation tool, relies on the use of a diversified indicator system and a precise weighted calculation process to quantify the relative development level of different economic entities or regions in the field of digital economy. This process not only involves complex data processing and analysis, but also aims to visually display the relative strength and weakness of the digital economy among various entities through sorting and comparison. Therefore, this method is often referred to as the comparative method in academic research, and its core value lies in providing a standardized perspective to examine and compare the performance and status of different economies in the digital economy era.

On a global scale, the Digital Economy and Society Index (DESI) continuously released by the European Statistical Office (Eurostat) since 2014 has been highly recognized. This index system comprehensively and deeply characterizes the multidimensional impact of the digital economy

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on the social economy. DESI consists of five core first level indicators, namely broadband access, human capital, Internet applications, digital technology applications and the degree of digitalization of public services. It is further refined into 31 second level indicators, forming a logical and complete evaluation system. This design not only highlights the importance of infrastructure, public services, and human capital, which are the cornerstones of the development of the digital economy, but also ensures the internal logic of the indicator system and the compatibility with the evolution laws of the digital economy. B á nhidi (2020) [24] proposed that the data collection process of DESI is rigorous, relying on solid and reliable research data, becoming a key benchmark for evaluating the digital economy strength and development stage of EU member states and the UK, and setting an example for measuring the digital economy on a global scale.

Since 2014, the Organization for Economic Cooperation and Development (OECD) has undergone several iterations to construct and release a statistical indicator system for information and communication technology (ICT) and digital economy for its member countries. The system covers four core primary indicators: investment in intelligent infrastructure, innovation capacity stimulation, social empowerment enhancement, and ICT driven economic growth and employment promotion, supplemented by detailed 38 secondary indicators, demonstrating the depth and breadth of its research system. In the process of constructing and applying this indicator system, OECD fully utilized the value of official statistical data, deeply explored the resources of the European Union Statistical Office and OECD's own diversified databases, and through rich chart forms, attempted to comprehensively reveal the profound impact of the digital economy on various key business areas. However, Zhang Meihui (2017) [25] believes that although the analysis of the system in the economic dimension is quite in-depth, it has not fully demonstrated the broad social value of ICT technology to a certain extent, which may limit its ability to evaluate the comprehensive impact on the digital economy.

Since 2002 (except for 2017 and 2018), the World Economic Forum (WEF) has continuously released the Network Readiness Index (NRI) covering 133 economies. The index system is rigorously built around four primary indicators - environment (including political governance and business innovation environment), readiness (infrastructure and payment capacity), applications (personal, business, and government levels), and impact (economic and social levels) - and its 53 specific indicators. This system aims to deeply analyze the practical wisdom and strategic paths of leading global information economies in promoting the digital economy, and its authority is widely recognized. The NRI framework profoundly reveals the three core driving forces for the development of the information economy: solid support from information infrastructure, widespread adoption of information applications, and positive promotion from the social environment. Kirkman (2012) believes that this index system emphasizes the precise measurement of the coordinated and interactive relationships between various components of the digital economy ecosystem, including the ecological environment of the digital economy, technological support conditions, breadth and depth of application practices, and the resulting broad social benefits, collectively weaving into a closed-loop digital economy "value chain".

Since 2017, the Shanghai Academy of Social Sciences has continuously released the Global Digital Competitiveness Index report for 120 economies. The index system consists of four core primary indicators, namely digital facility competitiveness, digital industry competitiveness, digital innovation competitiveness, and digital governance competitiveness. This system demonstrates significant foresight in the field of digital governance research, delving into the shaping role of key factors such as government service efficiency and data openness on the digital economy business environment. Pei Changhong (2018) proposed that when using this index system for global or regional analysis of digital economy competitiveness, it is necessary to carefully consider the limitations of data sources and supplement them with other reliable

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data sources and in-depth analysis to ensure the robustness and scientificity of research conclusions.

