



Research on Big Data Service of Shandong Government Based on Data Warehouse Technology

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Abstract. In the era of big data, data has penetrated into every aspect of economy, society and life, exerting a profound influence on economic development mode and social governance mode [1]. Through field investigation, literature analysis, quantitative and qualitative analysis and comparison, comprehensive analysis and other research methods, this study analyzes the problems and deficiencies of existing big data service in Shandong Province. By mining the essential factors of data layer and external characteristic factors of application layer that affect big data service, the big data service management model was built around three aspects of government service, public support and comprehensive guarantee. Through data warehouse technology and the distributed computing and storage framework of Hadoop, the government big data processing support service system was established with data analysis application requirements as the guidance. By analyzing the influence mechanism of big data service, the decision-making suggestions of big data service in Shandong province were put forward. This can further optimize big data service and achieve high-quality economic and social development.

Keywords: Digital government · Big data service · Data warehouse technology · Hadoop

1 Introduction

In the era of big data, data is one of the most valuable assets and has become a key driver of innovation [8]. The government holds about 80% of society' data. These data not only help the government formulate policies and provide public service, but also facilitate citizens, enterprises and other organizations and groups to participate in public affairs, develop new products and provide innovative service, which plays a key role in the development of the digital economy.

With the development of information technology, data has a significant impact on the effective development of government business. The concept of government data management is gradually put forward. As an important issue in the era of big data [9], it is the in-depth development of government information management under the background of big data. Some government agencies also learn from the model, strategy

and technology of enterprise data management to establish the management mode of organizational data.

At present, the concept of data management is relatively clear, but there is no clear definition of government data management. In recent years, researches on big data service at home and abroad are mostly from a single disciplinary perspective. The macro, medium and micro levels are separated from each other and lack of demand-oriented targeted research [2]. Based on big data, a new digital government model of “data floating upward, sharing convergence, service sinking, on-demand efficiency” has been formed. It can not only improve the efficiency of government work, but also realize the optimization and precision of government decision-making through data analysis, and promote the construction of service-oriented government.

2 Research Route

Data management originated in the field of enterprise management, and government big data service is an extension and expansion of data management. Government big data management and data management are inextricably linked. IBM defined data management as a quality control discipline [6]. Data management is used to add new rigor and discipline to the management, use, improvement, and protection of organizational information. DGI believes that data management refers to the allocation of decision rights and related responsibilities in enterprise data management. In short, data management is not a technical application, but a set of policies, organizations, standards, and guidelines.

2.1 Key Factor Analysis

The purpose of this study is to provide a comprehensive integration, adaptive and knowledge-based management rule system for government big data service. Then it provides a digital management mode of convenience service and security guarantee for data-driven public service and social management modernization. It can promote the sustainable development of data economy and digital society. To this end, the overall research process is formulated according to the basic scientific research logic of “problem raising - analysis - solution - feedback”.

2.2 Key Influencing Factors

Through field research, literature analysis and other methods, the components of advanced big data service are summarized and refined. Through questionnaire survey, data analysis of government affairs websites and other methods, the paper studies the progress of the construction of “Internet + Government service”.

Based on the actual situation of Shandong province, the influence model of key elements of big data service is defined from the perspectives of strategic planning, institutional guarantee, organizational guarantee, technical architecture, data management and management ability, so as to understand the status quo of big data service in Shandong and find the shortcomings and shortcomings. The key influencing factors of big data

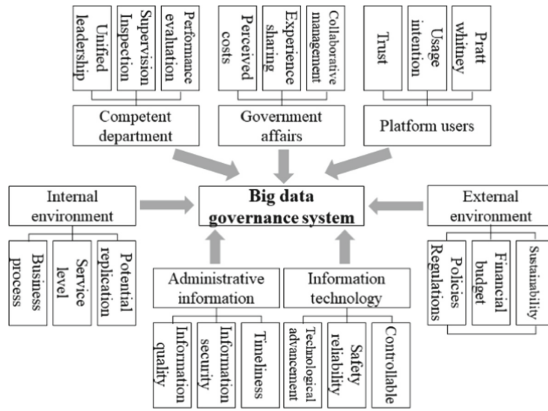


Fig. 1. The model of the influence factors of big data service.

service are studied through comprehensive analysis and other methods, and the mechanism of big data service construction is studied by focusing on government resources and support, social demand and regional economic development, and the path of big data service construction is established.

