Postprint: Cross-departmental Government Data Governance Framework Construction from a Data Sharing Perspective

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Abstract

[Purpose/Significance] Cross-departmental government data sharing faces enormous challenges, characterized by data isolation among departments and slow progress in data sharing. The introduction of cross-departmental government data governance can facilitate the sharing of government information resources and enhance both government service levels and the satisfaction of service recipients. Related practices in cross-departmental government data governance urgently require guidance from scientific theories. [Method/Process] First, the meaning of government data governance is analyzed and defined, existing data governance frameworks are summarized and discussed, and then the particularities of government data governance are analyzed. [Results/Conclusion] Based on data governance frameworks with relatively high recognition both domestically and internationally, and in combination with the particularities of government data governance, this paper proposes a cross-departmental government data governance framework for China—the CGCS data governance framework. This framework comprises six components: strategic objectives, norms and standards, scope of concern, governance subjects, processes, and methods and technologies. Each component of the framework is elaborated in conjunction with China's actual conditions. Finally, an example analysis of the application of the CGCS data governance framework in cross-departmental government data governance practice is conducted to demonstrate the framework's usability.

Full Text

Preamble

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Construction of a Cross-departmental Government Data Governance Framework from the Perspective of Data Sharing

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Abstract:
[Purpose/Significance] Cross-departmental government data sharing faces enormous challenges, with data isolated between departments and sharing progress moving slowly. Introducing cross-departmental government data governance can help promote government information resource sharing and improve government service levels and user satisfaction. Related practices urgently need scientific theoretical guidance. [Method/Process] This paper first analyzes and defines the meaning of government data governance, summarizes existing data governance frameworks, and then examines the particularities of government data governance. [Result/Conclusion] Based on internationally recognized data governance frameworks and incorporating the particularities of government data governance, this paper proposes a cross-departmental government data governance framework for China—the CGCS Data Governance Framework—comprising six components: strategic objectives, norms and standards, scope of concern, governance subjects, processes, and methods and technologies. Each component is elaborated in light of China's actual conditions. Finally, an example analysis demonstrates the framework's applicability in cross-departmental government data governance practice.

Keywords: government data governance; cross-departmental; data governance framework; data sharing
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In recent years, incidents of "bizarre certificates" such as "proving your mother is your mother" or "proving you have never been married" have frequently occurred, undermining public trust in government. These absurd requirements reflect the current situation of information silos and inadequate data governance across government departments. In response, Premier Li Keqiang proposed "letting data travel more while letting citizens travel less." Although the government has recognized the importance of data sharing, practice shows that the speed and level of integration and sharing of government data vary significantly across regions and departments. While vertical systems have largely achieved data flow and sharing, horizontal cross-departmental data sharing has progressed slowly with numerous obstacles. Issues such as imperfect organizational structures, insufficient data security, inadequate technical support, low quality of shared data, and unclear definition of rights and responsibilities have all impacted cross-departmental data sharing [1]. These problems can be addressed through cross-departmental government data governance by analyzing its particularities and constructing a corresponding framework to improve the

effectiveness of government data sharing.

A review of academic research on government data governance reveals that most studies treat cross-departmental, intra-departmental, and government-external data governance as a whole without distinguishing among them. Research on cross-departmental government data governance specifically is scarce and has not received adequate attention. To fill this gap, this paper examines cross-departmental government data governance from a data sharing perspective. Based on established data governance frameworks and incorporating the particularities of cross-departmental government data governance, we propose a framework suited to China's national conditions.

2. Data Governance and Its Frameworks

Scholars have defined data governance from various perspectives. Some approach it from a management standpoint [2-4], defining data governance as the management of data assets and viewing it as the "government" of data—an extension and development of data management. K. Weber et al., referencing IT governance definitions, propose that data governance is "a framework of decision rights and responsibilities to encourage desirable behavior in data use," emphasizing the division of authority and responsibility among organizational roles [5]. Others integrate concepts from IT governance and data management, viewing data governance as a method or process for managing and maintaining data that concentrates people, technology, and processes to ensure proper use of organizational data assets [6]. Additionally, some scholars approach data governance from a data lifecycle perspective, treating it as full lifecycle management encompassing collection, organization, analysis, storage, use, and control [7-10].