Caixin Think Tank (Shenzhen) Investment Development Co., Ltd. and private think tank institutions such as Chengdu Shulian Mingpin have jointly released the Digital Economy Index (CDEI) for various provinces in China since 2017. This index system deeply focuses on the promotion effect of the digital economy on the overall efficiency improvement of society, namely its media effect, demonstrating a unique academic perspective and practical value. CDEI consists of four core sectors: digital economy industry index, digital economy integration index, digital economy spillover index and digital economy infrastructure index. The digital economy industry index is further refined into three secondary indicators: big data industry, Internet industry and artificial intelligence industry. Under each secondary indicator, labor input, capital input and innovation input are considered respectively, covering the core elements of key areas of the digital economy. Guo Han (2020) believes that the CDEI system, with its monthly update frequency, demonstrates a high degree of timeliness and innovation, effectively capturing the latest developments in various industries in the digital economy, as well as the changing trajectory of market vitality and key development areas. This dynamic monitoring mechanism provides valuable real-time data and trend insights for policy makers, industry, and academia. However, the development of any evaluation system is accompanied by challenges and shortcomings. Xu Xianchun (2020) proposed that CDEI still needs further improvement in terms of theoretical foundation and indicator system construction. Although its current framework is relatively comprehensive, it still shows shortcomings in reflecting the overall situation of the digital economy at the macro level.

Andrew (2019) believes that the significant advantages of the index method in evaluating the relative development level of the digital economy are reflected in its wide applicability and direct horizontal comparability. When the scope of raw data collection covers a wide range, including multiple economies, the index method can directly and efficiently achieve horizontal comparison of the digital economy scale of these countries and regions. Whether from the macroeconomic or micro enterprise level, it can deeply reveal the depth and breadth of the integration of digital technology with other industries, and accurately capture the unique production factor characteristics and platform effects of the digital economy, providing strong data support for policy formulation and academic research. However, the index method is not flawless, and its disadvantages cannot be ignored. The primary issue lies in the high dependence on external data, which requires research institutions to continuously and stably provide a large amount of raw materials. Once the data supply is interrupted or discontinuous, it will directly lead to the inability to update the index in a timely manner, thereby affecting the timeliness and accuracy of the evaluation. In addition, the scientific and rational nature of the index system, especially the construction of its theoretical logical framework, is the key to ensuring the effectiveness of the evaluation results. If the indicator system is not designed properly and cannot accurately reflect the real development status of the digital economy in the region, its evaluation results will also lose their due reference value. Even more limited is that the index method can only compare and analyze the relative positions of countries or regions that have already been included in the system, and cannot effectively rank and compare entities outside the system, which to some extent limits the application scope and universality of the index method.

(2)Digital Economy Value Added Measurement Algorithm.

Value added measurement algorithm, as a systematic evaluation method, achieves comprehensive analysis and in-depth evaluation of the digital economy level of specific entities through a carefully constructed indicator system, clearly defined measurement scope, and scientifically reasonable indicator integration strategy. Cai Yuezhou (2018) believes that this method not only emphasizes a detailed examination of the various components of the digital

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economy, but also pays attention to the overall and coherent calculation process, ensuring the comprehensiveness and accuracy of the evaluation results.

The Bureau of Economic Analysis (BEA) of the US Department of Commerce has continuously released value-added reports on infrastructure, e-commerce, and fee based digital services in the United States from 2018 to 2021. In the view of Jin Xing Ye (2021), BEA's complex and rigorous indicator measurement system has won wide recognition and reference from official statistical agencies in multiple countries, including Australia, New Zealand, Canada, etc., due to its high degree of professionalism and applicability. These countries have carried out the measurement of the scale of the digital economy based on the BEA indicator system framework and their own actual situation, jointly promoting the progress and improvement of global digital economy statistical standards and evaluation systems.

Since 2017, the China Academy of Information and Communications Technology has continuously released measurement reports on the overall scale of the digital economy in various provinces of China. The indicator system it has constructed mainly focuses on the two core areas of digital industrialization and industrial digitization, while the quantitative evaluation of digital governance and data value has not yet been included in the current measurement scope. This indicator system has gained widespread recognition and adoption in China due to its close integration with the actual development of China's digital economy, providing a precise and comprehensive definition of the concept of digital economy. More importantly, it has promoted the formal inclusion of the digital economy into the gross domestic product accounting system, providing authoritative basis for accurately measuring the scale and scope of China's digital economy, and becoming an indispensable reference standard for evaluating the current development status of China's digital economy. In addition, Zhu He (2022) believes that this indicator system is highly compatible with the core characteristics of the digital economy, such as the characteristics of production factors (i.e. digital industrialization), the driving force of industrial efficiency improvement, and the platform effect (reflected through industrial digitization), further demonstrating its scientific and forward-looking nature in the field of digital economy evaluation.

(3)Compilation Method for Digital Economy Satellite Accounts.

