



Comparison of Research Trends of Digital Economy Between China and Foreign Countries—Visual Analysis Based on CiteSpace

Wenyang Zhang^(✉)

China University of Political Science and Law, 25 West Tucheng Road, Beijing, China
2102060249@edu.cn

Abstract. The purpose was to analyze the evolution path and cutting-edge trend of digital economy research in China and abroad. The research screened the relevant literature from 1990 to 2020, and the data source came from WoS database and CSSCI index database. CiteSpace software was used for quantitative analysis and comparison of keyword sharing, hot word clustering, time zone division of high-frequency words and discrimination of emerging words. It is found that firstly, the research on digital economy in China and abroad was basically the same in terms of stage division, but the time nodes are different. Foreign countries creatively put forward the concept of digital economy in the 1990s, and then entered the fault period from the incubation period to the current rise period. However, domestic digital economy research has been widely studied in the incubation period, then experienced the fault period and recently entered the rise period. Secondly, Chinese and foreign studies have reflected that digital technology innovation is the core, and the deep integration of digital industry, external governance of digital economy, digital path selection mechanism and other issues are the frontier trends of common concern.

Keywords: Digital Economy · Comparative Analysis Between China and Foreign Countries · CiteSpace

1 Introduction

Digital economy is an interdisciplinary subject that spans many fields of technology, economy, society and politics, and it is growing and iterative. It should be treated with an evolutionary thinking. By studying the context of the research theme of digital economy, the knowledge structure of subject words can be explained to a certain extent, which has a certain reference significance for researchers exploring the field of digital economy. Paying attention to the research progress of digital economy at home and abroad is of great significance to better grasp its connotation, extension and basic theory, predict the development trend and hot issues of digital economy, and promote the development of industry and discipline of digital economy. Therefore, this study makes visual analysis with the help of CiteSpace, carries out bibliometric research on keyword sharing, time zone division of high-frequency words, clustering of hot words and discrimination of

emerging words through SSCI paper data in foreign WoS core database and CSSCI data in domestic CNKI database, and makes an exploratory analysis on the evolution path and cutting-edge trend of digital economy research at home and abroad. The marginal contribution of this study is as follows: first, it combs the theoretical starting point, core concepts and branches of digital economy; the second is to measure and compare the contributions of China and foreign countries in the subject field of digital economy, and analyze the differences between Chinese and foreign digital economy research from the aspects of development stage, key fields and contribution focus.

2 Literature Review

Dong et al. (2019) [4] analyzed and expounded the knowledge management in the era of digital economy based on the network entity system by using the methods of literature research and theoretical analysis. Qi et al. (2018) [14] used CiteSpace software to visually analyze the Internet business model. Zhang (2018) [18] explained the driving mechanism and transformation mechanism of digital economy through the construction of scientific knowledge map, and concluded that business model and organizational innovation are an important part of the discipline of digital economy.

Wang and You (2017) [16] made a visual analysis with big data as the theme. He found that the development of digital technology based on artificial intelligence, big data and cloud computing has resulted in many new business models and organizational structures which have greatly promoted the development of digital economy. In terms of comparison between China and foreign countries, Yun and Zhu (2013) [17] reviewed the development trend of digital economy and the development strategies of digital economy in various countries, and explored the commercialization law and application paradigm of digital technology. Liao (2015) [11] put forward China's digital economic governance, digital financial governance model and future challenges by comparison and reference. It is not difficult to find that the existing research is mainly carried out around a specific field of digital economy, lack of systematic and comprehensive combing of the discipline system of digital economy, and lack of long-term tracking of the evolution track of digital economy at home and abroad.

3 Research Design

3.1 Data Sources

The data sources of this study are divided into domestic and foreign. The foreign data comes from WoS database. The search subject word and keyword are digital economy. A total of 2780 documents with inconsistent conditions are finally obtained by manual elimination. In order to ensure the quality of domestic literature, the database is selected from CSSCI index, and the subject words and keywords are "digital economy", and 720 articles are finally selected.

