Digital Economy Research Status, Hot Spots and Trends

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Abstract: The digital economy is becoming a new driving force for China’s economic development. Based on the functions of COOC/VOSviewer software such as high-frequency statistics and hot spot clustering, this paper conducts bibliometric analysis of the core journals of SSCI and CSSCI in the past ten years through China Journal Network, revealing the status quo, hot spots and trends of domestic data economy research from multiple perspectives. Results: The evolution of digital economy research in China has experienced two stages: initial exploration and rapid development; There is too little cooperation among scholars in the field of digital economy, which needs to be strengthened; Hot topics of research include digital governance, digital economy, digital technology, etc. Finally, combined with the clustering graph, the research topics in the field of digital economy are analyzed.

Keywords: Digital economy, Knowledge graph, Bibliometric, Research hotspot.

1. Quotation

In 1996, Don Tapscott, known as the father of the "digital economy", first proposed the term digital economy in his article "Digital Economy: Promise and Risk in the Age of Intellectual Internet", "The digital economy was born in the era of network intelligence, combining intelligence, knowledge and creativity to achieve breakthroughs, create wealth and social development[1]." At that time, the concept of "digital economy" has not been unified, until 1998, the United States Department of Commerce issued the "emerging digital economy" report, since the reference to the digital economy formally formed.

Compared with foreign countries, domestic research on the digital economy started a little later, but China has been accelerating the extension and development of the digital economy, so far, China's digital economy scale jumped to the world's second, digital economy has become an important road for China's economic development. Most of the domestic understanding of the digital economy uses the 2016 G20 Summit's definition of "digital economy" : "Digital economy refers to a series of economic activities that take digital knowledge and digital information as key production factors, take modern information networks as an important carrier, and take effective use of information and communication technology as an important driving force to improve efficiency and optimize economic structure.[2]."

From the overall status quo of the development of the digital economy, digital technologies such as blockchain, artificial intelligence, and big data continue to move from research and development to application, and the pace of technological innovation and iteration update continue to accelerate; New forms of business, such as the live-streaming economy, platform economy, and sharing economy, have gradually moved from exploration to the right track, and the dynamic circular system of economic and social development has been reshaped and optimized. New models such as cloud office, networked collaborative R&D and manufacturing, and unmanned retail are gradually maturing, and social production methods, lifestyles, and the way people communicate are undergoing earth-shaking changes. The state has also continuously invested heavily in digital economy research, repeatedly pointing out the importance of digital economy development for the country.

Based on this, from the perspectives of bibliometrics, collinear mapping and information visualization, this paper uses COOC/VOSviewer software to extract data from relevant literatures on digital economy research from 2012 to 2021, and conducts research from the aspects of annual publication volume, scientific research cooperation, research hotspots and future development. The purpose of this paper is to comprehensively present the knowledge structure in the field of digital economy in the past decade, provide useful reference for other scholars to further study, and contribute to the national digital economy research.

2. Data Sources and Research Methods

2.1. Data sources

Journal literature is a form of expression of research achievements in various disciplines, which facilitates the inheritance and development of research achievements in the field and provides effective communication media for the cross-integration of different disciplines. In-depth exploration of relevant elements of journal literature plays an important role in grasping the research panorama of disciplines, identifying research positioning and promoting the development and prosperity of disciplines[4]. In view of the importance of journal research, all the data in this paper are from the world's largest full-text Chinese network database, Kownet, which provides a large number of rich and reliable data for scholars.

At the same time, in order to follow the basic laws of bibliometrics and ensure the accuracy, comprehensiveness and objectivity of references, this paper conducts queries through the advanced search function of CNKI. The main theme of the queries is "digital economy, digital industrialization and digital economy", and the time span is "2012-2021". The SCI and CSSCI literature in CNKI database were used as the main data sources. After advanced search, 2090 relevant literatures were obtained, and 2012 literatures were obtained by deleting those unrelated to or duplicating the research topic. Finally, the literature is exported, and the year, author name, journal, key words,
institution, title and abstract of 2012 literatures are obtained.

