

The Evolution of Policies and Mechanisms in China's Digital Government Initiative: A Quantitative Text Mining Approach

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Abstract: Within the ongoing context of social informatization, China has achieved considerable development in its digital government construction. However, there remains a lack of systematic and scientific policy review concerning China's digital government construction. This paper investigates 290 policies pertinent to China's digitalization efforts from November 1995 to July 2024. By utilizing methods including word frequency analysis, semantic network analysis, and topic clustering, it conducts a systematic examination of the policy transitions and developmental framework of China's digital government from 1995 to 2024. The trajectory of China's digital government construction policies has encompassed three distinct phases: the initialization of government informatization and e-governance, the era of the Internet Plus Government Services initiative, and the current phase of digital government construction. These policies have been modified in response to the changing priorities of government digitalization, exhibiting both continuity and adaptability, and are in synergy with the progressive establishment of a service-oriented government in China.

Keywords: digitalization of government, text analytics, high-frequency words, semantic network, Latent Dirichlet Allocation.

1. Introduction

In recent years, the China's digital government construction has gradually become an important key initiative for building a digital China in the new era and promoting the modernization of the national governance system and governance capacity. In June 2022, China's State Council issued the Guiding Opinions of the State Council on Strengthening the Construction of Digital Government, making comprehensive arrangements for accelerating the construction of China's digital government, breaking new ground in the digitalization of government. The process of digital transformation of the Chinese government has promoted the academic research in the fields of impetus, path of practice, and policy research of digitalization of government, and provided a rich theoretical perspective and practical reference for in-depth understanding of government digitalization. However, the author suggests that there is a lack of systematic combing and targeted analysis of the Chinese government's digital construction policies, and the study of digitalization of China government can be enriched.

Therefore, based on the Chinese government's digitalization-related policies, this paper uses high-frequency words, semantic network, and topic clustering methods to quantify the policies and systematically trace the thematic evolution of China's digitalization policies since the end of the last

century, deeply understand the evolution logic and internal mechanism of the policy, and fill a research gap in related fields.

2. Literature Review

The concept of digital government presents both static and dynamic perspectives. From a static perspective, Wang Weiling believes that digital government is the result of the evolution of traditional government forms from the industrial age to the information age [1]. Meng Tianguang believes that digital government is a new operating mechanism for the government to provide administrative services and carry out administrative activities in a digital and networked environment [2]. From a dynamic perspective, digital government is considered as a process wherein the public sectors of the government employ information technology to establish communication channels between the government and citizens, enhance public services, and concurrently encourage citizens' participation in decision-making [3]. It is also a process through which the government systematically develops and transforms its governance concepts, responsibility boundaries, organizational forms, ways of fulfilling duties, and governance means to adapt to and advance the digital transformation of the economy and society [4].

At present, domestic and foreign scholars mainly focus on three aspects of government digitalization. The first is the risks and challenges of digital transformation of the government, such as the conflict and confrontation between digital government and social organizations [5], and the technical risks faced by digital government [6]. Based on China's national conditions, Wang Weiling, a domestic scholar, proposed that the construction of China's digital government may be affected by risk factors such as poor institutional mechanisms and imperfect legal systems [1]. The second approach involves exploring optimization pathways through methods such as case studies and comparative analysis. Luna · Reyes and other scholars took the Mexico federal government as the object to explore how to reduce the difficulty of cooperation between institutions and achieve organizational integration from the perspective of institutions and organizations [7]. He Shengdong and Yang Dapeng focused on the reform of "Maximum One Visit Service Procedure" in Zhejiang Province and put forward reform and innovation tasks such as changing management concepts and government functions, adjusting organizational rights and responsibilities, revising laws, and strengthening data security [8]. The third is the policy research on government digitalization. The policy provides institutional guarantee for the orderly promotion of digitalization of government. In the Chinese academic sphere, research in this field often centers on provincial policies and the central-local relationship. For instance, Luo Qiangqiang's research of local digital government reforms was based on an examination of 34 policy text from seven provinces and cities [9]. Zhao Yuanyue and his colleagues have leveraged the Public Value-based Government Performance Management (PV-GPG) framework to analysis digital government policy text of 31 provinces [10]. Furthermore, scholars such as Zhao Juan have used the event history method to investigate the dissemination patterns and efficacy of digital government policies across various cities in China, thereby deepening our understanding of the diffusion dynamics and developmental trajectory of these policies at both national and local levels [11].