The Organization for Economic Cooperation and Development (OECD) was the first to establish a fundamental theoretical framework for the Digital Economy Satellite Account (DESA) in 2017. This framework aims to provide a systematic methodology for the quantitative evaluation and measurement of the digital economy by compiling detailed supply and use tables. Based on this framework, OECD has conducted in-depth analysis and measurement of the US digital economy, which not only enriches the theoretical system of digital economy evaluation, but also lays a solid theoretical and practical foundation for the US Department of Commerce to explore the establishment of a digital economy satellite account to accurately measure the country's digital economy level in the future.

The Organization for Economic Cooperation and Development (OECD) conducted a comprehensive and in-depth evaluation of the development level of member countries' digital economy between 2017 and 2020, relying on its innovative satellite account compilation method. The evaluation dimensions cover a wide range of key areas such as digital connectivity, digital usage, digital innovation, digital work, digital society, digital trust, and digital market openness. However, Liu Wei (2021) believes that the implementation of this method also faces significant challenges, mainly due to the complexity and scale of data collection and screening work, as well as the potential limitations on data acquisition permissions encountered in practice, which pose a test for the smooth progress of the compilation work. Nevertheless, many countries and regions around the world have responded to the guidance of the OECD, such as Australia, Chile, South Africa, Malaysia, etc., gradually building their own information and communication technology (ICT) satellite account systems in order to more accurately grasp

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the pulse of digital economic development and promote the digital transformation process of the economy and society.

4. The evolution of micro measurement of China's digital economy

Zhang Luna (2021) believes that China's series of achievements in the current field of digital economy accounting not only enrich the micro case library of global digital economy research, but also demonstrate China's active exploration and contribution in digital economy statistical measurement. The National Bureau of Statistics closely follows the international forefront, referring to the macro measurement frameworks and indicator systems of international institutions such as the Organization for Economic Cooperation and Development (OECD), the European Union, and developed countries such as the United States. Since 2004, a series of industry classification standards closely related to the digital economy have been introduced. In the view of Guan Huijuan (2020), these classification standards not only provide scientific basis for the identification and measurement of the digital economy, but also reflect the vigorous development trend of information technology and emerging industries in China. Of particular importance is that in May 2021, the National Bureau of Statistics officially released the "Statistical Classification of Digital Economy and Its Core Industries (2021)", which clearly defines the five major areas of digital economy core industries: digital product manufacturing, digital product service, digital technology application, digital factor driven, and digital efficiency improvement. This measure not only demonstrates China's high attention and precise layout of the core industries of the digital economy, but also marks a solid step forward in the construction of the digital economy statistical measurement system, providing valuable Chinese wisdom and experience for the formulation and improvement of global digital economy statistical standards.

The research process of domestic academia on digital economy can be seen as an evolutionary process of gradual deepening and expansion, which has gone through the exploration and accumulation of many theoretical stages, such as new economy, knowledge economy, information economy, Internet economy, etc.

In the initial stage of digital economy research, domestic scholars were deeply influenced by the new economic development paradigm of countries such as the United States, and began to introduce this emerging economic concept into the academic field of China. The core task of this stage is to define the research boundaries of the new economy, and to deeply analyze its basic concepts, connotations, and characteristics. Scholars such as Liu Chongyi (2001) , based on the unique perspective of the US economic cycle, view the new economy as a comprehensive reflection of the digital economy, network economy, virtual economy, and information economy (including e-commerce, etc.), foreseeing its profound impact on the future economic models of the United States and even the world, thus officially opening the prelude to research on measuring the digital economy.

Subsequently, the research entered the second stage, and scholars gradually shifted their focus to the industrial characteristics, classification system, indicator system construction, and measurement method selection of knowledge economy and information economy. Liu Shiguo (2002) and others emphasized the importance of the information industry as the foundation of the new economy, and proposed a new approach to evaluating the potential of the information industry from multiple dimensions such as infrastructure, human resources, and technological foundations. Wei Heqing (2007) pointed out the limitations of the traditional National Accounting System (SNA) in adapting to knowledge economy accounting from the perspective of knowledge economy, and called for adjusting the measurement indicators according to the special characteristics of the development stage of knowledge economy. Kang Tiexiang (2008) proposed a specific path for digital economy accounting in a forward-looking manner, including

clarifying accounting standards, improving data collection techniques, and initially constructing a framework for estimating the scale of the digital economy, becoming a pioneer in domestic research on digital economy measurement.