2.2. Research tools and methods
Scientific knowledge graph is an effective tool to express the relationship of knowledge structure and historical process in related research fields with graphs and various data. In this paper, COOC/VOSviewer software is used to obtain scientific knowledge map. The visualization form is more abundant, the function is more powerful and the operation is more humanized.

Based on bibliometrics, this paper uses COOC/VOSviewer software to make a visual quantitative and qualitative analysis of 2012 articles related to digital economy in journal C and above. Through the analysis and measurement of the number of publications, publishing institutions, core authors, key words and other information of relevant research literatures, the research hotspots and development trends in the field of digital economy are presented in the form of scientific knowledge graph.

3. Feature Analysis of Digital Economy Research Literature
3.1. Number of publications and journal analysis
(1) Analysis of the number of published documents
The rapid development of science and technology causes the accelerated growth of scientific knowledge. As the carrier of scientific knowledge, the change of scientific literature can be used as an important standard to directly reflect the development of science. By describing the phased changes in the number of published academic papers, the literature in this research field can be counted intuitively and clearly, and the development trends and trends of this field can be reasonably analyzed [5]. In this regard, the author conducted a preliminary analysis of the annual publication of literature on the theme of "digital economy" (see Figure 1).

As can be seen from Figure 1, by 2021, the number of digital economy research literature publications has increased every year in this decade. Among them, from 2012 to 2017, although the number of digital economy papers is increasing every year, the number of papers in each year is less than 50, which means that digital economy research has just begun to get the attention of domestic academic circles, and at this stage, its relevant theoretical knowledge has gradually begun to be established. From 2017 to 2021, the literature related to the digital economy began to increase greatly, from 41 papers published in 2017 to 906 papers published in 2021, and the number of papers has changed greatly, which indicates that the digital economy has attracted more and more attention in China and has become a domestic research hotspot.

China's digital economy was officially incorporated into the information development strategy after 2006. Although its development started late, in the following time, China has constantly promoted the development of the digital economy with the advantage of ultra-large scale market. After 2017, China completed the basic construction of a number of world-class Internet high-tech companies represented by Huawei, Tencent, Jingdong, Ali and Xiaomi. For the follow-up of China's economic transformation and upgrading has provided a powerful impetus. According to Figure 1, China's digital economy is developing very rapidly, and it can closely follow the research process of foreign countries.

(2) Periodical analysis
With the increase in the number of published papers, the number of relevant journals is also increasing. Statistical analysis of the frequency of published journals can quickly identify the types of journal articles and provide references for contributors, which is one of the important platforms for scientific research, communication and learning. Therefore, this paper uses COOC/VOSviewer software to analyze journals related to digital economy, and obtains the statistics of high-frequency journals in digital economy research in Figure 2.

According to Figure 2, the first publication is Taxation Research, the second is International Taxation in China, the third is People's Tribune, the fourth is Reform, and the fifth is The Economist. The number of published "Tax Research", which is supervised by the State Administration of Taxation of China and sponsored by the China Taxation Research, ranks first, indicating the importance the state attaches to the research of digital economy.
which shows that the number of relevant articles published by the Economist is large and the number of citations is also high. Generally speaking, the journal plays an important role in the research of digital economy.

<table>
<thead>
<tr>
<th>Time</th>
<th>Journal of publication</th>
<th>Time</th>
<th>Journal of publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>424</td>
<td>Economic Research</td>
<td>119</td>
<td>The Economist</td>
</tr>
<tr>
<td>178</td>
<td>Science &amp; Technology</td>
<td>116</td>
<td>Journal of International Trade</td>
</tr>
<tr>
<td>173</td>
<td>Finance &amp; Trade</td>
<td>109</td>
<td>Reform</td>
</tr>
<tr>
<td>156</td>
<td>The Economist</td>
<td>109</td>
<td>E-Government</td>
</tr>
<tr>
<td>143</td>
<td>Shanghai Journal of</td>
<td>108</td>
<td>Zhejiang Social Sciences</td>
</tr>
<tr>
<td></td>
<td>Economics</td>
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</table>

