

Research Status and Challenges of Global Digital Governance Based on Knowledge Graph Analysis

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Abstract: Digital governance is an important issue in the digital age, involving the interests of governments, enterprises, individuals, and other parties. It is a key factor in achieving modernization of national governance and has attracted widespread attention from countries around the world. In this study, a Knowledge Graph was plotted to combine the research framework of digital governance through a big data system. The basic characteristics of digital governance research, the forefront of global digital governance research, and the current governance challenges facing global digital governance are also explained in this paper. The co-occurrence clustering analysis of keywords identified that the forefront of global digital governance research mainly includes digital government governance, artificial intelligence governance, digital platform governance, digital currency governance, etc. The main problems faced by digital governance at present include monopolistic challenges, the constant evolution of the “digital divide,” data privacy protection, and artificial intelligence ethics. Solutions proposed to these problems include the deep application of digital technologies such as artificial intelligence and blockchain, the protection and enhancement of digital rights, and international cooperation and sharing, to address the governance challenges in the digital age.

Keywords: Digital governance; Knowledge graph; Governance challenges

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1. Introduction

The digital revolution has dramatically transformed the world we live in, creating unprecedented opportunities and challenges for individuals, businesses, and governments. With the rapid growth of the digital economy, the emergence of new digital technologies, and the increasing connectivity and interdependence of global digital networks, the need for effective global digital governance has become more urgent than ever before. Global digital governance refers to the complex system of rules, norms, institutions, and processes that regulate and manage the digital ecosystem at the global level, which serves to ensure the sustainability, security, and inclusiveness of digital development.

In view of global technological revolution and industrial transformation, the development of digital technologies such as big data, the Internet, artificial intelligence, cloud computing, and blockchain are accelerating. These technologies are also continuously infiltrating various aspects of politics, economy, society, law, and culture, profoundly changing people’s lives ^[1]. Digital development has become a new area of international competition in the Industry 4.0 era, and digital governance is also becoming an

important issue. Countries around the world are implementing digital governance, and the widespread of digital technology in government management is crucial to promote the digital and intelligent operation of governments and to ensure the modernization of the national governance system and governance capacity [2].

2. Literature review

Since the 21st century, with the development of the digital age, the “digital age governance” revolution centered around the internet and information technology will gradually replace the new public management, and the “digital age governance” will move towards a more comprehensive, flexible, and holistic government [3]. Systematic research on digital governance can be traced back to the “Governance Theory in the Digital Age” by British scholar Patrick Dunleavy, which provided a relatively comprehensive summary of the various changes in public management during the development of information technology and the superiority of digital governance [4]. Although different concepts such as e-government, e-governance, digital government, and digital governance have emerged in different countries at different times, they all reflect the desire of governments to use digital technology to empower and optimize governance [2]. Digital governance is not only a technical issue but also a governance issue. Digital technology is the method, and governance is the goal. Digital technology is not omnipotent, and it cannot completely replace human participation. It should always be people-oriented and always have some room for human participation, wills, dignity, market, and society. Digital governance is still in the exploration stage. Multi-party coordination and participation can promote the modernization of the governance system and governance capacity and better integrate “digital” and “governance” to enhance the level of global digital governance [5].

In this study, we analyzed research literature on digital governance. Through plotting a Knowledge Graph and bibliometric methods, we explored the basic characteristics of digital governance research, the cutting-edge research on global digital governance, and the challenges faced in digital governance worldwide. The purpose of this study is to provide reference and guidance for future digital governance research and innovative practices.

3. Research methodology and data sources

3.1. Research methodology

A bibliometric method was adopted to further explore the development of the academic field based on the Knowledge Graph. Bibliometrics is a method of mining the inherent relationships in literature to reveal research foundations, frontiers, and trends [6]. The concept of Knowledge Graph can be traced back to a discussion held by the National Academy of Sciences in the United States in 2003 [7], and it was formally proposed by Google on May 17, 2012 [8]. The Knowledge Graph is an advanced technology that integrates bibliometrics, statistics, computer science, data mining, complex networks, and information visualization. In this paper, a combination of bibliometric analysis and Knowledge Graph was used, with the help of CiteSpace, to analyze and explore popular research topics and trends in the field of digital governance.