Considering the development of information technologies such as the internet, cloud computing, and big data, as well as the drive for data sharing, we define government data governance as: the government's clarification of data rights and responsibilities for various roles based on data governance objectives and principles, while utilizing information technology to manage the full data lifecycle, thereby ensuring rational and effective use of government data.

A data governance framework is a logical structure that organizes the fundamental concepts of data governance (such as principles, organizational structures, processes, and rules) and their interrelationships to achieve overall strategy and objectives. It provides theoretical foundations and practical guidance, helping organizations clarify authority relationships among different roles and activities.

Internationally influential frameworks include DAMA's framework from the Data Management Association and DGI's framework from the Data Governance Institute. The DAMA framework approaches data governance from a data management perspective, positioning it as the core of data management and viewing it as "managing" data management at a high level [9]. In contrast, the DGI framework is entirely governance-focused and independent of data management [11], constructing a complete top-down data governance system.

Representative domestic frameworks include the CALib framework proposed by Bao Dongmei et al. and the big data governance framework by Zheng Daqing et al. The CALib framework presents a comprehensive view of university library data governance from three dimensions: enabling factors, scope, and implementation and evaluation [12]. Zheng Daqing et al. categorize big data governance elements into four types—objective, enabling, core, and supporting elements—and clarify their logical relationships to form a big data governance framework [13].

Literature review reveals that research on government data governance frameworks is rare, let alone frameworks for cross-departmental government data governance. Xia Yijin discusses the transition from data management to data governance in government from perspectives such as object scope, technical radiation scope, business activities, stakeholder participation, risk response, and organizational culture [14], but does not develop a systematic conceptual framework. Government agencies' unique characteristics determine the particularities of their data governance, making mature general-purpose frameworks not entirely suitable. Therefore, localized empirical research is necessary to establish a cross-departmental government data governance framework to provide theoretical and practical guidance for China's government data governance and promote open sharing and utilization of government data.

3. Analysis of Government Data Governance Particularities

As a national governance institution, the government's unique organizational characteristics fundamentally differentiate its data governance from traditional enterprise data governance. The government's more complex internal and external structures, greater policy and institutional constraints, and broader social impact create more difficulties and challenges for implementing cross-departmental government data governance. Leavitt's organizational model suggests that organizations can be described using four variables—people, structure, technology, and tasks—with strong interdependencies among them [15]. When applied to cross-departmental government data governance, these variables reveal unique characteristics:

(1) Structure: Requires vertical-horizontal integration and collaborative governance. China's government administrative structure combines vertical and horizontal dimensions ("tiao-kuai" structure). "Tiao" refers to functional departments at all levels from central to local government with identical business natures, while "kuai" refers to governments at various levels composed of different functional departments [16]. Unlike enterprise structures that serve end customers with final products, government organizational functions and tasks within each "kuai" hinder cross-departmental information sharing [17]. Cross-departmental government data governance involves multiple functional departments, making single-department data management approaches inadequate for data sharing needs. Therefore, cross-departmental government data

governance requires vertical-horizontal collaborative governance, forming a top-down integrated data governance system with coordinated leadership at higher levels, mutual coordination among lower-level departments, and orderly internal unity within departments. Here, coordination and unity are key, with policies and standards serving as guarantees for collaborative governance.

(2) People and Technology: Requires strengthened outsourcing management and unified data standards. Compared to profit-driven enterprises at the forefront of technological innovation, government technical support capabilities are generally lower, with numerous and dispersed platform construction and maintenance outsourcing providers. On one hand, limited internal personnel and scarce professionals proficient in both business and IT lead governments to delegate non-managerial technical operations to enterprises or third parties [18], resulting in inconsistent technical solutions and data standards across different systems, causing problems such as technical incompatibility [19] and inconsistent data structures [20] that pose significant challenges for system integration. On the other hand, numerous dispersed outsourcing providers increase data security risks, particularly for data held by outsourcing parties, making data leakage, misuse, and malicious tampering more likely. Therefore, cross-departmental government data governance emphasizes supervision and management of outsourcing enterprises, unified data standards, and formulation of data interfaces.