3.2 Research Methods

This study uses CiteSpace to share keywords, cluster hot words, time zone map of high-frequency words and analysis of emerging words, and makes quantitative analysis on the research in the field of digital economy at home and abroad, including: statistics of the number of documents published, describing the overall production of papers in the field of digital economy at home and abroad; keyword sharing and time zone map of high-frequency words. After classifying and sorting the keywords with high word frequency in the digital economy literature, combined with the time zone map of high-frequency words, we can excavate the research hotspots of the overall discipline development and find the evolution law of the hotspots of digital economy research; clustering of hot words, through clustering analysis of relevant literature at home and abroad, in order to construct the core theoretical framework of digital economy research at home and abroad; the analysis of emergent words uses word frequency detection technology to detect the emergent words with high frequency change rate by investigating the time distribution of word frequency, so as to explore the frontier direction of research in this field. Through the above research methods, sort out the historical trend, research theme and hot frontier of digital economy at home and abroad, and realize visual analysis with the help of CiteSpace software.

4 Research Findings

4.1 Research Context at Home and Abroad

Using the high-frequency time zone map to mine the basic characteristics of the dynamic evolution of digital economy research hotspots with time, we can find the evolution law of innovation hotspots of digital economy research, and observe that the research of digital economy at home and abroad has presented a gradual evolution stage since its inception.

4.1.1 Foreign Research Context

Through the tracking of WoS foreign language core database, foreign academic research on digital economy is divided into embryonic stage, incubation stage, fault stage, rapid development and rise stage.

4.1.1.1 The First Stage (Embryonic Stage), 1990–1998

The concept of “digital economy” first appeared in the digital economy: promise and peril in the age of networked intelligence, which was published by Tapscott (1996) [15]. Tapscott (1996) doesn’t give a specific definition of “digital economy” in his book, but puts forward the concept of “digital economy”, which is different from the traditional economy for the first time, defines it as “new economy”, and puts forward that the current network era further integrates communication, computing (computers, software, services, information) and content (publishing, entertainment and information providers), create interactive multimedia and information superhighway. Lane (1999) [10] emphasized that the digital economy is based on information and computing communication

technology and the extensive impact of the digital economy on the economy related to e-commerce. In the same year, Margherio et al. (1998) [12] defined the specific composition of digital economy, including e-commerce, digital delivery of goods and services, detail of tangible goods and Internet infrastructure. This stage (1990–1998) is defined as the embryonic stage. The concept of digital economy still stays in the description stage of economic and technological phenomena. It belongs to the embryonic stage of this field and has not risen to the level of economic theory and technological empowerment.

4.1.1.2 The Second Stage (Incubation Period), 1999–2003

In November 1998, the US Department of Commerce released the emerging digital economy [9]. In the report, the government invited experts and scholars to evaluate the impact of the digital economy and consider how to best measure and evaluate the digital economy in the future. This paper focuses on the decisive role of information, the core resource, in macro-economy and micro economy. Experts recognize that digital economy promotes social and economic development while communication, computing and information integration. Here, social economy mainly refers to the fields of e-commerce, it infrastructure and related equipment. Babbitt and Mahoney (2001) [1] pointed out that the digital economy is defined by the changing characteristics of information, computing and communication. It is the main driving force of e-commerce economic growth and social change, especially organizational change. Later, scholars carried out specific research on the digital economy. At this stage, some scholars also try to interpret the phenomenon of digital economy from the perspectives of Schumpeter's innovation theory, network externality and locking effect in network economics, and virtual perspective theory. For instance, Evans and Wurster (2000) [6] believed that digital innovation can be regarded as an emerging "creative destruction process", which is promoted by microelectronics related information and communication technologies. The explosive growth of digital connectivity and the rapid emergence of universal communication technology standards allow everyone to communicate with others at essentially zero cost. These forces help to form the key characteristics of digital networks, namely openness, interoperability, scalability and scalability. Mcknight et al. (2001) [13] believed that the Internet is a general technology or platform technology, which promotes digital innovation. In the operation of digital economy, enterprises can use user network and professional technology to lock their own business and business channels, and obtain a dominant position in the market, that is, the core theory of narrow network economics - Network Externality and locking effect [5]. For example, Brynjolfsson and Kahin (2002) [3] explains the characteristics of digital economy from the perspective of macro-economy, enterprise competition, labor demand and participation and organizational change. Generally speaking, at this stage, we began to explore the impact of digital technology on economic development, but stayed in explaining the digital economy from the construction of communication infrastructure, information technology and e-commerce in a broad sense. There were no emerging technologies at this stage, and the industry also stayed at the level of e-commerce in a broad sense, specifically referring to e-commerce commodity sales and