3.2. Data sources

The data sources for this paper were divided into two parts: Chinese and English literature, with a search time ranging from March 2011 to March 2022. Chinese literature was derived from the Chinese Social Science Citation Index (CSSCI) database of China National Knowledge Infrastructure (CNKI), while English literature mainly came from the Social Science Citation Index (SSCI) and the Science Citation Index (SCI) in the Web of Science (WOS) database. During the process of data collection, search keywords such as “digital governance,” “data governance,” “internet governance,” “intelligent governance,” “digital

government,” and “digital currency” were used. To ensure the comprehensiveness and accuracy of the samples and improve data quality, non-research literature such as interviews, news reports, conference minutes, conference notices, journal solicitations, academic seminar reviews, and conference reviews, as well as literature that were not related to digital governance were excluded during data cleaning [9]. After removing duplicate records, a total of 735 valid Chinese and English literature were obtained as samples for bibliometric statistics and visualization analysis in this study.

4. Results

4.1. Basic feature statistical analysis

4.1.1. Annual quantity of literature

The publication of literature can be regarded as an important indicator of the development of a discipline, and the change in its quantity can somewhat reflect the attention of the academic community and society towards the field and direction, thereby making predictions for future trends. In the past decade, research in digital governance has been increasing. As shown in **Figure 1**, from 2011 to 2018, the number of publications in digital governance research has slightly increased with some fluctuations. However, from 2018 to 2022, there has been an explosive growth. By fitting the curve of the number of papers, the slope of the trend line is 0.7889, and the trend line shows an exponential growth trend, indicating that the field of digital governance research has entered a phase of rapid development. The amount of research continues to rise, reflecting that digital governance is becoming increasingly popular. The rapid rise of digital governance research is closely related to the formulation of global digital transformation development strategies and policies in recent years.

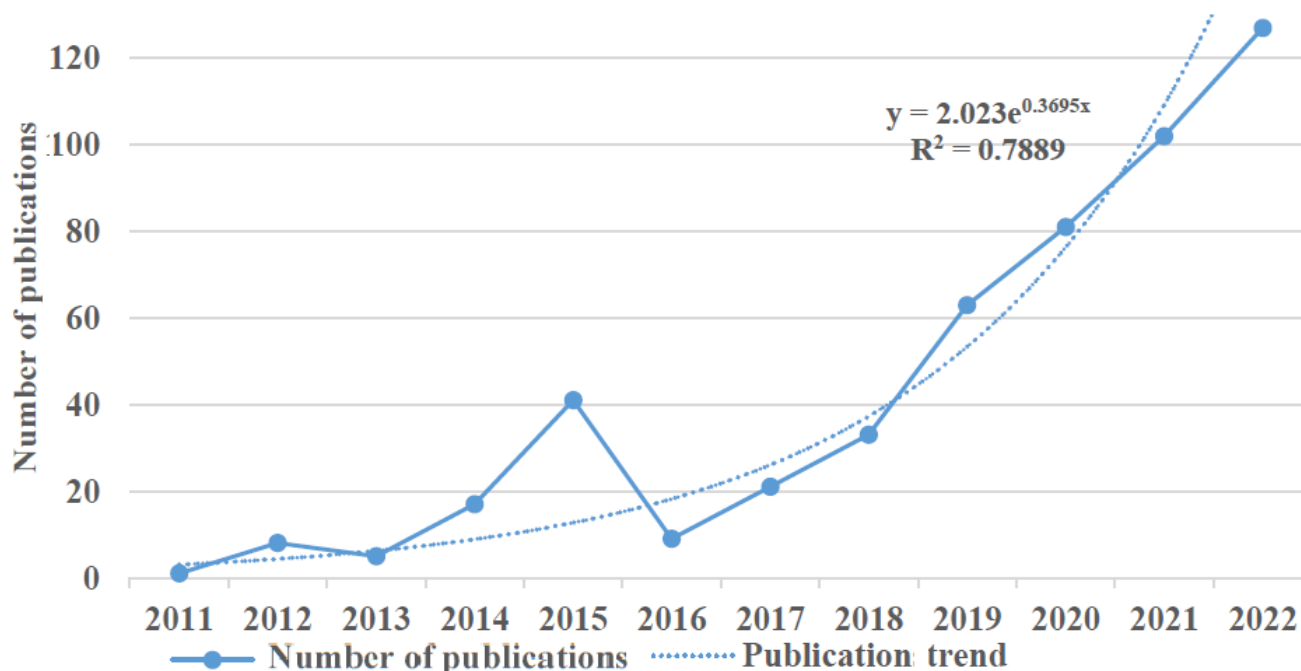


Figure 1. Number of publications on digital governance research in Web of Science from 2011 to 2022