Policy text analysis extracts potential information from the content of texts to analyze the connotation and essence of policies, thereby guiding the further refinement of policies [12]. Currently, scholars often use manual coding to study policy texts. For instance, Wang Hongxin and others have coded and classified over 90 national policies on poverty alleviation through relocation to explore the characteristics of policy development and evolution in this field [13]. Huang Ruhua and Wen Fangfang have used the Chinese government's open data sharing policies as their research subject [14], employing NVivo for policy text coding and thematic categorization. Manual coding aids researchers in deeply and meticulously understanding the connotation of policy texts, possessing

strong adaptability and flexibility. However, it has limitations such as over-reliance on the subjective interpretation of researchers, which can affect the objectivity of the research and limit the volume of data that can be processed.

In light of this, this paper proposes to utilize ROST CM6 software to conduct word frequency statistics and semantic network analysis on central government digitalization construction policy texts since 1995. Furthermore, the Latent Dirichlet Allocation (LDA) method will be applied for topic modeling to clarify the thematic transition process of China's government digitalization construction policies. This will explore the policy focus and overall characteristics at different stages, filling the research gap in the relevant field and providing support for subsequent studies.

3. Research Design

3.1. Data Sources and Processing

This paper employs the keywords “e-Government”, “the Internet Plus Government Services initiative”, “the Government Service Platform”, “Government Informationization”, “Digital Government”, “Government Online” to retrieve relevant policy documents on government digitalization construction from the databases of Peking University Law Database and the State Council Policy Document Library. The search yielded a total of 314 policy documents from November 1995 to July 2024. These documents were manually screened to exclude those with low relevance, and irrelevant content such as signatures and dates were removed from each document, resulting in 290 policy documents.

3.2. Research Methods

High-frequency word analysis can identify key terms in large volumes of text, analyzing the focus and emphasis of policies. Semantic network analysis allows researchers to gain a deeper understanding of the structure of policy texts and uncover hidden information within them. This paper utilizes ROST CM6 for the analysis of high-frequency words and semantic networks in texts. Developed by Wuhan University, ROST CM6 is a textual metric analysis tool capable of text segmentation, word frequency statistics, and semantic network analysis, among other functions. It assists researchers in efficiently processing large volumes of text data and visualizing analysis results, thereby reducing the workload of research.

Latent Dirichlet Allocation (LDA), a document generation model proposed by Blei, D. M. and other colleagues, is an unsupervised machine learning algorithm that can extract latent thematic features from large batches of text content, enhancing the accuracy and efficiency of deep semantic analysis of text. LDA aids researchers in better comprehending the connotation of policy texts and, to some extent, compensates for the limitations of traditional qualitative text analysis methods such as manual coding.

3.3. Phases of Policy Development

The concept of “e-Government” had sporadically appeared in documents of some government departments since it was introduced to China in the 1990s. In 2002, the Central Committee of the Communist Party of China and the State Council jointly forwarded the “Guiding Opinions on the Construction of e-Government in China” by the National Informatization Leading Group, officially establishing “e-Government” as a significant goal of government digitalization at the policy level. After a guiding document for the implementation of The Internet Plus Plan of Action was issued by the State Council on July 1, 2015, the central government issued multiple policies to promote the integration of internet technology with government digitalization, with the Internet Plus Government

Services initiative becoming a pivotal concept in the policy discourse of government digitalization. The Fourth Plenary Session of the 19th Central Committee of the Communist Party of China, held from October 28 to 31, 2019, explicitly proposed the construction of digital government, signaling a new strategic planning for government digitalization in China.