services, and information technology mainly refers to Internet technology. At the theoretical level, some scholars try to interpret the phenomenon with economic theory, but it is not systematic.

4.1.1.3 The Third Stage (Fault Stage), 2004–2011

At this stage, the research contribution in the field of digital economy is not prominent, and there is no new breakthrough in theory. Most of the research is an extension of the previous stage.

4.1.1.4 The Fourth Stage (Rapid Development Period), 2012–2018

With the continuous development of technology and the continuous integration of digital economy and related industries, more economic benefits are created, which are continuously expanded by scholars and government official organizations. These definitions are extended to include all digital economic activities. Specifically, the Internet technology relying on the digital economy has introduced cloud computing, big data and other related emerging technologies [7]. In terms of communication infrastructure, mobile and sensor networks and intelligent networks have been added. In terms of industry, it has also surpassed e-commerce and applied to other fields. It has been successively combined with the real economy such as culture and entertainment industry and manufacturing industry, and the concepts of industrial digital transformation and digital industrialization have emerged [2, 8]. At this stage, the scope of digital economy expands from phenomenon interpretation to theoretical demonstration, discusses the impact of digital economy on social development and the underlying mechanism, and formally puts forward that data is a factor of production. And we'll find out "The digital economy is increasingly mixed with the traditional economy. The definition is not very clear, the scope boundary is vague, and the proposition of the urgency of digital transformation has emerged. The concepts of intelligent agriculture, intelligent manufacturing and intelligent medical treatment have emerged. The literature volume of new models and new business forms such as digital intelligence and digital sharing is in a blowout state at this stage, indicating that the degree of economic digitization is increasing and the number of people is increasing Word economy has developed from isolation and independence to integration and all-round development, and scholars study the digital future as a special theme.

4.1.1.5 The Fifth Stage (Rising Period), 2018–Now

At this stage, the number of high-frequency words has increased, forming multiple research focuses. In addition, it is the exploration of economic and social activities based on artificial intelligence algorithms. After 2018, artificial intelligence algorithms have made substantial progress. The application of Bert model has made great room for the development of deep learning algorithms, and more AI projects have been implemented in combination with various task scenarios. The data-based algorithmic economy has been proposed and concerned by many scholars. Machine learning has greatly explored the potential of data mining, which can be replaced by intelligent manual work. In the future, it will have a great impact on the labor market. The resulting data security, digital monopoly, data governance, digital labor, digital ethics and so on have been widely concerned by scholars. The second aspect is the research based on the Internet and

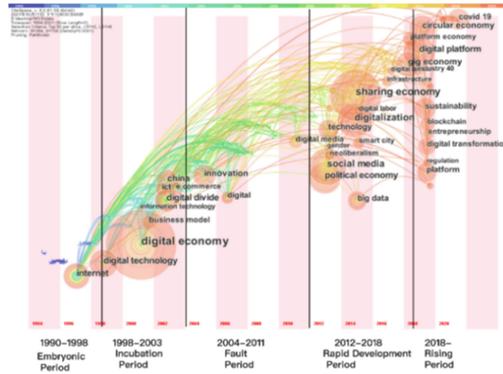


Fig. 1. Data source of digital economy research abroad.

emerging technologies, such as blockchain technology and application. The third aspect is the research on the labor and employment market. The influence of platform economy, sharing economy and artificial intelligence technology makes the original “enterprise employee” employment contract system gradually change to the “platform individual” transaction mode. The emergence of freelancers makes the concept of casual economy appear. Unfortunately, the scope of the connotation of digital economy has not been expanded. However, there are some problems in this definition, which does not well cover the social relations of digital economy. In fact, in the interaction of economic activities under the background of digital economy (Fig. 1).

