# Value Governance of Government Open Data: Model Interpretation and Trend Outlook

**Authors:** Peng Zongfeng, PENG Zongfeng

**Date:** 2023-04-03T14:31:53+00:00

## Abstract

In the era of big data, government open data is considered to harbor immense potential value. However, consciously constructing a comprehensive framework for understanding government open data value governance is of significant importance for fully, accurately, and effectively realizing this potential.

Method/Process Through an in-depth examination of domestic research on government open data value governance, five relatively typical theoretical models can be identified: value chain governance, ecosystem governance, assetization governance, knowledge-based governance, and intelligent governance. However, these theoretical models exhibit characteristics of fragmentation, superficiality, and incompleteness, necessitating composite reconstruction on the basis of profound reflection.

Results/Conclusion From the perspective of value forms and their evolution, the overall framework for understanding government open data value governance constitutes a paradigm of intelligent civilization. This paradigm takes government open data as its prerequisite, is supported by technologies such as big data and artificial intelligence, and promotes the transformation of government data from resources to assets, knowledge, and intelligence, thereby fully excavating and releasing the potential value of government open data to form an intelligent governance pattern.

## Full Text

## 1. Problem Statement

In the era of big data, constructing an appropriate understanding framework for the comprehensive and effective development and utilization of the potential value embedded in government open data represents a crucial epistemological question concerning government open data value governance. An examination of domestic scholarly responses to this question reveals five relatively typical

theoretical models. The first is the value chain governance model, which addresses issues such as value discovery [1], value types [2], value addition [3], value utilization [4], and value measurement [5] in government open data. The second is the ecosystem governance model, formed around topics including value creation ecosystems [6], value realization power systems [7], factors influencing value co-creation [8], and stakeholders [9]. The third is the asset-based governance model, developed through discussions on asset value assessment [10], asset management models [11], and the construction of asset rights systems [12] for government open data. The fourth is the knowledge-based governance model, shaped by research on knowledge discovery [13], knowledge association [14], knowledge fusion [15], knowledge management [16], knowledge creation [17], and knowledge services [18]. The fifth is the intelligent governance model, constructed around issues such as the allocation of intelligent data resources [19], evaluation of intelligent data services [20], and performance of intelligent government services [21].

Although these five models coexist in domestic academia, they exhibit characteristics of dispersity, superficiality, and incompleteness in their understanding frameworks. Dispersity refers to the relatively separate and loose relationships both within and among these models, with no integrated understanding framework yet formed. Superficiality indicates that these models remain at a relatively shallow logical level, with more profound frameworks yet to be excavated. Incompleteness means these models cannot effectively answer questions about the overall understanding framework for government open data value governance, which remains in a formative stage. These characteristics naturally prompt a critical question: What kind of theoretical model can provide a relatively scientific and profound overall understanding framework for comprehensively and effectively developing and utilizing the potential value of government open data?

To address this question, this paper reflects upon and interprets these five typical theoretical models, assesses their respective logical evolution trends, and then attempts to propose a path for constructing an overall understanding framework, aiming to provide a useful knowledge reference for advancing domestic research on government open data value governance.

## 2. Value Chain Governance Theory Model

The value chain governance theory model is essentially a framework encompassing governance stages such as value generation, value development, value utilization, and value feedback. Built on the premise that government open data contains enormous potential value, this model develops such value through the segmentation of the value governance chain. In current domestic scholarship, the overall construction strategy for this model primarily adopts a supply-side dominant cognitive approach and governance framework.

### 2.1 Value Generation Governance

Value generation governance constitutes the crucial foundation for developing the potential value of government open data and represents the primary link in the value chain governance model. It primarily revolves around the management of government open data resources, including activities such as data collection, storage, processing, exchange, and opening. Its main objectives and key tasks involve constructing scientific, standardized, and efficient government data resource management systems [22] and government data resource opening systems [23]. Regarding the construction of government data resource management systems, the aim is to achieve comprehensive and effective management of government data resources by establishing and improving policy frameworks, standard systems, and internal data exchange and sharing mechanisms, thereby providing high-standard, high-quality datasets for open data utilization. Concerning the construction of government data resource opening systems, the goal is to facilitate the open circulation of government data resources by establishing and improving opening policy frameworks, management process systems, and open data platforms, thereby providing society with more freely accessible resources and convenient channels. In summary, through the improvement of these two systems, value generation governance activities lay a solid foundation of potential value for the open utilization of government data.

### 2.2 Value Development Governance

Value development governance represents the key to unlocking the potential value of government open data and forms the central link in the value chain governance model. It primarily focuses on value addition through the development, design, and manufacturing of digital products and services based on government open data. Due to differences in development actors and purposes, value development governance can be divided into public welfare-oriented and market-oriented approaches. From the public welfare perspective, governments or social organizations develop government open data and design related products and services to promote public utilization of such data for the realization of public interests. From the market perspective, various data enterprises conduct in-depth development of government open data for profit, designing related products and services for paid consumption. By improving both public welfare and market-oriented development approaches, value development governance can provide broader space for the value-added utilization of government open data.