2.2.1 Influence Factor Action Model

Through field research and policy text analysis and other methods, this paper analyzes the development status of big data service in Shandong Province, focusing on data quality, institutional process, implementation ability and other aspects.

Centering on the integration, sharing and open application of government data, as well as the requirements of high efficiency and facilitation of government service, this paper theoretically discusses the realistic basis, principles and characteristics of big data service from the perspective of service-oriented government. On this basis, from the perspectives of driving factors and hindering factors, based on multidimensional dimensions such as data layer, organization layer and environment layer, the mechanism of various influencing factors under the existing mode is studied, and the action model of influencing factors is proposed (Fig. 1).

2.2.2 Theoretical Framework

Based on the research on the key influencing factors of big data service and the mechanism of creating big data service, it focuses on the characteristics of multi-source, heterogeneous, massive and changing roles of data management.

The goal is to realize the organic connection and interaction of decision-making, execution and supervision within government organizations, and to promote the creation of big data service. Through different means such as accelerated optimization and route reconstruction, and combined with the theoretical framework of “technology-organization-environment”, the methodological guidance of big data service construction is formed.

The case study of Guizhou and other provinces with good big data service was carried out, focusing on the specific practices of the governments in these regions in promoting the construction of big data service. Combined with the actual situation of Shandong province, this paper puts forward the mode and method suggestions for building big data service centering on the key influencing factors and mechanism of big data service construction.

2.3 Big Data Service of Shandong Province

The research framework is divided into “two directions, a mapping and a main line”.

2.3.1 Study on the Influencing Factors of Government Data Management

Through literature analysis and field research, this paper studies the components of a government data management system and extracts the key influencing factors of government data management. The factor model is established from the dimensions of demand identification and service capability. This paper made a scientific and objective evaluation on the current government data management system of Shandong Province to analyze the current situation and seek for the optimization method of government data management system.

2.3.2 Analysis of Key Factors in the Development of Big Data Service

Through expert interviews and material research, the status quo of big data service in Shandong province is fully understood. We investigated and analyzed the advanced experience and excellent cases of big data service construction at home and abroad. Then the technical advantages of big data service construction was formed.

Based on the development status of big data service in Shandong and the development experience of Zhejiang and Guizhou in related fields, typical cases are sorted out and shortcomings are analyzed. Based on the internal data operation, organizational management and external application environment of government service, this paper proposes the driving factors and hindering factors that affect big data service, establishes the model of key factors for development, and analyzes the mechanism of action.

2.3.3 Mapping Relationship Between Big Data Service and Government Data Management System

Based on the characteristics of big data and government data management, the relationship between big data and data management is systematically analyzed through comprehensive analysis methods. By studying the mechanism of creating big data service, mapping relationships are established.

From a practical point of view, the construction of big data service in Shandong Province mainly includes three main modules, namely collaborative planning, process implementation and monitoring and evaluation, as well as basic modules (Fig. 2).

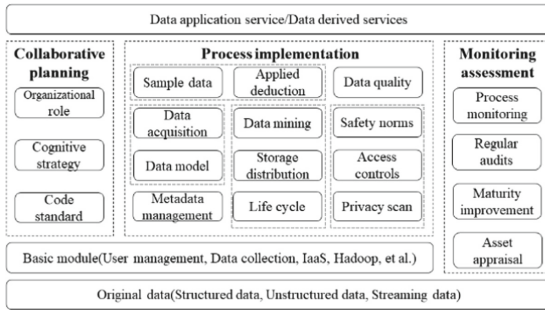


Fig. 2. Big data service of Shandong Province.

2.3.4 Implementation Path of Government Data Management

Based on the mapping relationship, the methodology of big data service construction path is constructed. With the goal of creating big data service, based on the requirements of Shandong Province’s policy documents and actual development, and in view of the current situation of big data service construction, countermeasures and suggestions are put forward to promote the construction of big data service.