4.1.2 Domestic Research Context

Through the tracking of CSSCI core database, domestic academic research on digital economy is also divided into embryonic stage, incubation stage, fault stage, rapid development and rise stage.

4.1.2.1 The First Stage (Embryonic Stage), 1990s

At this stage, China officially connected to the Internet, digital technology began to rise, and information technology began to be popularized and applied in traditional industries and various fields. At this stage, domestic scholars only have a vague concept of digital economy, and began to study digital economy. At this stage, the number of digital economy documents is small and the topics are scattered, and the digital economy has not been accepted by the majority of scholars.

4.1.2.2 The Second Stage (Incubation Period), 1998–2002

With the progress of network technology and the development of information industry, a large number of Internet pioneer enterprises have been established in China. Digital economy is gradually found to be an independent new thing. Some scholars began to describe the theoretical construction and application of digital economy. China has tentatively proposed that digital economy includes information technology and corresponding infrastructure, it industry itself, digital transmission of goods and services, tangible

commodity retail supported by it, and high added value generated by the combination of traditional products and digital technology.

4.1.2.3 The Third Stage (Fault Stage), 2003–2007

At this stage, there are few high-frequency words, indicating that there is an obvious fault in theoretical innovation and the core problems cannot be focused. At the same time, this stage has more connections with the nodes in the previous stage and less connections with the nodes in the later stage, indicating that this stage is mainly an extension of the previous research, but it does not have much innovation and expansion. At this stage, the construction of a large number of digital economic infrastructure has promoted the development of new digital technologies in the future, laying a solid foundation for the rise of the fourth stage.

4.1.2.4 The Fourth Stage (Rapid Development Period), 2008–2017

At this stage, the continuous integration of digital technology and traditional industries, and the penetration of artificial intelligence technology and algorithms in the economic field have led the research of digital economy from innovative research of digital technology to applied research. Digital Trade and digital transformation have become the focus of digital economy research.

4.1.2.5 The Fifth Stage (Rising Period), from 2018 to This Year

At this stage, high-frequency words show a blowout growth, artificial intelligence technology and algorithms continue to penetrate in the economic field, high-quality development has become the goal of the industry under the 14th five year plan, the relationship between digital economy and high-quality economic development has become a more concerned research direction, and digital monopoly, digital governance and digital taxation have become more urgent research hotspots (Fig. 2).

4.2 Research Hotspots at Home and Abroad

This study uses word frequency detection technology to detect the burst term with high frequency change rate by investigating the time distribution of word frequency, and arranges it according to the time size, such as the cutting-edge terms and their duration as shown in the figure, and looks forward to the development of digital economy in the future through the forward trend and development trend of digital economy at home and abroad.

4.2.1 Foreign Research Hotspots

It can be seen from Fig. 3 that in recent years, foreign digital economy research still focuses on digital technology, digital economy application and digital risk. Among them, digital labor, sharing economy, community and risk are the latest high current value words, which reflect the latest frontier issues of digital economy research. In the field of big data, foreign research has shifted from the technical level to the application level, focusing on the application of big data in the adoption of new products, obtaining consumer value, drawing digital enterprise map, supply chain management, intelligent

