On the Establishment of the Government Chief Data Officer System: With Discussion on the Big Data Bureau Model and Operational Mechanism (Postprint)

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Abstract

[Purpose/Significance] The organizational structure of government data governance constitutes a critical determinant of both the effectiveness of government digital governance and the efficiency of data development and utilization. A comparative analysis of the government Chief Data Officer system and China's Big Data Bureau model can furnish valuable references and insights for deepening the reform of China's government data management system. [Method/Process] Through extensive textual analysis and comparative analysis, this study systematically examines the connotations and functional positioning of the foreign government Chief Data Officer system and the government Big Data Bureau model, with particular emphasis on comparing their operational characteristics across dimensions including government data authority structure, cross-departmental data communication, team-based operation, and diversified operational mechanisms. [Result/Conclusion] This paper explores the intrinsic logical relationship between China's Big Data Bureau model and government data governance, and summarizes the practical innovations of China's Big Data Bureau model, encompassing the centralization of responsibilities and authority, the consolidation of authority execution, the clustering of work networks, and the concentration of resource deployment. Through comparative analysis, it proposes that China's Big Data Bureau model should further enhance its performance in optimizing and clarifying responsibility objectives, overall layout of authority structure, and strengthening the implementation of data-driven government construction, building upon the experience of the Chief Data Officer system.

Full Text

Preamble

Establishing a Government Chief Data Officer System: With Discussion on the Big Data Bureau Model and Operational Mechanisms

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Abstract: [Purpose/Significance] The organizational structure of government data governance is a critical factor affecting the effectiveness of government digital governance and the benefits of data development and utilization. Comparing the government Chief Data Officer system with China's Big Data Bureau model can provide useful reference for deepening China's government data management system reform. [Method/Process] Through extensive text analysis and comparative analysis, this paper systematically examines the connotation and functional positioning of foreign government Chief Data Officer systems and the Big Data Bureau model, focusing on comparing their operational characteristics in terms of government data power structure, cross-departmental data communication, team-based operations, and diversified operational mechanisms. [Result/Conclusion] The paper explores the inherent logical relationship between China's Big Data Bureau model and government data governance, and summarizes the practical innovations of China's Big Data Bureau model, including the centralization of responsibilities and authority, intensification of power operation, clustering of work networks, and agglomeration of resource operations. Through comparative analysis, it points out that China's Big Data Bureau model should, based on absorbing the experience of the Chief Data Officer system, further improve in terms of optimizing and clarifying responsibility objectives, overall layout of authority structure, and strengthening the implementation of data-driven government construction.

Keywords: Government Chief Data Officer; Big Data Bureau; Government Data Governance; Organizational Structure; Digital Government

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2. Connotation and Operational Patterns of the Government Chief Data Officer System

The Chief Data Officer position first emerged in the private sector, where early CDOs were defined as senior executives responsible for data quality management within organizations [2]. The 2008 global financial crisis prompted the adoption of data-driven approaches to prevent financial risks, bringing CDOs into the mainstream of various institutions [3], with their responsibilities continuously expanding. Scholars have summarized that CDOs should be responsible for organizational data governance, including data quality, data analysis, business intelligence, data management, and system and data security and privacy pro-

tection, moving toward the top of the organizational hierarchy [4]. Compared with corporate CDOs, "the role of government CDOs aims to promote data sharing and transparency, improve data-driven decision-making, while protecting data confidentiality and privacy. The full utilization of government data can enhance organizational performance and success, making data managers crucial in maximizing the value of this strategic asset" [5].

The United States was the first country to appoint government CDOs. In 2011, the City of Chicago established the first municipal CDO, and in 2013, the Federal Reserve Board appointed the first CDO at the federal government level. In conceptualizing the government CDO role, the federal open data program describes it as a hybrid position combining multiple roles: "part data strategist and advisor, part data quality improvement steward, part data sharing evangelist, part technology expert, and part new data product developer" [6]. In January 2019, President Trump signed the *Foundations for Evidence-Based Policymaking Act*, which stipulates that "the head of each agency shall designate a non-politically appointed career employee as the agency's Chief Data Officer" [7].