In summary, this study categorizes the policy documents into three phases: the first phase, from November 1, 1995, to July 1, 2015, encompassing government informatization and e-Government construction; the second phase, from July 1, 2015, to October 31, 2019, focusing on the Internet Plus Government Services initiative; and the third phase, from October 31, 2019, to the present, centered on the construction of “Digital Government.”

4. Research Process and Findings

4.1. Government Informatization and E-Government Construction

4.1.1. High-Frequency Word and Semantic Network Analysis

Through high-frequency word analysis, the first stage of government initiatives was primarily characterized by “construct,” “manage,” “develop,” “lead,” and “guarantee.” The government aimed to achieve informatization of government departments and develop e-government through measures such as increasing investment and utilization of information technology, constructing information systems and electronic data repositories for various government departments, and promoting information sharing. In this stage, “construct,” “manage,” and “technology” were at the core of the semantic network, with the highest degree of association with other keywords. “Informatization,” “e-government,” “business,” “system,” and “security” were in the secondary core layer, closely related to the main themes and interconnected with other words. Terms like “supervision,” “data,” “development,” “focus,” and “system” were in the more peripheral outer layer, with weaker associations with other themes, as depicted in Figure 1.

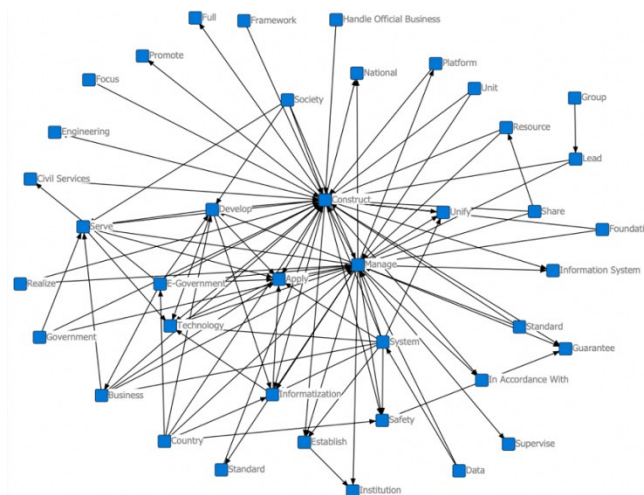


Figure 1: Phase1 semantic network diagram.

The stage of government informatization and e-government construction marks the beginning of the government digitalization. Initially, policies laid the groundwork for government digitalization through the establishment of informational infrastructure, major engineering projects, government business systems, and official websites. Subsequently, the informatization transformation processes of government departments and office processes was inseparable from management, requiring a combination of various control and monitoring efforts to ensure the orderly advancement of

government informatization and e-government construction. Furthermore, the use of computers and information technology was the most critical policy instruments in this stage, playing a pivotal role in the construction of information engineering projects and business systems, thereby achieving the policy objectives of government informatization and e-government development.

4.1.2. LDA Topic Model Analysis

Determining the optimal number of topics is a critical task when employing LDA topic modeling for textual theme identification. In this study, the coherence score was selected as the criterion for assessing the quality of the number of topics, with a higher coherence score indicating greater accuracy of the LDA model. As shown in Figure 2, the coherence score was calculated for each stage of policy texts by varying the number of topics from 3 to 8. In the first stage, the highest coherence score was achieved with 3 topics. Through LDA topic model analysis, the policy themes of the first stage can be categorized into three main groups: E-Government and Government Informatization; Information Security Protection and Credit Assurance; Enhancement of Regulatory Capabilities and Work Performance Management.

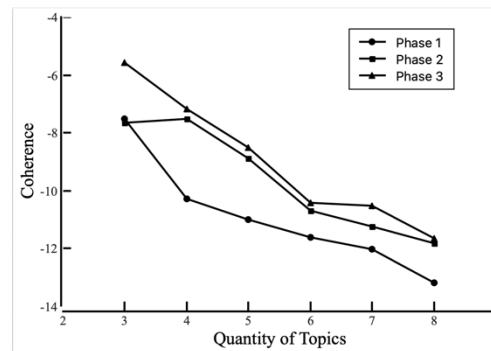


Figure 2: Coherence score.