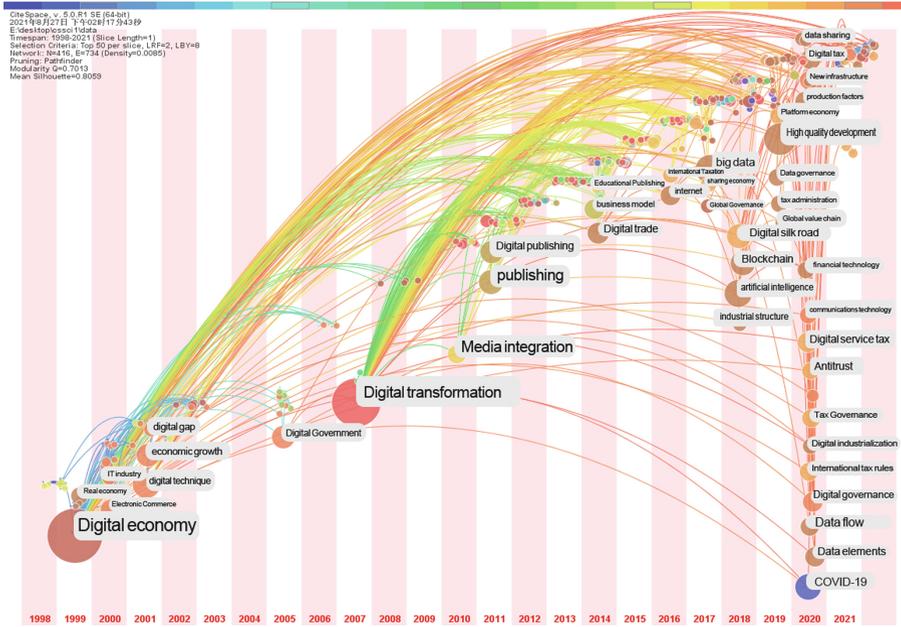


Fig. 2. Domestic digital economy research context.

management and other aspects. With the wide application of digital technology, people use digital technologies such as Internet of things, supercomputing and deep learning to engage in communication, learning, work and other activities, which are constantly generated, precipitated and transformed into new production resources. The creation of digital resources is an important guarantee for sustainable development in the future, and the data revolution will promote the evolution of society. Further, the academic circles gradually realize that data socialization is the necessary channel of data capitalization, and data capitalization is the driving force of data socialization. In the field of digital community, the access, activity and cooperation of digital community have been explored in the aspects of digital capital, community resilience, digital inclusiveness and digital infrastructure. In the field of sharing economy, it has changed from concept to application. It explains the business growth and sustainability of sharing economy through digital platform, potential consumption transformation, price mechanism, occupational discrimination, sustainable and inclusive development, neoliberalism and other aspects. In the field of digital labor, scholars believe that labor in the digital economy has changed from physical requirements to intellectual requirements. The research focuses on digital work remuneration, the current situation of digital labor force, the characteristics of digital labor, digital intermediary platform and digital exploitation. Digital innovation is the evaluation standard of digital labor value, and digital technology and algorithms are used to build asymmetric enterprise labor relations. Platform disintermediation plays an important role in shaping the power relationship and communication between employers and employees.

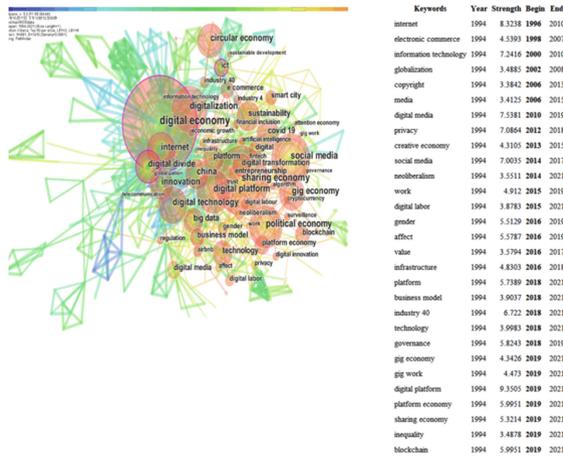


Fig. 3. Digital economy highlights in foreign.