### 3.2. Author analysis

Statistical analysis of author frequency can show the distribution of research forces in the field and identify the backbone forces that promote academic innovation and discipline development. The 2012 core literature selected in this paper is calculated to have a total of 2867 authors. Due to the excessive number of authors, the author only makes statistics on the top 25 authors (see Figure 3). Among them, the top five scholars published more than or equal to 10 papers, and the first scholar is Qi Yudong, who published 21 papers; The second place was scholar Chen Bing, who published 18 papers; The third place was Yang Dong, who published 14 papers. The fourth was Ren Baoping, who published 11 papers. The fifth is Tang Yaojia scholar, who published 10 papers; Most other scholars have published fewer than 10 articles. These scholars provide a powerful impetus for the development of the digital economy.

![Figure 3. The top 25 authors](image.jpg)

In order to directly observe the cooperative relationship between authors, this paper then conducts cluster analysis on authors with more than or equal to 6 papers (see Figure 4). As can be seen from Figure 4, two main research systems have been initially formed in the study of digital economy. The first type is the research system with Xiao Jinghua, Xie Kang and Wu Yao as the core. The second type is the research system with Qi Yudong, Liu Cuihua, Xu Xianchun and other scholars as the core.

At present, the joint research among domestic scholars is still in the development stage, and most of them are based on individual research, and there are few cooperative researches with others, but the cooperation system is gradually mature, and the development trend of cooperative researches on digital economy in the future is still very impressive. This situation is very favorable for the research of digital economy.
3.3. Visual analysis of the mechanism

The frequency statistical analysis of institutions can show the distribution of research forces in the field and identify the backbone forces that promote academic innovation and discipline development. Based on this, this paper uses software to sort and analyze the institution sample data. The analysis found that there were 1,683 digital economy research institutions. In order to facilitate the publication level of research institutions, high-impact institutions with a publication volume greater than or equal to 10 were selected for separate analysis (see Table 2). As can be seen from Table 2, there are a total of 13 institutions with a publication volume greater than or equal to 15, among which the top five institutions are as follows:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Organization Names</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National Academy of Economic Strategy, CASS</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>Institute of Industrial Economics of CASS</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>School of Economics and Business Administration, Beijing Normal University</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>School of Economics and Management, Northwestern University</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>School of Economics, Nankai University</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>University of Chinese Academy of Social Sciences</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>Law School, Nankai University</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>Economics School, Renmin University of China</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td>Institute of Quantitative and Technological Economics, Chinese Academy of Social Sciences</td>
<td>17</td>
</tr>
<tr>
<td>10</td>
<td>Chinese Academy of Fiscal Sciences</td>
<td>16</td>
</tr>
<tr>
<td>11</td>
<td>School of International Economics and Trade, University of International Business and Economics</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>China University of Political Science and Law, Law School of Civil and Commercial Economics</td>
<td>15</td>
</tr>
<tr>
<td>13</td>
<td>Institute of Economics, Chinese Academy of Social Sciences</td>
<td>15</td>
</tr>
</tbody>
</table>

The institution with the highest number of publications is the National Academy of Economic Strategy, CASS (29), the second is the Institute of Industrial Economics of CASS (27), the third is the School of Economics and Business Administration, Beijing Normal University (23), and the fourth is the School of Economics and Management, Northwestern University (20) and the School of Economics, Nankai University (20). The fifth is University of Chinese Academy of Social Sciences (19). Among them, the top two are the research institute and the research institute, according to which we can see that the country attaches great importance to the research of digital economy, with the strong support of the country, the future development of digital economy is very optimistic.