Table 1: Phase 1 LDA topic modeling results.

Serial Number	The Name of the Topic	Keywords
1	E-Government and Government Informatization	Service, Construct, Country, E-Government, Department, Network, Develop, Society, Informatization, Broadband, Reform, Business Information, Government, Data, Credit,
2	Information Security Protection and Credit Assurance	Entrepreneur, Build, Calculate, Resource, Market, Institute, Information Security, Protect Project, Supervise, Manage, Technology,
3	Enhancement of Regulatory Capabilities and Work Performance Management	Performance Evaluation, Work, Capacity, Institution, Indicator, Evaluate, Enhance, Approve

E-Government and Government Informatization. Towards the end of the 20th century and the early 21st century, in response to the informational wave brought about by the Fourth Industrial Revolution, China formulated the significant policy of “Government-led informatization initiatives in China.” This policy clearly defined the objectives and strategic frameworks for e-Government development and focused on cultivating a macro-environment for the growth of government informatization. By vigorously constructing information infrastructure such as broadband networks, popularizing

computer use within government agencies, establishing internal information office networks within government departments, and implementing initiatives like the “Government Online Project,” China significantly enhanced the informatization level of government departments and business operations, gradually establishing and improving e-Government platforms. In this stage, the government placed great emphasis on the construction of government informatization. Marked by the official launch of e-Government construction in 2002, government informatization entered a new phase of overall planning and development, achieving rapid progress over the following decade and a half.

Information Security Protection and Credit Assurance. The central government ensured the information security of government and enterprises through policies such as the “Administrative Measures for the Security Protection of International Internet Connections of Computer Information Networks.” On one hand, “Unified standards and security assurance” were established as one of the guiding principles and ideas for e-Government construction, with increased emphasis on the deployment and arrangement of data security in the orderly promotion of government informatization. On the other hand, while enhancing the level of social informatization and promoting the sharing of information resources, China established and improved a social credit system, strengthening market credit supervision in important economic sectors such as e-commerce and finance, and protecting enterprise information security. It is evident that policies in this stage demonstrated a high level of concern for the authenticity, reliability, and security of information.

Enhancement of Regulatory Capabilities and Work Performance Management. During this period, the government improved its regulatory enforcement methods and capabilities through modern information technology. Government departments achieved a full integration of information technology with regulatory functions through significant measures such as the construction of regulatory systems, reforms in regulatory systems and mechanisms, and strengthening staff training. Priority was given to strengthening regulation in areas with high social attention and economic and social benefits, such as finance, taxation, food and drug safety, and credit. Concurrently, the Chinese government deployed numerous major information engineering projects to advance government digitalization, with dynamic tracking and scientific evaluation of these projects becoming an important theme of policy in this period.

4.2. the Internet Plus Government Services Initiative

4.2.1. High-Frequency Word and Semantic Network Analysis

In the stage, the term “services” topped the list of high-frequency words, with “construct,” “manage,” and “supervise” appearing multiple times, indicating that the government accelerated its shift towards a service-oriented function. High-frequency words like “Internet” and “big data” began to emerge, signifying that the policy focus during this period shifted to the Internet Plus Government Services initiative empowered by the Internet and big data. As shown in Figure 3, the term “services” occupied the central layer, with the highest density of association with other words. “Government,” “platform,” “Internet,” “manage,” “system,” and “share” were all in the secondary core layer, not only closely related to the central term “services” but also interconnected with each other. Terms like “government,” “service platform,” “security,” “innovation,” and “services” were in the outer layer.