4.1.2. Publications in various countries

Analyzing the countries that the authors of the papers are from can help identify the distribution of research interests and governance capabilities in the field of digital governance. According to the results, as shown in **Figure 2**, the United States, the United Kingdom, and China rank the top three in terms of research

output in the field of digital governance, producing 55.69% of the total publications in this field, accounting for more than half of the total. The United States is the country that first entered the field of digital governance and has produced the most research literature. Overall, research on digital governance is dominated by the United States, with China and other developed countries as the main players. This is mainly due to the maturity of information technology in these countries.

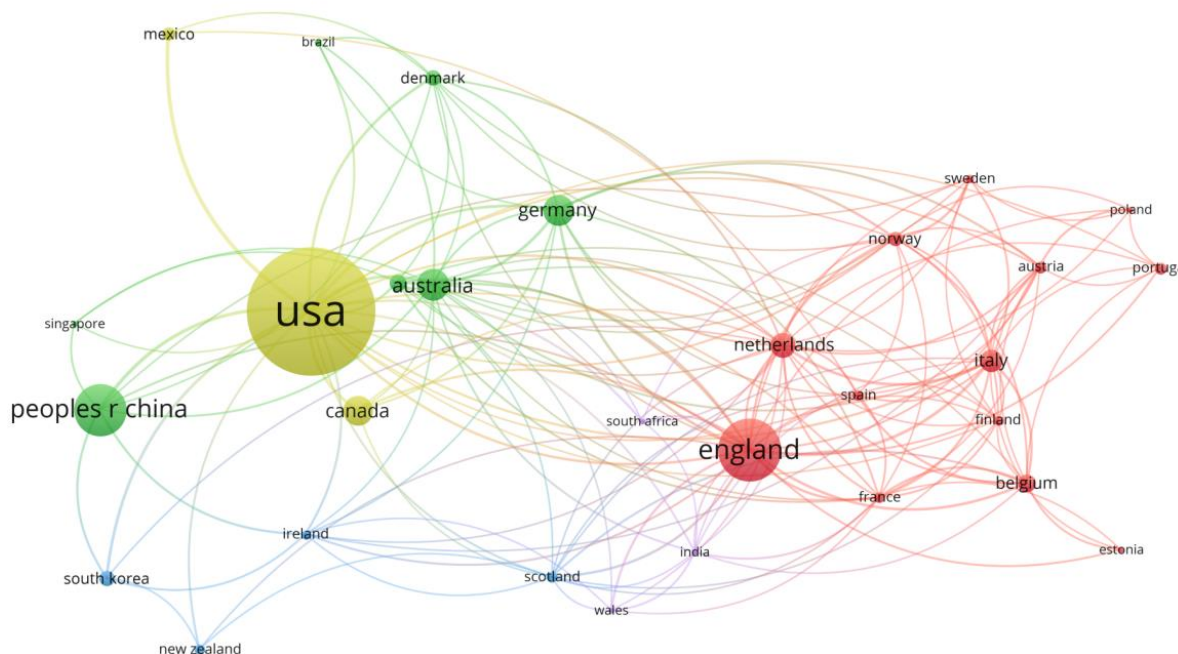


Figure 2. Web of Science Distribution of countries in digital governance research

4.1.3. Keyword cluster analysis

Keywords provide a highly condensed and refined summary of the main ideas and central themes of the papers. Through the analysis of the co-occurrence map of keywords in digital governance research, we can clearly grasp the focus and hotspots of the research. According to the co-occurrence analysis of keywords, as shown in **Figure 3**, the most frequently occurring keywords in digital governance research are “digital government,” “data governance,” “e-government,” “big data,” “management,” “governance,” “technology,” “innovation,” “information,” “privacy,” etc. The development of digital governance is a complex process, with “data” and “network” as the core components of the evolution and development of digital social forms, promoting the development of the digital economy. Data governance and Internet governance are the basic elements of digital governance, and they are important components of the evolution and development of digital social forms.