4. Digital Economy Research Hotspot and Trend Analysis

4.1. Keyword preprocessing

Keywords are highly summarized by the author on the content of the literature, reflecting the central idea and viewpoint of the paper. At the same time, keywords can also show the clustering theme of the research field and further determine the research hotspot and development trend of the field [12]. COOC/VOSviewer software was used to analyze the keywords in 2012 literatures, and 4417 different keywords were found. Through the analysis of the frequency of keywords, the keywords with more than 30 frequency were
selected for analysis, and the statistics of high-frequency keywords in digital economy research were obtained in Figure 5.

It can be seen from Figure 5 that the occurrence frequency of each keyword is quite different. Among the top five keywords, "digital economy" ranks first. As a central keyword, its occurrence frequency is about ten times that of other keywords. In second place was "high-quality development"; In third place was "digital transformation"; In fourth place were "big data" and "digital trade"; No. 5 was "digital technology."

![Figure 5. Statistics of high-frequency keywords in digital economy research](image)

High-frequency keywords appear most frequently in digital economy papers, which to some extent represents the current research hotspot of information literacy. However, the linear arrangement of these keywords in Figure 6 according to their frequency of occurrence cannot fully reflect the relationship between them, and co-word analysis is still needed.

Based on pair-to-pair statistics of 30 high-frequency keywords in digital economy research, a 30*30 keyword matrix is constructed, and the value on the diagonal is the frequency of keyword occurrence. Limited by space, the first 4 keywords are listed (see Table 3).

<table>
<thead>
<tr>
<th>Co-occurrence matrix of high-frequency keywords in digital economy research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital economy</td>
</tr>
<tr>
<td>Digital economy</td>
</tr>
<tr>
<td>High-quality development</td>
</tr>
<tr>
<td>Digital transformation</td>
</tr>
<tr>
<td>Digital trade</td>
</tr>
</tbody>
</table>

Co-occurrence matrix is a symmetric matrix, and the frequency of two keywords will directly affect the frequency of two words. In order to truly reveal the co-occurrence relationship between keywords, it is necessary to introduce an index indicating the relative intensity of keyword co-occurrence. Therefore, it is necessary to convert the 30*30 keyword co-occurrence matrix into a different matrix. Due to space problems, only the first 5 characters are listed (see Table 4).

<table>
<thead>
<tr>
<th>High-frequency keywords of digital economy research diversity matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital economy</td>
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<td>High-quality development</td>
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<td>Digital transformation</td>
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<tr>
<td>Digital trade</td>
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</tbody>
</table>
4.2. Key words cluster analysis

Cluster analysis is a method to study keyword classification, which classifies unclassified keywords according to their similarity degree. This paper uses software to search the frequency of 30 high-frequency keywords that appear more than 20 times in each literature, and then carries out systematic cluster analysis.

The cluster analysis tree shows each class merge in the cluster analysis. The COOC/VOSviewer software automatically maps the distance between the classes to between 0.0 and 2.0, while approximating the condensation process in the diagram (see Figure 6). The results of cluster analysis can reflect the closeness of these keywords, and reorganize the closely related keywords. As can be seen from Figure 8, the 30 high-frequency keywords are divided into three categories, namely Digital Economy, Digital Governance and Digital Technology.

![Figure 6. Tree diagram of keyword cluster analysis](image)

(1) Digital Economy

The digital economy mainly includes the "Belt and Road", data, tax collection and management, high-quality development, industrial digitalization and blockchain, and mainly discusses the development, impact and unique theories of the digital economy.

In the 21st century, the world has entered the digital era, and the digital economy has gradually developed into the most active field of world economic development. With the continuous expansion of the breadth and depth of integration with various fields, the digital economy has become an important driving force to stimulate consumption, stimulate investment and create employment[28]. For the domestic, with the rapid development of the digital economy, the digital economy has been continuously integrated into the "Belt and Road", "new infrastructure", "blockchain" and "sharing economy" and other industries, thus promoting China's high-quality development and stimulating domestic economic vitality. In addition, the rapid development of digital economy also makes tax collection and administration more efficient and convenient. In the era of digital economy, China, combined with its national conditions, draws on advanced concepts, constantly strengthens database construction, improves tax collection and administration, defines data property rights, and plays the role of a big country to participate in the formulation of national tax, providing basic guarantee for the development of digital economy.