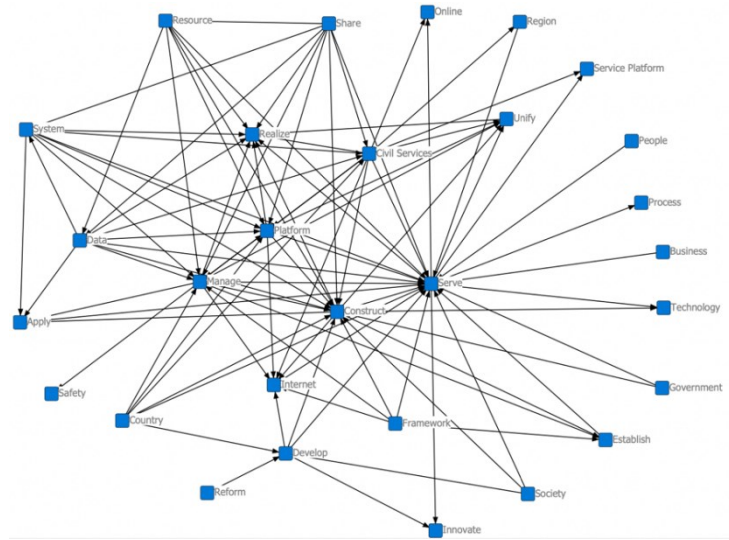


Figure 3: Phase2 semantic network diagram.

Building a service-oriented government that satisfies the people became the guiding ideology for government digitalization in the stage. The government placed greater emphasis on the construction of macro-control, market regulation, public services, and other service-oriented functions. In this process, the government's significant measures to enhance service efficiency included promoting the development of emerging information technologies such as the Internet and big data, and establishing regionally integrated government service systems and platforms using information technology. While emphasizing technological development and innovation, the state also focused on building a unified standard system to manage the application of Internet technology, the operation of platform systems, and the sharing of information data, ensuring the stable and orderly progress of digitalization.

4.2.2. LDA Topic Model Analysis

Through the calculation of the coherence score, the number of topics was determined to be 4. The results of the LDA topic model analysis for this stage are shown in Table2

Table 2: Phase 2 topic modeling results.

Serial Number	The Name of the Topic	Keywords
1	Internet-Empowered Business Environment Optimization	Supervise, Internet, Construct, Publish, Innovation, Countryside, Security, Approval, Digital, Random, Administrative, Nation, Service Industry
2	Innovating Service Mode and Improving Service Capabilities	Service, Civil Service, Integration, Business License, Law, Issue, National, Public, Online, Handle, People, Consolidate
3	Public Resource Trading Intensification and Facilitating the People and Enterprises	Public Resource, Trade, System, Identification, Register, Enterprise, Law-Enforcement, Intensification
4	Information Platform Construction and Data Sharing	Platform, Electronic, Information, Department, License, Market Entities, Service Platform, Certify, Unify, Integration, Region

Internet-Empowered Business Environment Optimization. Optimizing the business environment is a crucial aspect of China's deepening "streamlining administration, delegating power, and improving services" reform and accelerating transforming government functions, which is also one of the key content of policies in this stage. To achieve this goal, the government focused on optimizing business environment by optimizing approval processes, building regulatory platforms, and improving the efficiency of government services. Emerging technologies such as the Internet and big data empowered the various aspects of business environment optimization, facilitating the government's effective performance of its functions and enhancing governance efficiency.

Innovating Service Mode and Improving Service Capabilities. In this stage, the government aimed to promote modern governance and build a service-oriented government to transform its function. Guided by the basic principles of demand orientation, process optimization, service innovation, and overall promotion, the government drove diverse reform practices, established online government service platforms for the public, transformed the organizations and institutional mechanism of government, promoted the government service processes re-engineering, and continuously enhanced comprehensive service capabilities.

Public Resource Trading Intensification and Facilitating the People and Enterprises. During this period, policies required to construct a unified, transparent public resource trading platform, enabling the interconnection of public resource trading information across the country, and promoting the marketization, openness, and intensification of public resource trading. To better facilitate the people and enterprises, the government focused on integrating various registration businesses with Internet technology to enhance the informatization level of registration business management; at the same time, it strengthened information disclosure and credit supervision to maintain market order and protect the legitimate rights and interests of market entities.