1, countries with significant influence in the AI field are fiercely deploying their resources to exert their influence, enhance their voice and control, and gain competitive advantage. Among them, the United States' AI development strategy and policies mainly focus on maintaining its global leadership and expecting to maintain its initiative and foresight in the development of AI.

Table 1. Specialized AI Governance institutions established in major countries and regions (Source of information: compiled based on relevant literature)

Country /Region	Organization name	Time of establishment	Responsibilities
United States	National Security Council on Artificial Intelligence (NSCAI)	November 2018	Examine and monitor the application of AI technology to the military and assess its security, ethical and international law risks
European Union	Advanced Group on Artificial Intelligence	June 2018	Study and draft the AI regulatory framework and guide relevant European enterprises to implement it
Britain	Artificial Intelligence Council	April 2018	Oversee the implementation of the UK's AI strategy and make recommendations to the government
France	Ethics Committee on Artificial Intelligence	April 2019	Overseeing the development of military artificial intelligence
Canada	Canadian AI Strategy	March 2017	A research and talent development strategy
Japan	Artificial Intelligence Technology Strategy Conference	April 2016	A comprehensive AI management body at the national level, responsible for policy and application supervision
South Korea	Korean AI Strategy	January 2019	Promote the development of artificial intelligence industry
India	Alliance of Ethics Committees on Artificial Intelligence	June 2018	Setting standards for AI product research and development
China	New generation of Artificial Intelligence Development Planning and Promotion Office	November 2017	Research on AI related laws, ethics, standards, social issues, and governance issues

Cutting-edge technology of artificial intelligence governance includes new-generation artificial intelligence technologies such as ChatGPT, which is promising in the field of public governance. However, it is also important to anticipate the risks of using these technologies, and it is important to make them a usable, trustworthy, reliable, and friendly “enabler” [13]. In addition, the production and dissemination of AI-generated content (AIGC) also face a series of transformations, risks, and governance issues, requiring strengthened regulation and governance of AIGC to ensure that its dissemination conforms to social public interests and values. At the same time, it is also necessary to strengthen research and development of AIGC technology, improve the accuracy and fairness of its algorithms, and ensure the quality and effectiveness of its dissemination [14].

5.1.3. Digital platform governance

The influence of digital platforms in the economic, social, and political sectors is growing, leading to a series of governance issues [16]. Some large multinational digital platforms, such as Apple, Amazon, Google,

Facebook, Twitter, Microsoft, Tencent, Alibaba, and ByteDance, dominate the global data value chain. While providing digital services to consumers worldwide, the companies of these platforms also gain most of their profits from the global data value chain, leading to issues such as security risks, disorderly market competition, and imbalanced wealth distribution. Therefore, administrative, and legal regulations in different countries need to keep up with the digital era's characteristics, promote regulatory efforts, encourage various regulatory forces to work together, maintain the orderly operation of the market, balance the interests of multiple stakeholders, and maximize social benefits ^[15]. The key is to improve the external structure of the government, promote internal management changes in enterprises, and establish a sustainable joint governance framework ^[16].

5.1.4. Digital currency governance

In view of the development of financial technology, various forms of digital currencies have emerged, which can be mainly summarized as follows: central bank digital currency, super-sovereign digital currency, private stable currency, and cryptocurrency like Bitcoin. Digital currencies have become an important part of the global currency system, and digital currency governance involves issues such as monetary policy, regulatory system, and technical standards ^[17]. The vigorous development of digital currencies has raised concerns among governments worldwide about financial stability and security, posing new challenges to the operation of sovereign currencies and financial regulation, prompting many countries to strengthen regulatory oversight of private digital currencies while actively conducting trials of legal digital currencies. The governance of digital currency requires international cooperation and coordination, the establishment of international standards and regulatory mechanisms for digital currencies, and the enhancement of technological research and innovation to improve digital currency's efficiency and credibility, promoting its widespread application and popularization.