(2) Digital Governance

With the development of The Times, the digital economy has become a new driving force for global economic growth. In order to gain competitive advantages, market mechanism participants compete to obtain various resources by using cross-border data flow, which easily leads to a chaotic digital economic environment. To ensure the long-term development of the digital economy, the country needs a more scientific and standardized governance mechanism. Especially in the governance of the three giants of "Internet", "big data" and "artificial intelligence".
In the past decade or so, the new generation of information technology represented by the Internet, big data, industrial intelligence, etc. has supported the vigorous rise of a new round of scientific and technological revolution, brought new opportunities and challenges to the development of human society, and also caused a significant impact on the job market[27], but with it comes the wave of digital governance.

Digital governance is the prerequisite for the national government to do a good job in various public affairs in the new era, and it is also the basis for the stable development of the digital economy. However, the domestic research on digital governance started late, and high-tech means such as the Internet, big data and artificial intelligence have been continuously used in various fields to accelerate the stage of development and innovation, but unified planning and guidance are lacking. This will seriously affect the development of the digital economy, and even curb the development of the digital economy. In this regard, the state has always emphasized the importance of digital governance, and constantly increase investment in digital governance research, hoping to create a good digital environment as soon as possible, so as to promote the rapid development of the digital economy, create more value for the country, and improve the competitiveness of the country in the era of big data.

3) Digital Technology

As our country enters the era of digital economy, the development of digital technology ushered in explosive growth. Its emergence has fundamentally changed people's understanding of signals and systems, opened up the communication range of production factors, reset the status and sequence of resource factors, and made data, cloud space and other elements emerge. In particular, the sudden onset of the novel coronavirus pandemic has strengthened the development of digital technology.

The rapid development of digital technology has promoted the expansion of coverage and enhancement of functions of digital infrastructure. At the same time, driven by digital technology, the rapid rise of Internet platforms, the continuous emergence of new business models, and the gradual popularization of intelligent terminals throughout the country are promoting the continuous emergence of new forms of employment, such as "digital finance" and "digital trade", which are also constantly improving people's quality of life. In a word, the rapid development of digital technology is an inevitable trend of this era.

5. Conclusion and Prospect

This paper takes the literature in the field of digital economy as the research object, CSSCI and SSCI database as the data source, and COOC/VOSviewer software as the time span from 2012 to 2021 to analyze the literature in the past ten years. The research finds out the current status of digital economy research in China, and sorts out the current hot spots and future prospects of digital economy.

The Outline of the 14th Five-Year Plan issued by the State clearly states that it is necessary to create "new advantages of the digital economy", improve the goals and role of digital economy development and digital transformation, give full play to the advantages of huge data and rich application scenarios, promote the deep integration of digital technology and the real economy and the upgrading of traditional industries, and cultivate new industries, new forms of business, and new models. Strengthen new drivers of economic development[29]. At the same time, it is also proposed that China should make adequate preparations for the comprehensive arrival of the digital era, activate the potential of data elements, promote the construction of a network power, accelerate the construction of a digital economy, a digital society, and a digital government, and drive the transformation of production methods, lifestyles and governance models with digital transformation as a whole[29].

In general, the world today is undergoing profound changes unseen in a century, a new round of scientific and technological revolution and industrial transformation is developing in depth, and the normalization of the COVID-19 epidemic will further promote the development of the digital economy, making a large number of new business forms and new scenarios continue to emerge, becoming a new driving force for economic recovery, and the digital economy is about to usher in an important period of explosive development.

References


[29] Proposal on formulating the 14th Five-Year Plan for National Economic and Social Development and the long-range goals for the next 35 years [N]. People's Daily,2020-11-04(001).