Information Platform Construction and Data Sharing. The 13th Five-Year Plan explicitly instructed the construction of a national government information resource management and service system. To implement these instructions, policies during this period emphasized the establishment of a government information resource sharing services system and standard system based on the national government intranet and extranet. The construction of a national data exchange hub and the enhancement of government information sharing websites for the public were also emphasized. These policy provisions have led to breakthroughs in China's government data sharing and opening up, as well as in the integration and application of social big data.

4.3. Digital Government

4.3.1. High-Frequency Word and Semantic Network Analysis

In this stage, the term "Service" remained the core of policy, with "Construct" and other words appearing frequently; new high-frequency words such as "Digital" and "Integrated" emerged as key terms. "Service" and "Construct" were in the central layer of the semantic network, with very close connections to other nodes in the text. "Government," "Manage," "Integrated," "Resources," "Data," and "Platform" were in the secondary core layer, while "Unify," "Standard," and "Business" were in the outer layer of the semantic network, with fewer connections to other nodes.

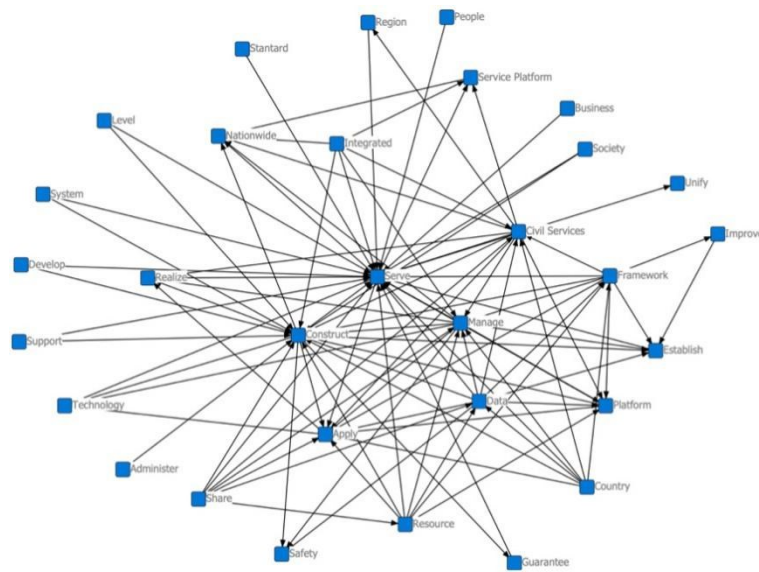


Figure 4: Phase3 semantic network diagram.

In the stage of digital government construction, government digitalization was still guided by the dominant concept of building a “service-oriented government.” The state aimed to achieve the goal of building a digital government and a digital China, with policies focusing on further consolidating the construction of network and information infrastructure. By using information technology instrument, the government strengthened the construction and management of a national integrated government service platform, promoted the collection and sharing of data resources. Thereby the government enhanced overall governance efficiency. Through constructing a social governance system that encompasses government service content and standards, comprehensive regulation, resource planning, and security assurance, the government ensured service quality and improved service levels.

4.3.2.LDA Topic Model Analysis

Through the calculation of the coherence score, it was found that the topic division best aligned with the actual content of the policy texts when the number of topics was 3. Through LDA analysis, the following three themes were presented, as shown in Table 3:

Table 3: Phase 3 LDA topic modeling results.

Serial Number	The Name of the Topic	Keywords
1	Optimization and Enhancement of Service Platforms	Service, Civil Service, Electronic, Issue, Handle, Enterprises, Department, Office, Service Platform, People, Platform, National
2	Enhancing Financial Management and Risk Prevention	Bill, Finance, Write-Off, Unit, Strengthen, Manage, Risk, Information, Improve, System, Standard, Intelligence
3	Data Regulation and Credit Assurance	Data, Supervise, Construct, Enhance, Digitalization, Sound, Digital, System, Credit, Efficient, Emphasis, Govern

Optimization and Enhancement of Service Platforms. In this stage, the formation and optimization of a national integrated platform improved the overall governance and service capabilities of the government. For example, the government incorporated all matters not specifically stipulated by law into the service platform and established a comprehensive system of standards and norms to ensure the safe operation of the platform. These initiatives were aimed at meeting the universal needs of diverse social entities for public services by optimizing the government service platform and reengineering the model of public governance and service delivery.