Entering the third stage, with the booming development of the digital economy in China, scholars have begun to actively explore measurement indicator systems and implementation methods that are suitable for their own national conditions. Qu Chao and Zhang Meihui (2015) drew on the experience of the Organisation for Economic Co operation and Development (OECD) and proposed the construction and improvement of ICT satellite accounts based on ICT carrier functions, aiming to comprehensively reflect the important impact of ICT on the economy. Hong Jianjian (2019) relied on the classification method of China Academy of Information and Communications Technology to clearly define digital industrialization and industrial digitization, and deeply analyzed the development status and level of China's digital economy through the combination of value-added measurement algorithm and index method. Continuation and Tang Qi (2019) explored the challenges of the digital economy to the nominal accounting system from multiple dimensions such as consumption, investment, and imports and exports, emphasizing the scientific and effective nature of value-added accounting. Shi Fengdan et al. (2022) further combined the concept of inclusive growth and proposed a digital economy scale measurement method that integrates the direct method and the growth accounting account framework. Xiang Shujian (2018), based on the accounting method of the Bureau of Economic Analysis (BEA) of the US Bureau of Commerce, combined with China's national conditions, innovatively used tools such as national economic classification and industry value-added structure coefficient to deepen the theory and practice of digital economy scale accounting.

In summary, although scholars at home and abroad have made significant progress in the field of measuring the digital economy, there is currently no unified measurement standard and method due to the complexity and variability of the digital economy itself, as well as the differences in economic development stages among countries. Whether using the index method, value-added calculation method, or satellite account compilation method, they all face common challenges such as data screening and measurement method selection. Therefore, future research on digital economy measurement needs to continue deepening theoretical exploration, strengthening international exchanges and cooperation, in order to build a more scientific, comprehensive, and applicable digital economy measurement system.

5. Conclusion

Firstly, whether it is constructing index methods based on relative indicator systems or applying comprehensive value-added measurement algorithms, the foundation lies in a clear definition of the concept of digital economy. From a micro perspective, the construction of indicator systems is deeply rooted in the value orientation and theoretical framework of organizational structures, and different research focuses directly lead to significant differences in indicator selection. Therefore, accurately defining the research scope of the digital economy is an essential prerequisite for conducting effective measurement.

Secondly, with the rapid development of digital technology, new formats and models are constantly emerging in the field of digital economy, which requires data screening strategies and measurement dimensions to keep up with the times. Since 2014, the European Union has been closely tracking the progress of its member states in the field of digital economy through continuous surveys, statistics, and in-depth research, and regularly releasing the annual Digital Economy and Society Index 9 report (DESI). It is worth noting that the EU has optimized and adjusted its indicator system in 2021, not only streamlining the number of primary indicators, but also adding multi-dimensional sub indicators reflecting the application of digital technology,

digitalization of public services, and environmental sustainability. In addition, the EU has utilized rich market research data to re evaluate and revise the DESI scores and rankings over the years, ensuring that data feedback is more closely aligned with the actual situation of each country. This large-scale, sustained, open, and dynamically adjusted measurement model effectively captures the added value of the digital economy and provides a solid foundation for international comparisons. Therefore, maintaining the continuity of measurement methods and indicators in time and space, relying on reliable and long-term basic data sources, and building unified measurement standards are crucial for improving the widespread applicability and comparability of digital economy measurement.

Finally, high attention should be paid to the challenges of obtaining data related to the digital economy, especially the difficulty in directly quantifying its added value in economic development. Digital technology, as a key factor in improving production factors or industrial efficiency, has significant value creation effects but is difficult to independently separate. Especially in the field of industrial digitization, the contribution of efficiency improvement and structural optimization is often difficult to directly extract from GDP growth, which constitutes a major challenge in measuring the digital economy. Currently, many indicator systems use indirect indicators to approximate the level of development of the digital economy, which to some extent weakens the accuracy of evaluation. In view of this, it is necessary to continuously optimize and update the measurement system of the digital part of the industry to ensure the availability of relevant data. The Organisation for Economic Co operation and Development (OECD) combines index and satellite account methods to construct a supply and use table for digital economy satellite accounts using years of continuous data, providing new ideas for measuring the digital economy. Future research should further focus on the precise definition of the connotation of the digital economy, the adaptability of measurement methods, and the continuity of data foundation, to ensure that the measurement results can be effectively compared horizontally among different economic entities, thereby providing more solid data support for policy formulation and academic research.