(3) Tasks: Requires establishing data authority and ensuring data security. Government authority requires establishing government data authority when executing tasks. However, multi-sourced government data and non-unified standards may result in uneven data quality, weakening its usability and authority. Therefore, data quality is a key focus in cross-departmental government data governance to ensure data reliability and authority. Moreover, compared to enterprise data, government data involves public security, citizen privacy, and commercial secrets to varying degrees, with large volumes, extensive coverage, and extremely high added value. While centralized government data sharing unleashes data value, it also creates greater security risks. Therefore, cross-departmental government data governance emphasizes data security and confidentiality when executing tasks, requiring reliable security systems at legal, policy, technical, and management levels to ensure government data security.

4. Cross-departmental Government Data Governance Framework

Based on the above analysis, the CGCS framework comprises six components: governance subjects, strategic objectives, norms and standards, scope of concern, processes, and methods and technologies (see Figure 1 [Figure 1: see original paper]). Governance subjects describe the roles and their authority and responsibilities in government data governance. Strategic objectives describe expected governance outcomes. Norms and standards clarify the support mechanisms needed in governance processes. Scope of concern describes key

focus areas. Processes describe specific implementation activities. Methods and technologies describe specific approaches and tools used in implementation. Below, we elaborate on each component and their logical relationships in light of government data governance particularities.

Drawing on DGI's top-down governance system and DAMA's environmental elements, and addressing government data governance particularities, we propose the Cross-departmental Government Data Governance Framework—CGCS Data Governance Framework (China Government Cross-Sectoral Data Governance Framework). The DAMA environmental sub-framework includes seven elements: goals and principles, organization and culture, technology, practices and methods, roles and responsibilities, key deliverables, and activities [9]. Mapped to cross-departmental government data governance, the top level requires strategic objectives to clarify expected outcomes; the middle level requires norms and standards to define principles and focus areas; the bottom level requires processes, methods, and technologies to guide implementation. Thus, the CGCS framework covers three levels: top-level (government strategic objectives), middle-level (norms and standards, scope of concern), and bottom-level (processes, methods, and technologies), forming a top-down governance system. Additionally, people are the subjects of data governance activities, and the division of authority and responsibility is key to stable governance practice, so the CGCS framework also includes government governance subjects.

4.1 CGCS Governance Subjects

Government data governance must first clarify governance subjects and their authority and responsibilities. Governance subjects include the Data Governance Committee, Data Governance Office, Data Governance Requirements Investigation Team, Data Governance Platform Construction Team, and other stakeholder departments, promoting collaborative governance and deep integration across departments. The relationships among subjects are shown in Figure 2 [Figure 2: see original paper].

(1) Data Governance Committee. The Committee is responsible for setting governance strategic objectives and reviewing norms and standards. Given the "tiao-kuai" structure's emphasis on vertical-horizontal integration, the Committee Director is generally held by a leader from a higher-level horizontal department, with members including leaders from other stakeholder departments. This reduces leadership-level uncertainty while enhancing motivation for data integration across departments.

(2) Data Governance Office. The Office is the core of implementation, responsible for formulating norms and standards, executing specific activities, coordinating communication between roles and activities, reporting progress to the Committee, and supervising the Investigation Team and Platform Construction Team.

(3) Other Stakeholder Departments. These departments provide or use

data. Following the principle of "whoever is in charge, provides, and is responsible," providing departments must timely maintain and update data to ensure quality. Following the principle of "whoever handles, uses, manages, and is responsible," using departments should use data according to law based on their duties [21].

(4) Data Governance Requirements Investigation Team. Government data governance does not mean integrating all government data—only useful data. Therefore, departmental data requirements must be investigated. The Investigation Team surveys existing data and requirements across departments, often using focus group interviews.

(5) Data Governance Platform Construction Team. Cross-departmental governance requires integrating data onto a unified platform, necessitating platform construction to support data integration and storage. Due to special government functions and limited personnel and skills, platform construction is generally outsourced to professional IT companies.