2.1 Basic Positioning of the Government Chief Data Officer System

The exponential growth of data volume and the complexity of data governance have prompted further reflection on data power distribution and the utility of different stakeholders in government digital transformation [8]. The emergence of the government CDO system is a product of adjustments to government data management patterns, reforms in data management organizational systems, and the development of digital government. The responsibilities and tasks vary across different stages and types of government agencies:

(1) **Phased differences in responsibilities and tasks.** Early government CDOs' work was more compliance-oriented, focusing on data support for government activities as arranged by government leaders, including data quality, data aggregation and supply, while emphasizing and enhancing the role of data value in government activities. They were aptly described as "the ultimate data matchmakers, with a vision to bridge the gap between data producers and data users, creating new opportunities for innovation and enhanced citizen engagement and collaboration" [9]. With the development of e-government, particularly the advancement of open government data, government CDOs have "rocketed to the moon in terms of importance" [10], with their responsibilities further expanding and connecting more closely with government work, directly leading data-driven government transformation with greater initiative, voice, and influence. The 2019 U.S. *Foundations for Evidence-Based Policymaking Act* details 11 responsibilities for government CDOs, including promoting data management best practices, guiding data asset value creation, conducting interagency data coordination, and fostering a data culture, covering the entire lifecycle of government data management. Some have enthusiastically

called them "government big data heroes" [11].

(2) **Different agencies have different focuses in their role positioning.** Empirical research by American scholars found that no two government department CDOs have identical responsibilities, yet all play the role of data leaders, with data management as their foundational activity (see Table 1). Overall, CDOs at the central government level differ significantly from those at the state and municipal levels. The former focuses more on macro-level data strategy implementation, emphasizing overall planning of data, formulation of regulations, policies, and standards, follow-up on major data projects, assessment of data governance maturity, and coordination of data relationships. The latter faces greater diversity in data types and demands, undertaking basic tasks such as operating data portals, establishing and using data warehouses, conducting data mining and analysis, and managing master data [12], while being responsible for realizing government data value, implementing data security and privacy protection, and data regulation. They place greater emphasis on promoting intra-departmental data governance tasks and solving complex data problems. Additionally, different agencies may have slight variations based on actual conditions. For example, in 2014, the Los Angeles mayor stated that the CDO's goal was to manage data and establish "a culture of innovation and excellence driven by data" [13]; while the mission of Chicago's CDO Office is "to use data to improve the quality of life for city residents and enhance city operational efficiency" [14].

2.2 Operational Characteristics of the Government Chief Data Officer System

Scholars believe that the CDO's role space within an organization depends on the three-dimensional intersection and mutual influence of data work collaboration direction (inward or outward data management), data space (big data or traditional data), and value function (service-oriented or strategy-oriented) [16]. The implementation of the CDO system requires a smooth decision-making command system and a clear division of labor and cooperation framework, constructing an organizational model that breaks through tradition and operates efficiently in terms of organizational structure, operational mechanisms, and management methods.

(1) **Optimized and enriched data governance power system.** The CDO's position in the government power system is crucial for ensuring the fulfillment of their responsibilities. For data-driven public sectors, "CDOs with a strategic vision for data governance, when fully authorized, can rely on soft and hard policy levers to effectively coordinate various central government ministries and synchronously implement structurally sound policy objectives (including open government data)" [17]. Compared with traditional data management systems, the key difference of the CDO system lies in the discourse power over major data issues. CDOs

not only directly participate in high-level decision-making, propose planning solutions and regulatory policy implementation recommendations on data development and utilization issues, and are accountable to leadership, but also strengthen inter-departmental data governance coordination and work linkage through various forms such as CDO councils, CDO committees, and roundtable meetings. They improve specialized management positions such as data stewards and data analysts within departments, ensure high integration of data responsibilities and business work, and form a well-defined, vertically and horizontally connected, and tightly linked government data governance organizational structure system (see Figure 1 [Figure 1: see original paper]), thereby effectively ensuring that the execution tentacles of the government data governance system can reach both vertically to the bottom and horizontally to the edges.