Based on the management elements of collaborative innovation of information resources, through literature review and investigation and research, this paper analyzed the attribute characteristics of big data itself, management subjects and transformation characteristics of management process. Based on collaborative innovation theory, public value theory, digital continuity theory and pluralism, the ecological environment of government big data service rule system is constructed from three dimensions, namely big data supply management system, big data resource guarantee management system and big data resource service management system (Fig. 3).

2.4 Government Big Data Processing System

The “Internet + government” model promoted by China in recent years has accelerated the development of typical government big data formats such as e-government and digital government [10]. The construction of government big data platform is still in the initial stage of promotion, and the management of various aspects is not standardized, and the relevant national standards are not complete [13]. Considering the limitations of Shandong government’s big data in resource management, analysis technology, system operation and value mining, this study constructed a support service platform. This platform was based on data warehouse technology and was oriented to data analysis application requirements. The platform was pragmatic, user-focused, sustainable and scalable (Fig. 4).

2.4.1 Overall Architecture

Big data warehouse needs to realize the four core functions of “data management, data storage, data calculation and data application”, providing important support for information interaction, resource sharing and value mining of existing major platforms.

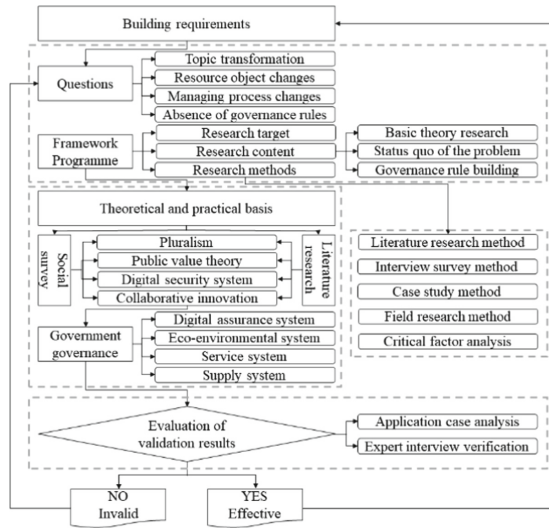


Fig. 3. The technical route of constructing big data service management system.

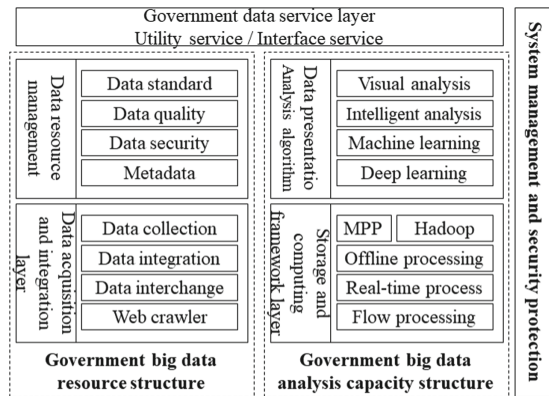


Fig. 4. Government big data processing system.

The overall architecture was composed of four parts: macroeconomic data theme, big data warehouse hardware environment, big data warehouse supporting software, standard specifications and management system. The project established a data topic and several sub-data topics and data models. Data topics were the basic standard of data storage classification, as well as the basic support of data management, data calculation, data exchange, data security and data application. As an infrastructure layer, the hardware environment of big data warehouse included server cluster, network system and other hardware facilities. The big data warehouse support software layer was divided into storage computing layer, application support layer and business exchange layer according to functions (Fig. 5).

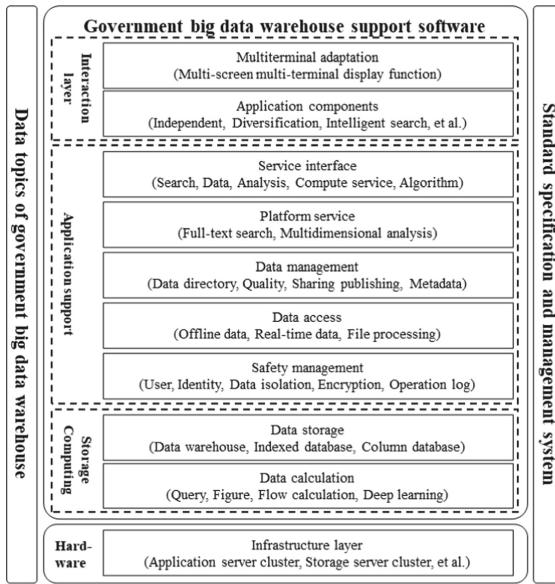


Fig. 5. Shandong government big data warehouse overall architecture.