4.2 CGCS Strategic Objectives

Strategic objectives, formulated by the Data Governance Committee, guide governance work. IBM proposes that data governance objectives are risk control and compliance, and value creation [22]. The DGI framework suggests corporate data governance objectives are increasing revenue and value, managing costs and complexity, and controlling risk [11]. Zheng Daqing et al., analyzing big data governance objective elements, propose that objectives are realizing value and controlling risk [13]. Synthesizing these and considering government data governance particularities in tasks and personnel, we identify government strategic objectives as value creation and risk control:

(1) Value Creation. Value creation refers to the benefits and efficiencies generated by cross-departmental government data governance [13], with data sharing as its key manifestation. Data sharing improves data asset utilization, eliminating the need for departments to expend resources reacquiring data, thereby reducing waste and lowering storage and management costs. Through cross-departmental data sharing, government work efficiency and information service capabilities improve.

(2) Risk Control. Government data typically contains detailed personal information, with redundant and cross-referenced content from different sources, increasing privacy leakage risks. Therefore, data security control is crucial. Additionally, numerous stakeholders in cross-departmental governance often blur data rights and responsibilities, necessitating clear data decision-making authority, unified data use agreements, and proper desensitization.

4.3 CGCS Norms and Standards

Currently, no unified norms and standards exist for government data governance, and inconsistent departmental data standards are key obstacles. Therefore, establishing norms and standards is necessary to ensure successful governance and inter-departmental data sharing, improving data usability and authority. CGCS norms and standards define activity guidelines, including data management norms, data standards, and evaluation standards:

(1) Data Management Norms. Cross-departmental governance involves multi-departmental data integration with collaborative characteristics in a complex, interlocking environment. To improve data quality and prevent security risks, following full lifecycle management and security and privacy management principles, norms include collection, organization, storage, sharing, and security specifications.

(2) Data Standards. Cross-departmental governance requires unified data standards to support platform development and facilitate system integration and data management across departments. Establishing standards requires participation from both business and technical personnel from all departments to ensure convenience for integration and storage while meeting business needs. National and local standards can be referenced to build a unified data standard system.

(3) Evaluation Standards. These assess governance work, including data quality and governance maturity. Data quality is the core concern and prerequisite for value realization, assessing authenticity, completeness, consistency, accuracy, and timeliness. Governance maturity assessment measures current status, levels, and gaps to identify improvement paths [11].

4.4 CGCS Scope of Concern

The scope of concern refers to key focus areas that affect governance effectiveness, including data lifecycle management, data security and privacy, and data quality management.

(1) Data Lifecycle Management. This involves managing data from creation through storage to disposal. Cross-departmental governance must consider each lifecycle stage's characteristics, formulate appropriate policies, and employ suitable methods and technologies to keep data "alive."

(2) Data Security and Privacy. Cross-departmental government data is multi-sourced and heterogeneous, with massive volumes and numerous stakeholders, making security and privacy increasingly complex. All relevant government policies include security provisions.

(3) Data Quality Management. With government data dispersed across systems and departments, inconsistent data sources often lead to inconsistencies for the same data type. Therefore, ensuring authenticity, completeness,

consistency, and accuracy is essential for data authority.

4.5 CGCS Processes and Methods and Technologies

CGCS processes are specific implementation activities that put strategic objectives and scope of concern into practice. Implementation faces various difficulties, requiring scientific methods and technologies. The framework includes five sub-processes: requirements clarification, data classification and coding and identification, data extraction, transformation and loading, and data analysis and application, with corresponding methods and technologies:

(1) Requirements Clarification. Cross-departmental government data governance is business-driven [23]. It does not operate on all government data but focuses on valuable, business-needed data. In cross-departmental contexts, stable inter-departmental relationships are built on reciprocity, so clarifying requirements helps define governance scope and improve effectiveness. Higher-level departments must consider lower-level needs. In practice, requirements can be reported upward level by level, with the Investigation Team aggregating them at higher levels to ensure completeness. Surveys or interviews can be used. The specific process is shown in Figure 3 [Figure 3: see original paper].

(2) Data Classification, Coding, and Identification. Classification and coding quality directly affects sharing quality and efficiency. Classification should follow principles of systematicity, scalability, stability, compatibility, and practicality [24]. Data identification determines source and using departments, helping clarify decision rights and responsibilities. However, government data's "multiple sources for one number" characteristic makes identification challenging. Clarifying sources facilitates collection, comparison, and cleaning, while identifying using departments supports exchange and sharing. Identification can use the U/C matrix method based on classification results and investigation data to determine each data category's creating and using departments.