(2) **Cross-departmental coordination mechanisms.** Coordinating cross-departmental data activities is a major difficulty and pain point in government data governance. Permanent institutions or cooperation networks composed of CDOs from various agencies play an important role in promoting inter-departmental data cooperation and ensuring long-term sustainable results. The U.S. *Federal Data Strategy and 2020 Action Plan* proposes the establishment of a Federal CDO Council to coordinate cross-departmental data flows, unify standards, and promote inter-agency data sharing agreements [18]. The Canadian government supports and authorizes CDOs to strengthen horizontal cooperation with Chief Information Officers and other government departments to build cross-departmental data management capabilities [19]. Constructing and operating a government data development and utilization responsibility system across regions, departments, and fields in a complex social network environment requires accurately grasping the essential attributes, structural characteristics, and operational mechanisms of the government CDO system (see Table 2). This involves not only the alignment of data systems such as licensing, openness, and privacy protection across different agencies, but also the unification of technical parameters, metadata standards, data formats, and other data specifications, as well as the interconnection of data activities. The essence is to coordinate the data demands of all parties and balance horizontal collaboration with vertical accountability relationships.

(3) **Well-structured team collaboration system.** Team-based operation is the basic operational form of the CDO system. Generalists who understand both government business and have strong analytical capabilities are the core team members, mainly engaged in business process analysis, data analysis, data visualization, data modeling, and performance analysis. Generally, CDOs establish and deploy teams with different professional skills, adopting a combination of professional line management and project line management to ensure seamless connection of business processes. For example, Chicago's CDO Office consists of four parts: an Advanced Analytics Team, an Open Data Team, a Business Intelligence

Team, and a Data Management Team. The Advanced Analytics Team focuses on operating data analysis platforms, the Open Data Team manages the government data portal, the Business Intelligence Team provides user interfaces for city hall staff, and the Data Management Team manages various municipal databases in Chicago [21]. The CDO of the U.S. General Services Administration concluded: "Our success depends on bringing together a talented and diverse workforce, including data scientists, real estate experts, architects, procurement specialists, technology experts, and policy analysts, to build a cohesive, customer-centric team" [22]. Additionally, outsourcing data projects through crowdsourcing with universities, research institutions, and enterprises is also an important aspect of their team-based operation.

(4) **Flexible and diverse operational models.** A survey of the administrative affiliation of U.S. government CDOs shows that 38.8% report to Chief Information Officers, 5.9% to Chief Technology Officers, 3.5% to Chief Executive Officers, 7.1% to department heads, and 34% to other department heads [23], indicating diversified administrative operational characteristics of the CDO system. Some focus on network information technology and platform development, others on data analysis and business intelligence applications, and still others on data-driven evidence-based decision-making. Different focuses directly affect the scale, structure, division of labor of CDO teams, and their cooperation methods with other departments. The models are mainly divided into centralized, decentralized, and hybrid types, mostly centralized, that is, as direct subordinate agencies of administrative heads or Chief Information Officers, coordinating the organization and management of government data activities. However, which type to adopt depends on multiple factors such as the CDO's role positioning, resource facilities, supporting conditions, and management capabilities of government departments.

"To be more effective, CDOs may need input from the private sector and policy guidance to provide help and support" [24]. Limited by data skills, financial resources, and other constraints, market-oriented or public welfare operations have become necessary supplements to the CDO operational model. City CDOs in the U.S. are often small teams responsible for urban data service operations, with the vast majority establishing partnerships with institutions outside the government system. New York's Mayor's Office of Data Analytics is an internal analytics consulting company that connects with the Mayor's Office through a Chief Analytics Officer (i.e., the Director of the Data Analytics Office), while Chicago's CDO has established close cooperative relationships with enterprises and receives free financial support from them.