References

[1] Xue Xiaoyuan, 2021. Digital Globalization and Digital Ethics [J]. Foreign Social Sciences (5): 32.

[2] Zhang Yunjie, Feng Liyuan, Li Zheng, et al., 2022. Comparative Study and Suggestions on International Digital Governance Patterns between China, the United States and Europe [J]. Journal of the Chinese Academy of Sciences (10): 1390.

[3] Tapscott D. The Digital Economy：Promise and Peril in the Age of Net-worked Intelligence [M]. New York：McGraw-Hill,1996.

[4] Brynjolfsson E, Kahin B. Understanding the Digital Economy: Data,Tools,and Research [M].Cambridge: MIT Press,2002.

[5] Bukht R, Heeks R. Defining, Conceptualising and Measuring the Digital Economy [J].Development

[6] Informatics Working Paper,2017,(68).

[7] Sandberg J, Holmström J, Lyytinen K. Digitization

[8] and Phase Transitions in Platform Organizing Logics:

[9] Evidence From the Process Automation Industry [J].MIS Quarterly,2020,44(1).

[10] JONES C I, TONETTI C. Nonrivalry and the economics of data[J]. American Economic Review, 2020, 110(9): 2819–2858.

[11] LIN W C, XIE D, ZHANG L. Knowledge accumulation, privacy, and growth in a data economy[J].Management Science, 2021, 67(10): 80–92.

[12] Wang Yu, Zhang Zhanbin, 2021. Digital Economy, Factor Allocation, and Regional Integration Level [J]. Southeast Academic (5): 129-138.

[13] Li Xiaohua The Formation Mechanism of New Characteristics and New Momentum of Digital Economy [J]. Reform, 2019, (11) .

[14] Chen Xiaohong, Li Yangyang, Song Lijie, etc Theoretical System and Research Prospects of Digital Economy [J]. Management World, 2022, 38 (2).

[15] GOLDFARB A, TUCKER C. Digital economics[J]. Journal of Economic Literature, 2019, 57(1): 3–43.

[16] ACEMOGLU D, RESTREPO P. The race between man and machine: implications of technology for growth, factor shares, and employment[J]. American Economic Review, 2018, 108(6): 1488–1542.

[17] Robots and Jobs: Evidence from US Labor Markets[J]. Daron Acemoglu;Pascual Restrepo.Journal of Political Economy,2020.

[18] Elibin, Huang Yongwen New Mode of International Trade: The Latest Research on Cross border E-commerce [J]. Journal of Northeastern University of Finance and Economics, 2014, (2).

[19] Schmid B F. What is New About the Digital Economy? [J].ElectronicMarkets,2016,11(1).

[20] Xu Heng, Zhang Yilin, Cao Yujia Digital Economy, Technology Spillover, and Dynamic Competition Policy [J]. Management World, 2020, 36 (11).

[21] The Sustainable Value of Open Government Data[J]. Thorhildur Jetzek;;Michel Avital;;Niels Bjørn-Andersen.Journal of the Association for Information Systems,2019.

[22] Measuring GDP in the digital economy: Increasing dependence on uncaptured GDP[J]. Chihiro Watanabe;;Kashif Naveed;;Yuji Tou;;Pekka Neittaanmäki.Technological Forecasting & Social Change,2018.

[23] Liu Yang, Dong Jiuyu, Wei Jiang Digital Innovation Management: Theoretical Framework and Future Research [J]. Management World, 2020, (7): 198-217.

[24] Qiu Zeqi, Zhang Shuqin, Liu Shiding, Xu Yingkang From Digital Divide to Dividend Difference -- From the Perspective of Internet Capital [J]. China Social Sciences, 2016, (10): 93-115.

[25] Nonrivalry and the Economics of Data[J]. Charles I. Jones;;Christopher Tonetti.American Economic Review,2020.

[26] Yang Zhongshan, Zhang Meihui Digital Economy Satellite Account: International Experience and Design of China's Compilation Plan [J]. Statistical Research, 2019, 36 (5).

[27] Bánhidi Z, Dobos I, Nemeslaki A. What the Overall Digital Economy and Society Index Reveals: A Statistical Analysis of the DESI EU28 Dimensions [J].Regional Statistics,2020,10(2).

[28] Zhang Meihui Progress in International New Economy Measurement Research and Its Reference to China [J]. Economist, 2017, (11).