The U/C matrix expresses relationships between departments and data. Rows represent data categories (at appropriate granularity), columns represent departments, with letters U (Use) and C (Create) indicating usage and creation. If department m creates data n, mark C; if it uses data n, mark U. Through matrix transformations, each data category's creating and using departments are determined (see Table 1).

(3) Data Extraction, Transformation, and Loading. ETL technology extracts, transforms, and loads cross-departmental government data into a unified platform, integrating multi-sourced heterogeneous data and addressing dispersion, inconsistency, and non-standardization [25]. Extraction inputs data from departmental databases to unified storage. Transformation addresses inconsistencies and granularity issues, converting to uniform formats and merging fine-grained data. For example, citizen death information from civil affairs, ethnic affairs, and public security departments may use different names and formats for death data, requiring unification. Loading outputs transformed data into

unified databases to support sharing and decision-making.

(4) Data Application. The ultimate goal is applying data to realize sharing value, with big data analytics as a common technique. Data governance solves practical problems with broad prospects [26]. Cross-departmental integration improves collaborative efficiency and accelerates governance transformation, enabling "data-driven" governance [27] and precise governance based on data and technology [28].

5. CGCS Framework Application Analysis

To demonstrate the CGCS framework's applicability in Chinese cross-departmental government data governance, we analyze Beijing's cross-departmental elderly care data governance as an example.

By the end of 2018, Beijing's elderly population reached 3.648 million, with an aging rate of 16.9% [29], representing severe aging characterized by high degree, rapid growth, advanced age, uneven distribution, and heavy dependency burden. In response, Beijing proposed "promoting widespread application of information technologies like internet, IoT, cloud computing, and big data in elderly care services to improve service capacity" and "establishing an elderly population database to promote government information resource sharing and achieve data integration among civil affairs, public security, health and family planning, and social security systems" [30]. Achieving these goals requires cross-departmental elderly care data governance. Beijing has 54 municipal commissions, offices, and bureaus related to elderly care, all members of the Beijing Municipal Committee on Aging.

At the "conceptual" level of cross-departmental elderly care data governance, Beijing must first clarify strategic objectives: risk control and value creation. Second, it must define the scope of concern: full lifecycle management of elderly care data, data security and privacy protection, and quality assurance, ensuring implementation focuses on these areas.

At the "practical" level, Beijing must first clarify governance subjects and establish norms and standards. For governance subjects, a Data Governance Committee including Committee on Aging and commission leaders should be formed, along with a Data Governance Office for coordination. The Office should commission third parties for requirements investigation and platform construction. For norms and standards, the Office should formulate management norms, data standards, and evaluation standards for elderly care data. In integrating data from different member units, the process involves: first, investigating and aggregating data requirements and holdings from member units and district aging offices; second, classifying and coding needed data; third, using the U/C matrix to identify data sources and using departments; fourth, using ETL technology to load elderly care data into a unified platform to support sharing across horizontal member units and vertical aging systems; and finally, applying big data analytics to integrated data to deeply 挖掘 its value.

Based on mature data governance frameworks and government data governance particularities, this paper proposes the CGCS framework comprising strategic objectives, norms and standards, scope of concern, governance subjects, processes, and methods and technologies, forming a systematic top-down governance system. The CGCS framework includes macro-level conceptual content, micro-level operational content, and middle-level management content, incorporating considerations of government data governance particularities to provide comprehensive guidance for cross-departmental government data governance. However, as a guiding framework, it may require adaptation to specific departmental contexts, necessitating refinement and flexibility in application.

We hope this work provides reference for future government data governance research and that the CGCS framework offers theoretical and practical guidance for implementing cross-departmental data governance, enabling systematic approaches to better achieve government data sharing.

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Author Contributions

Zuo Meiyun: Responsible for overall conception, research framework design, and paper revision.
Wang Peipei: Participated in overall conception and research framework design, responsible for refining research ideas and paper writing.

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