3. Logic Design and Operation of China's Big Data Bureau Model

Since the 18th National Congress of the Communist Party of China, the establishment of Big Data Bureaus by local governments has been a noteworthy new trend in institutional and administrative system reform [25]. After reviewing the institutional reform plans of 31 provincial-level administrative units (excluding Hong Kong, Macao, and Taiwan) and 334 prefecture-level administrative units in China, scholars found that 17 provinces (municipalities) and 203 cities (prefectures, leagues) have established specialized big data management institutions [26]. As a highlight of this new round of government institutional reform, the establishment of Big Data Bureaus is not a simple addition of government agencies, but rather reflects China's government data management moving from singular industry management toward integrated functional management, implemented through role positioning, power operation, and work mechanisms. Essentially, the basic logical starting point of the Big Data Bureau model is the overall governance of government data business and the comprehensive realization of data utility value, with the core being the establishment of a logical connection and methodological approach between the data management organizational system and government data governance. Its institutional design, operational characteristics, and foreign government CDO systems are highly consistent.

3.1 Logical Connection Between the Big Data Bureau Model and Government Data Governance

Data governance is a complex task, and past government data governance projects often failed [27]. Among these, isolated and fragmented organizational management systems characterized by decentralized authority and data blockades have become major obstacles to China's government data development and utilization. The reason why the Big Data Bureau model has gained high recognition and rapid promotion from provincial and municipal government departments is closely related to its data philosophy, value pursuit, and goal orientation.

(1) **The Big Data Bureau model is the organizational manifestation of government data governance philosophy.** From the institutional naming perspective, titles such as "Big Data Development and Management Bureau," "Data Resources Management Bureau," and "Big Data and Government Services Management Bureau" not only imply that government departments aim to coordinate the management of big data resources, but also indicate a high emphasis on the development of government data resources. Compared with singular, departmentalized government data management, although both need to perform data management functions, the former treats data as government assets and nerve centers, following data thinking principles of openness, sharing, value, and collaboration, pursuing data-driven decision-making and digital public services,

while taking into account the value demands of the market and society for data products. Traditional data management systems, limited to the instrumental rationality of data, focus on specialized management of data collection, processing, and storage, concentrating on specific solutions to micro-level issues such as data formats, standards, and quality for data opening and cross-departmental data sharing, lacking holistic consideration of government data development and utilization in complex environments, with limited integration between data management and administrative work.

(2) **The Big Data Bureau model is the operational carrier of government data governance practice.** Overall, the functional positioning of local Big Data Bureaus focuses on determining the philosophy, strategy, and action plans for government data governance, solving data management issues such as collection, transaction, and opening formats, standards, and technologies, expanding the application of data-driven management and services in fields such as transportation and urban comprehensive governance, being responsible for the operation and maintenance of government data infrastructure such as public data platforms, and carrying out digital industry planning and guidance, as well as addressing related issues such as data security, privacy protection, and e-government. The design of responsibilities and tasks reflects holistic thinking in data philosophy, that is, implementing holistic deployment and integrated construction of government data opening, integration, and sharing through integrated power operation. On the one hand, it strengthens digital government construction, breaks through existing departmental resistance in data management, achieves optimization of data power within the government system, and promotes overall planning and integrated utilization of data resources. On the other hand, it relies on the government's strong resource allocation and social mobilization capabilities to extend data development and utilization power to more enterprises and society, cultivating new types of market entities and activating the development of the data economy and the acceleration of smart society construction.