5.2. Challenges of digital governance

5.2.1. Monopoly

Many powerful international digital platform companies have advanced information technology, algorithms, and data, with large amounts of user data forming a monopolistic position, limiting the entry of other competitors into the market, affecting fair competition in the market, and bringing potential risks to innovation, entrepreneurship, consumer welfare, and industrial development ^[18]. With the development of society, the influence of monopoly on the economic and political system is becoming more and more prominent, which poses a severe challenge to the existing national and social governance system and brings major risks to the economic development ^[19]. Therefore, the government should be wise in adjusting the criteria and scale of monopolies in the digital age.

5.2.2. The evolving “digital divide”

“Digital divide” is one of the main challenges of digital governance, mainly manifested in the gap between the application of digital technology and the development of the digital economy of different groups, such as developed and developing countries, urban and rural areas, the wealthy and the poor, and the young and the old ^[20]. Digital governance research should aim to narrow the digital divide and promote balanced and sufficient digital development. To promote substantive public participation in digital governance, it is necessary to focus on the purpose of information technology, respect and protect personal data, follow the rule of law to balance data monitoring power ^[21]. At the same time, attention should be paid to the fundamental support role of data for society, economic development, and national governance, and a scientific and effective way of digital governance should be sought to prevent and manage the social risks brought by digital technology.

5.2.3. Challenges of digital privacy protection and security

Digital privacy protection is an essential issue in digital governance, and it is important to strengthen the legal and institutional protection of personal privacy and data protection. The development of emerging technologies such as big data and artificial intelligence will bring unprecedented revolutionary technological innovation and social changes, bringing more development and welfare ^[22]. Meanwhile, digital security threats, network attacks, data leaks, social security risks, and political security risks are also becoming increasingly prominent. Therefore, data security and privacy protection are the key to reasonable use of data ^[23].

5.3. The future of digital governance

There will be more opportunities and challenges in digital governance as digital technology continues to develop. Therefore, it is necessary to explore and apply new digital technologies in digital governance, accelerate the construction of digital infrastructure, including key technologies and infrastructure such as 5G and the Internet of Things, to improve governance efficiency and service levels. The digital economy is an important support for digital governance, and in the future. Therefore, it is crucial to strengthen the development and promotion of the digital economy, promote the transformation and upgrading of the digital economy, improve the quality and efficiency of the digital economy, and build digital governance systems such as digital government, digital society, and digital economy to improve governance capacity and level. From the perspective of national and social development, it is important to strengthen the protection and enhancement of digital rights, as well as the legal and institutional guarantee for digital privacy and data protection. The establishment of data regulation like legal and regulatory frameworks will help to reduce the harm caused by data abuse and enhance people's trust in data transactions ^[24].

From a global perspective, digital governance requires the cooperation and sharing of governments and enterprises worldwide. On one hand, the United States and the European Union have dominated the two major global digital governance systems, with different governance focuses, both aiming to turn their governance methods into global norms and standards ^[25]. On the other hand, big countries such as China, Japan, Russia, India, Brazil, and Canada have gradually formed their own characteristics in digital governance. In the process of promoting globalization, it is necessary to improve the governance level of all countries, coordinate the relationship between domestic society and international society, and enhance the interaction between national governance and global governance ^[26].

Countries need to break free from the "zero-sum" world political culture, adhere to the principle of sovereignty, tolerate diverse subjects, establish a new governance order, and adapt to the trend of the times. All stakeholders including governments and relevant parties should continuously improve the global digital governance system ^[27].

6. Conclusion

The research on global digital governance has been continuously increasing in popularity and developing rapidly. The keyword co-occurrence network analysis shows that "digital government," "data governance," "e-government," "big data" are the focus global digital governance research. "Data" and "network" are the core components of the evolution and development of digital society, promoting the development of the digital economy. Data governance and Internet governance are the basic elements for conducting digital governance.

The main research areas of digital governance are focused on four aspects: digital government governance, artificial intelligence governance, digital platform governance, and digital currency governance. Issues such as big data, cloud computing, blockchain, artificial intelligence, the Internet of Things, digital economy, and privacy protection are increasingly highlighted.

There will be more challenges in digital governance as digital technology continues to develop. Companies with ultra-strong digital “platformization” have formed a monopolistic position globally, and the increasingly serious “digital divide” problem, digital privacy protection, and security issues pose significant challenges to global digital governance. The future of global digital governance will be full of opportunities and challenges, and countries around the world must work together, establish a new digital governance order, and address various risk challenges to promote the development of the digital economy and world harmony and stability.

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Disclosure statement

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