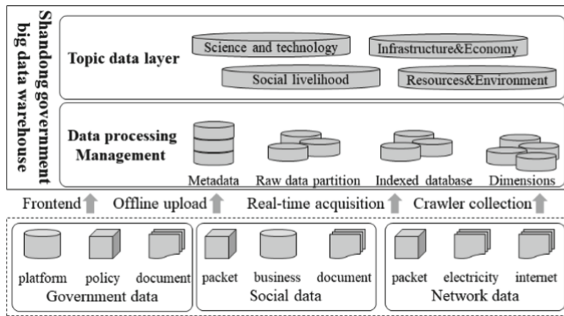


Fig. 6. Data architecture of Shandong Government's big data processing support service platform.

2.4.2 Data Architecture

The data architecture of Shandong Big data processing support service platform was mainly reflected in data processing, data analysis, resource management, system operation and other aspects (Fig. 6).

Shandong Big data processing support service platform could read and construct physical and chemical cubes from original data partition and establish multidimensional analysis database through multidimensional analysis service according to the demand of index analysis, analysis report and situation prediction. According to the search demand, through the search service, index database and the search and multidimensional analysis database were build.

In terms of government big data resource management, data warehouse bring together government data, Internet data and social data. According to different conditions and different scenarios, data collection was realized through warehouse data access layer. In view of different types and sources of heterogeneous system data, data packets and filled files, the warehouse data access layer adopted pre-system channel access, real-time collection, crawler collection and offline upload, etc. After all kinds of data were processed in the warehouse data management layer, metadata storage and original data partition storage were realized.

By combining the business function and application product demand, it has constructed multi-field and multi-type analysis subject database of economy, environment and resources, social livelihood, science and technology education, infrastructure and information.

2.4.3 Core Functions

In the construction of big data platform for government affairs, the main work involved was the integrated management of big data platform [7]. A comprehensive strategy was generally adopted for data processing. Unstructured data used Hadoop technology, while structured data used data warehouse technology. The construction process formed a standard system, including management system, standard norms, data standards, etc. Cloud platforms were usually used to host data and business systems of various departments. The migration of department business information system was the key sign of successful construction.

3 Suggestions

Big data service is a complex system engineering, aiming at data sets with huge volume, different sources and different formats. Moreover, the business relationships between different data subsets are complex. It is difficult to complete metadata system, improve master data quality, or ensure data security overnight, [5] and requires gradual and continuous iterative improvement.

3.1 Information Sharing

Information island is a prominent problem in government governance, especially in the process of government information construction. To solve this problem, the first step is to get rid of departmental departmentalism and treat the collection and application of big data with a systematic thinking and an open and inclusive concept.

3.2 Data Integration

The precise use of big data inevitably requires the optimization of government processes [4]. Therefore, after removing information barriers, it is necessary to provide strong support for the accurate use of big data and government governance by reengineering and optimizing government processes.

3.3 Data Information Security

While the precise use of big data brings strong support to government governance, it also brings information security and data ethics problems. This means to pay attention to the security of data information. In general, to find a balance between the accurate application of big data and information protection, we should neither block the accurate use of big data because of the “possible” risk of information leakage, nor open the data “without reservation” because of the need for data, ignoring the necessary data security barrier construction. Therefore, data security should be placed in an important position.

4 Conclusions

Big data service are an indispensable part of the era of big data [3]. The rise of “digital China” and “smart cities” provides a new scene for government governance [12]. This not only promotes the application of new technologies in the government big data service, but also brings unprecedented impact and development opportunity for our local government administrative system reform and management mode innovation.

The big data service management system of Shandong Province constructed in this paper keeps up with the demand and provides direction and verification ideas for the government’s big data service practice. It provides theoretical guidance and practical basis for the establishment and improvement of Chinese government big data service. It should be noted that government big data service are not static [11]. While grasping the key elements, the government can adjust the content according to the regional development background.

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