3.2 Operational Characteristics of the Big Data Bureau Model

(1) **Centralization of functions and tasks.** Compared with the fragmented government data management hierarchy system, the Big Data Bureau model strengthens the comprehensiveness of data management responsibilities, optimizing and consolidating data management authority previously dispersed across multiple departments such as the Development and Reform Commission and the Economic and Information Commission, and granting corresponding administrative levels, powers, and resources to form a unified framework for data macro-leadership, decision-making, execution, and supervision (see Figure 2 [Figure 2: see original paper]). This institutional design avoids phenomena of unclear responsibilities and

multiple authorities, facilitating the establishment of a government data governance organizational management system with unified standards, vertical and horizontal coordination, and efficient operation. Meanwhile, unlike foreign government CDO systems, China has not subdivided roles such as Chief Information Officer, Chief Technology Officer, or Chief Security Officer. Therefore, the Big Data Bureau model not only has more functions and greater authority in overall layout and macro-level data governance planning, with more powerful resource allocation rights and more authoritative administrative disposal capabilities, but also has more direct administrative intervention and command scheduling in managing data resources and promoting data development and utilization.

(2) **Intensification of power operation.** On the one hand, it vertically connects all aspects of data collection, processing, transmission, reuse, and storage, and horizontally seamlessly connects various business facets such as data planning and data quality, forming a closed-loop data value chain management cycle that is end-to-end connected and cyclically smooth. Currently, local Big Data Bureaus have initially established comprehensive work systems and business process management methods. By improving institutions and standardizing departmental division of labor, they have strengthened vertical allocation and internal constraints of data power, achieving parallel progress in multiple fronts such as data opening and sharing, data asset development, data security management, and platform operation, avoiding the inefficiency of previous campaign-style data management. On the other hand, to promote barrier-free flow and intelligent application of government data, Big Data Bureaus have made breakthroughs in intensive management. First, they have achieved intensification of governance tools, implementing comprehensive application of political positioning, administrative constraints, economic incentives, atmosphere creation, legal means, and technological iteration. Second, they have achieved intensification of data chain management, that is, breaking down the long-standing practice of segmented management by data business departments, conducting integrated consideration of data quality, security, privacy, data-driven decision-making, and asset development with data sharing and business collaboration as goals, and carrying out process reengineering, such as using intensive data platforms to implement classified implementation and collaborative processing of government data resource library development, intelligent management, interactive communication, data opening, and online services. Third, they have achieved intensification of data resources, completing comprehensive aggregation and full-process processing of government data resources through compiling government data resource catalogs and open catalogs, conducting centralized management of data resources, and building basic government resource databases.

(3) **Clustering of work networks.** Cross-departmental data flow and opening are bottlenecks in government data governance worldwide. The Big

Data Bureau model has conducted beneficial explorations in balancing data interests of all parties and promoting multi-stakeholder data governance collaboration (see Figure 3 [Figure 3: see original paper]). First, it establishes normalized cross-departmental work coordination mechanisms under the name of Big Data Development Leading Groups or Digital Government Construction Leading Groups and special working groups, building a macro-leadership network for overall data planning. Second, it adapts to the openness and diffusion characteristics of data distribution structure and transmission methods, strengthening both the work linkage between Big Data Bureaus and relevant business departments such as economic information, cyberspace administration, and public security, forming a collaborative negotiation network that connects top and bottom and cooperates horizontally in meso-level guidance regarding data acquisition methods, format standards, and process specifications. It also uses internal and external data sharing platforms to promote the application of data-driven governance in industry management such as finance, industry and commerce, and transportation, clarifying the rights and responsibilities of relevant departments in data exchange, storage, and utilization processes, and continuously expanding the government data work network. Third, at the grassroots and end-level data governance, it actively establishes business cooperation links with enterprises, institutions, and social organizations that connect top and bottom and support each other, incorporating various social entities into the full lifecycle management of government data development and utilization, establishing a relatively tight data exchange and integration mechanism with society, and promoting the government data governance organizational structure to become grid-based and flattened.