In the field of digital risk, it mainly discusses the impact of digital economy on the current social development, such as the increasing threat of unemployment and inequality of artificial intelligence, the digital divide caused by the rapid development of digital economy, and the prosperity of digital economy is accompanied by the network risks and network threats faced by all countries. Scholars pointed out that today’s digital economy has spawned a series of double-edged sword technology and economic models, and the iteration of the core achievements and key elements of the digital economy may cause huge fluctuations in the social system. Among them, there are both technical risks and moral risks; there are both economic and social risks; there are both personal risks and national risks.

4.2.2 Hot Spots in Domestic Research

From the Fig. 4, we can see that the frontier of digital economy research in China can be divided into technology frontier and business model frontier. One is the technological frontier, including cloud computing, the Internet of Things, artificial intelligence, large data, block chains, and so on. At the same time, the research trend changes from digital technology innovation to digital resource generation and application innovation. Second, business model frontier, including applications including shared economy, digital finance, industry digitization, and so on. In the field of large data technology research, the research involves data acquisition, cross-domain transmission, data storage, analysis decision-making and feedback execution. The main innovations are algorithm innovation and application scenario fitting.

At the same time, interconnection, key technology, infrastructure, ownership of property rights, privacy protection are major bottlenecks in the development of large data technology, which needs further exploration. In the field of artificial intelligence, scholars believe that this technology is triggering a chain breakthrough, promoting the transformation of consumption patterns and the reshuffling of industrial society. Existing research

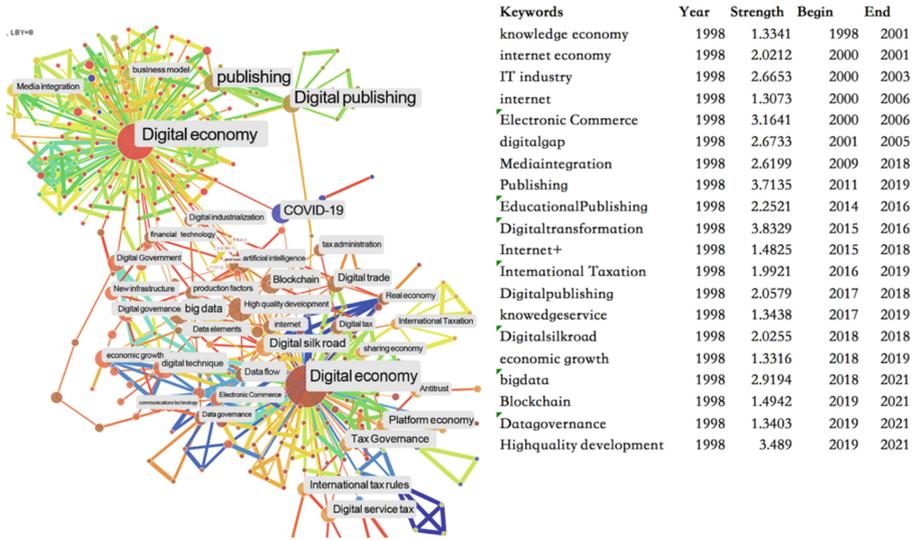


Fig. 4. Digital economy highlights in domestic.

focuses on marketing strategies, science education, technology adoption, no economy, and results transformation, while research in R&D is scarce. In the field of economic digitization, China “should focus on promoting the deep integration of the Internet and the real economy”. The focus of economic digitization research is to solve the impact of digital economy on the real economy or traditional economy, and to achieve better, faster and higher quality economic growth by means of digital-real integration. Shared economy and production mode innovation, digital finance and service value innovation are two important support for economic digitization. The Chinese Government has promulgated a series of documents and strategies to promote the development of digital economy, such as Made in China 2025, the Outline of National Information Technology Development Strategy, and the Outline of Action to Promote the Development of Big Data, to provide appropriate funds, talents and policy guarantees for the development of digital economy.