Enhancing Financial Management and Risk Prevention. Financial management plays a crucial role in securing funding sources for the construction of a digital government and optimizing resource allocation. The government is refining the fiscal and taxation system and improving fiscal institutions. By standardizing the management of electronic financial bill write-off and strengthening the application of fiscal big data analytics, the level of modernization in fiscal governance is being enhanced. Furthermore, with the continuous advancement of digitalization in both government and society, the government is reinforcing its risk management efforts. By utilizing information technology to monitor and provide early warnings across various social sectors, potential risks and hidden dangers are prevented and resolved, thereby ensuring the stable operation of society.

Data Regulation and Credit Assurance. As the level of social informatization continues to rise, data, as a vital information resource, has further evolved into a new type of production factor. While promoting the circulation and sharing of data elements to unleash significant benefits, the government clearly recognized the importance of data security regulation and governance. Efforts are being made to establish a comprehensive mechanism for data sharing and collaborative regulation across different levels, departments, and regions. By establishing a unified national big data system, the government managed the credit information of both government and society, substantially improving the capabilities of data regulation and credit assurance. A series of policies and regulations have strengthened the top-level design in the field of data security governance, addressing the social demand for data security regulation.

5. Conclusion

Based on the analysis of 290 policy documents, this paper utilized ROST CM6 text mining software and LDA topic modeling methods to examine the evolution of policy themes in China's government digitalization from 1995 to 2024. Based on the analysis of 290 policies, the following conclusions were drawn:

5.1. Policies Alignment with Government Digitalization Tasks Across Different Periods:

The main tasks of China's government digitalization have evolved from strengthening the application of digital technology to transforming government structures and systems, and finally to enhancing the overall governance effectiveness of the government. In the first phase, the government focused on applying information technology to governmental processes through infrastructure construction and information project implementation, promoting e-governance such as departmental informatization and paperless operations. In the second phase, government digitalization efforts concentrated on using emerging information technologies such as the Internet and big data to build integrated government service platforms, promoting the "streamlining administration, delegating power, and improving regulation and services" reform, and shifting government functions towards a service-oriented model. In the third phase, the concept of "digital government" introduced a new era in government digitalization, with the government committed to fully leveraging the role and benefits of data elements in digital government construction and digital economy development, and continuously enhancing the overall state governance effectiveness.

5.2. Continuity and Flexibility in Policy Adjustment.

China's digital government policies have demonstrated continuity and flexibility in content adjustment, adapting to the complex changes in the external environment. Firstly, policy evolution aligns with the phased progression of continuous technological development and progress. The goals of China's government digitalization have been adjusted in step with advancement in information technology. Secondly, specific policy issues have continuity, as exemplified by data governance, where the focus has shifted from protecting government and market data and information security in the first phase, to promoting data information sharing in the second phase, and to emphasizing data sharing and data governance in the third phase, which is a coherent and dynamically adjusted policy theme across the three phases. Finally, on the macro view of China's government digitalization, various new scenarios and problems have also driven flexible policy changes. For example, in the realm of government regulation, issues such as online government services, the platform economy, and the explosive growth and circulation of data have given rise to new regulatory responsibilities for the government, expanding the scope of regulatory targets from the behaviors of internal and external government organizations and individuals to data elements.

5.3. Policy Evolution in Line with the Deepening Process of a Service-Oriented Government.

The construction of a service-oriented government is a strategic choice for China in transforming government functions and deepening administrative system reforms. In the first phase, China's government digitalization policies were efficiency-oriented. As the transformation of government functions progressed through the second and third phases, the focus of government digitalization shifted to a service-oriented approach, adhering to the principle of starting from the needs of the people and providing efficient, high-quality government services to substantially enhance the people's sense of gain and satisfaction. The evolution of China's digital government policies not only aligns with the deepening process of building a service-oriented government but also reflects the people-centered development philosophy of China's government reforms.

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