(4) **Agglomeration of resource operations.** Scholars have pointed out that unlike comprehensive management departments such as development and reform, finance, and human resources and social security that focus on resource allocation, coordination in data governance requires resource concentration or redistribution, thus necessitating more powerful administrative arrangements [28]. From the actual operation perspective, sufficient administrative authorization, corresponding administrative levels and staffing, necessary investment in infrastructure and digital projects have endowed Big Data Bureaus with due administrative resource allocation capabilities and government influence. At the same time, the administrative approval power, inspection and evaluation power of government performance or service quality, operation rights of data portals and "one-network 通办" platforms, and government data talent training and data skills training power possessed by some local Big Data Bureaus can objectively and rapidly form institutional resource aggregation advantages, effectively assembling necessary human, financial, and material resources from inside and outside the system, and accelerating the aggregation and integration of data resources. Of course, establishing data rights confir-

mation, classification, circulation, and transaction mechanisms, as well as using contract outsourcing, data project crowdfunding, hackathons, and data utilization competitions are not only effective methods for the diversified resource agglomeration of Big Data Bureaus, but also necessary ways to enhance the breadth and quality of data resource agglomeration and promote data sharing and co-governance with enterprises and society.

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4. Shortcomings and Improvements of China's Big Data Bureau Model

As a carrier form of government data governance organizational model innovation, the government CDO system and the Big Data Bureau model tend to be consistent in many aspects such as institutional mission, functional authority, structural elements, and operational methods, all following the holistic, systematic, and global laws of data governance, and strengthening the functional positioning of overall management and comprehensive utilization of government data. The two systems reflect the common characteristics of government data governance organizational operation in terms of logical thinking of position setting, responsibility space, and work methods, exploring institutional and mechanism approaches to transforming data advantages into governance effectiveness to achieve government data empowerment.

Of course, different national conditions and administrative traditions determine that while adhering to common laws, there are also trends of differentiated development. For example, the CDO system, following a decentralized model, has relatively simple authority and functions, flexible operational methods, and focuses more on government data platform operation and the supply of data-driven government services. Overall, China's government Big Data Bureau model has a higher degree of organization, more concentrated functions and authority, more complex objectives and tasks, and stronger resource allocation capabilities, while the supporting holistic implementation architecture, integrated governance capabilities, and data culture cultivation and social support participation have not yet kept pace. Therefore, while fully absorbing and learning from the experience of the government CDO system, it is necessary to improve and surpass it in institutional design and organizational structure based on actual conditions.

4.1 Responsibility Objectives Need Optimization and Clarification

Big Data Bureaus play a crucial role in connecting top and bottom in the data governance organizational system, and need to achieve a transformation from specialized/professional management institutions for government data to comprehensive management institutions for data governance in terms of institutional positioning. On the one hand, it is necessary to conduct comprehensive construction of responsibilities and tasks. Although "broader authority integration is more conducive to building a unified data management system, with certain

human and financial resources, Big Data Bureaus may also lose sight of other priorities" [29]. Currently, whether through reorganization, adding signs, or establishing subordinate agencies under government departments, the responsibilities and authority of Big Data Bureaus have been expanded and consolidated to varying degrees on the basis of inheritance. For example, incorporating privacy and data security responsibilities into the jurisdiction of Big Data Bureaus means demarcating boundaries with cyberspace administration and public security to avoid functional ambiguity and disconnected rights and responsibilities. Another example is that many provincial Big Data Bureaus undertake tasks far beyond the scope of government internal data management, such as promoting information construction and digital economic development, requiring further clarification of responsibility boundaries with development and reform, industry and information technology departments. On the other hand, it is necessary to enhance and refine the operability of responsibilities and tasks. Functional reorganization and transformation inevitably weaken the original data resource acquisition and flow allocation authority after the independent operation of Big Data Bureaus, requiring reshaping of data governance logic and structure, and refined institutional design of management objects, business processes, data resources, and application software. At the same time, as data issues become increasingly closely associated with various business work within the government system, it is necessary to replan and redesign the roadmap for work advancement, including both standardizing specific data governance matters with intensive and integrated thinking and clarifying responsibility lists.