5 Conclusion and Deficiency

This study compared and analyzed the innovation track of Chinese and foreign digital economy research. The results showed that Chinese and foreign research shows some differences and connections in the current situation, content, evolution and trend. Firstly, in the hot spot evolution of digital economy research, foreign research initiated digital economy research from the perspective of technological innovation. It was brewing in the research of digital divide and digital creative industry. In the financial crisis, digital transformation suddenly emerged, and finally broke out in new models and new formats such as digital intelligence and digital sharing; domestic research sprouted in the application of information technology, mutated in the exploration of the concept of digital

economy, faulted in theoretical innovation, and finally rose in the application innovation of digital technology. Secondly, in the frontier field of digital economy research, from the comprehensive trend of research in China and abroad, issues such as iterative innovation of digital technology, intelligent cooperation of digital production, deep integration of digital industry, external governance of digital economy and digital path selection mechanism are the forward direction of common concern. The construction of digital economy needs the support of technology and industry, In the future, China needs to increase support for the cutting-edge technology field of digital economy and consolidate the support of relevant industries for the development of digital economy.

References

1. Babbitt, T. G. & Mahoney, J. T. (2001). Understanding the digital economy: Data tools, and research. *Academy of Management Review*, 26(3), 463–464. <https://doi.org/10.5465/amr.2001.4845862>
2. Bahl, M. (2016). The work ahead: The future of businesses and jobs in Asia Pacific's digital economy. Cognizant. <https://www.cognizant.com/whitepapers/the-work-ahead-the-future-of-business-and-jobs-in-asia-pacifics-digital-economy-codex2255.pdf>
3. Brynjolfsson, E. & Kahin, B. (2002). *Understanding the digital economy: Data, tools, and research*, MIT Press, Cambridge, MA.
4. Dong, X., Hu, Y. & Cao, p. (2019). Knowledge management in the era of digital economy: Challenges and trends. *Libr. Inf. Work*, 63(1), 60–64.
5. Dong, X., Xia, S., Chen, Y. & Tian, X. (2020). Evolution, framework and frontier of digital economy research based on scientific knowledge atlas. *Sci. Manag. Technol.*, 41(6), 108–127.
6. Evans, P. B. & Wurster, T. S. (2000). *Blown to bits: How the new economics of information transforms strategy*, Harvard Business Scholl Press, Boston, MA.
7. G20 DETF. (2016). G20 digital economy development and cooperation initiative. <http://www.g20.utoronto.ca/2016/g20-digital-economy-development-and-cooperation.pdf>
8. Hanelt, A., Bohnsack, R., Marz, D. & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: insights and implications for strategy and organizational change. *J. Manag. Stud.*, 58(5), 1159–1197. <https://doi.org/10.1111/joms.12639>
9. Henry, D., Cooke, S. & Montes, S. (1998). The emerging digital economy. http://www.esa.doc.gov/sites/default/files/emergingdig_0.pdf
10. Lane, N. (1999). Advancing the digital economy into the 21st century. *Inf. Syst. Front.*, 1(3), 317–320. <https://doi.org/10.1023/A:1010010630396>
11. Liao, Y. (2015). Meeting the challenge of digital economy to the international tax legal order. *Int. Tax.*, (3), 20–25.
12. Margherio, L., Henry, D., Cooke, S. & Montes, S. (1998). *The emerging digital economy*, Department of Commerce of USA, Washington, DC.
13. Mcknight, L. W., Vaaler, P. M. & And Katz, R. L. (2001). *Creative destruction*, The MIT Press, Cambridge, MA.
14. Qi, E., Tian, Y. & Liu, L. (2018). Visual analysis of Internet business model research based on knowledge map. *Res. Sci. Technol. Manag.*, (4), 190–196.
15. Tapscott, D. (1996). *The digital economy: Promise and peril in the age of networked intelligence*, McGraw-Hill, New York, NY.
16. Wang, C. & You, J. (2017). Big data literature review: visualization research based on software CiteSpace. *Research on Science and Technology Management*, (21), 187–196.

17. Yun, J. & Zhu, X. (2013). Development trend of foreign digital economy and national development strategy of digital economy. *Sci. Technol. Prog. Countermeas.*, 30(8), 124–128.
18. Zhang, X. (2018). Logic of digital economy development: a systematic analysis framework. *E-government.*, (6), 2–10.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