4.2 Authority Structure Needs Overall Layout

The authority structure has a significant impact on the fulfillment of government data functions, involving issues of conceptual transformation, behavioral change, and specific methodology. First, the data power operation system needs to transform from top-down unidirectional flow to multi-dimensional circulation with vertical and horizontal connectivity. Currently, the administrative level and influence of local Big Data Bureaus are insufficient to command and coordinate different types of government business departments. Many provinces have not yet established special working groups such as digital government construction cross-departmental leading groups, and normalized communication mechanisms are missing. To advance work, Big Data Bureaus should both inherit and utilize government authority to promote data business and avoid the problem of insufficient horizontal communication and weak vertical interaction caused by excessive reliance on vertical power. It is necessary to follow the example of government CDO committees and data steward workshops to balance data interests of all parties and establish a powerful central agency capable of comprehensively coordinating data work of all government departments, in order to achieve synergy in work concepts, objectives, policies, tools, and standards regarding data quality, data flow, and interest compensation.

Second, data power operation should shift from power-based to responsibility-

based, and from administrative space to social space. In other words, while relying on administrative power to strengthen overall data business coordination, it is necessary to highlight that data governance is driven by citizen needs and guided by the responsibility to serve the modernization of national governance capabilities. Strengthening the responsibility-based approach does not reduce the status and influence of Big Data Bureaus in government data governance, but rather represents an objective requirement for transforming the leadership style of data governance from the overall interests of data development and utilization. It also means that on the basis of overall planning for data resources and building a synergistic government data business system with coordinated policies, standards, management, and platforms, it is necessary to improve power operation, transform power flow from command-oriented to open cooperation-oriented, increase regulatory means from single administrative orders to the necessary parallel use of market mechanisms and social autonomy for data economic development, transform power circulation structure from rigid and closed to open and flexible, and form a holistic data governance organizational pattern with multi-stakeholder and multi-departmental collaboration led by Big Data Bureaus, as shown in Figure 4 [Figure 4: see original paper].

4.3 Data-Driven Government Governance Needs Strengthened Implementation

The ultimate goal of establishing or forming government Big Data Bureaus is not only to develop and utilize government data resources, but also to implement the national big data strategy and enhance government digital governance capabilities. Compared with foreign governments that use the CDO system to strengthen government decision analysis and public service supply, the business of China's local Big Data Bureaus focuses more on the disclosure, processing, and development and utilization of data resources for the data economy, with some gaps in promoting data analysis within government departments and optimizing data-driven decision-making and services (see Figure 5 [Figure 5: see original paper]). Therefore, it is necessary to learn from the practices of major U.S. city government CDO teams, establish close connections with relevant government business departments, embed professional personnel such as data scientists as expert advisors into the core business of various departments, cooperate to identify key issues and task requirements for data governance, and provide data-driven insights and professional knowledge guidance [31]. In departmental scenario applications, it is necessary not only to promote government departments' value perception and correlation analysis of data, improve evidence-based decision-making processes, and enhance the precision of government services, but also to use efficient data management to strengthen intelligent management of government officials and improve work efficiency. At the same time, they also bear the obligation to shape the government data ecosystem, and need to take new actions in conducting civil servant data skills training, advocating a data sharing culture, and optimizing government data analysis practice processes.

In summary, as an active exploration to deepen the reform of the government data management system, the Big Data Bureau model can not only effectively organize and orderly carry out the entire lifecycle management of data within the government administrative system, but also widely mobilize social participation, guide the data economy, and promote data sharing. Facing the multiple expectations placed on the Big Data Bureau model by all parties in the government, society, and enterprises in the digitalization process, and based on learning from foreign government CDO systems, it is necessary to conduct objective reflection and prudent adjustment of the functional tasks, power operation, and practical effects of local Big Data Bureaus to ensure that their data governance capabilities match their functional positioning and that operational mechanisms adapt to authority requirements, thereby building an efficient and collaborative government data governance organizational system with Chinese characteristics.

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Note: Figure translations are in progress. See original paper for figures.