### 2.3 Value Utilization Governance

Value utilization governance constitutes an important component of developing the potential value of government open data and represents a crucial link in the value chain governance model. It primarily centers on the promotion and application of government open data products and services, including marketing planning and promotion activities. Its key tasks involve constructing

marketing and consumption systems to ultimately realize the value of government open data. On one hand, by developing marketing designs, information promotion, and functional introductions, a marketing system for government open data products and services can be built to enhance user awareness and understanding. On the other hand, by establishing and improving consumption policies and optimizing consumption structures, a consumption system can be constructed to promote user consumption behavior and realize the value of government open data. In other words, through the construction of marketing and consumption systems, value utilization governance activities facilitate the realization of government open data value.

### 2.4 Value Feedback Governance

Value feedback governance also constitutes part of developing government open data value and forms the final link in the value chain governance model. It primarily revolves around user information feedback, including user satisfaction surveys and opinion collection activities. The key activities involve constructing public feedback mechanisms [24] and public participation mechanisms [25] for government open data value governance. On one hand, public feedback mechanisms for government open data products and services are built to collect user demand information, thereby optimizing product and service design to better meet user needs. On the other hand, public participation mechanisms are established to promote user involvement in product and service development, enhancing the precision of government open data development and utilization. In summary, by improving these feedback and participation mechanisms, value feedback governance activities can optimize governance approaches and achieve the reproduction of government open data value.

## 3. Ecosystem Governance Theory Model

The ecosystem governance theory model is essentially a framework that promotes the realization of government open data value through analyzing the constituent elements and interactive relationships of the value ecosystem. Built upon structural-functional analysis, this model constructs an ecosystem model for government open data value governance by identifying different governance actor roles, governance environmental structures, and ecological governance approaches.

### 3.1 Governance Actor Roles

Governance actors are the agents of government open data value governance and represent the most active factors in the ecosystem governance model. In essence, they are various stakeholders in government open data value governance that can be categorized into different role types. For instance, domestic scholars have classified stakeholders into data providers, data users, and data beneficiaries [26]; or into data owners, data aggregators, data processors, data

analysts, data re-users, data operators, fund providers, and end users [27]; or into leading stakeholders (government and its departments), supporting stakeholders (technology and fund providers), peripheral stakeholders (media), and beneficiary stakeholders (enterprises, citizens, research institutions, etc.) [9]. These classifications reveal a diverse role structure among governance actors. Cross-comparison also shows that each stakeholder may simultaneously assume multiple roles—for example, a data enterprise can be both a data user and a data developer as well as a data beneficiary. Therefore, each actor in government open data value governance likely represents a set of roles that transform across different stages of value realization. The role transformation, integration, and interaction among actors constitute the role system of government open data value governance.

### 3.2 Governance Environment Structure

The governance environment structure constitutes the action space for governance actors and forms the relational network in the ecosystem governance model. Domestic academia tends to divide the governance environment into internal and external dimensions. Regarding the internal environment, organizational governance primarily influences government open data value governance. For government organizations, influential factors include: the completeness of institutional norms concerning government open data value governance, the availability of strategic planning and implementation schemes, whether organizational structures can adapt to governance needs, whether management processes can effectively support governance, and whether talent development can meet governance requirements. Regarding the external environment, political, economic, cultural, social, and technological factors exert influence. The political environment affects governance through value orientation, institutional supply, strategic planning, policy output, and project implementation. The economic environment influences governance through resource investment, operation models, pricing mechanisms, and consumption demand. The cultural environment impacts governance through values and knowledge reserves. The social environment shapes governance through social organizations, public opinion, and social demand. The technological environment affects governance through basic, key, and core technologies as well as technological innovation. The interaction between external and internal governance environments shapes the environmental structure of government open data value governance and profoundly influences its effectiveness.

### 3.3 Ecological Governance Approaches

Ecological governance approaches represent the product of interactions between governance actors and their action space, constituting specific governance patterns within the ecosystem model. Current domestic research on ecological governance approaches has developed along different paths, forming three relatively typical approaches. The first is government efficiency enhancement-oriented

ecosystem governance, where different stakeholders such as government, data service enterprises, and the public interact around problems in government governance to promote the development and value addition of government open data, thereby enhancing government governance effectiveness. The second is social welfare promotion-oriented ecosystem governance, where stakeholders interact around public interest issues concerning people's livelihood to promote development and value addition, thereby effectively realizing social welfare. The third is economic development promotion-oriented ecosystem governance, where stakeholders interact around the commercialization of data products and services to promote development and value addition, thereby reasonably realizing economic value. The coupling of these three ecological governance approaches constitutes a complex ecosystem for government open data value governance.

## 4. Asset-Based Governance Theory Model

The asset-based governance theory model is essentially a framework formed around the market-oriented and commercial development and utilization of government open data. Built upon the asset-based management of government data, this model promotes value addition and realization by constructing a rights and interests system related to government open data development and utilization.

### 4.1 Government Data Assetization

Government data assetization forms the foundation for the market-oriented and commercial development of government open data and constitutes an important prerequisite for the asset-based governance model. Initially, government open data was released as a public resource for free social use, thus lacking pricing and transaction attributes. However, as the potential economic value of government open data was discovered and market-oriented development emerged, data products and services based on value-added government open data gained pricing and transaction potential. This fostered an assetization concept that, in turn, influenced government perceptions of their own data, shifting from a resource-oriented to an asset-oriented cognition. Based on this cognition, asset-based management activities for government open data emerged. However, government-side asset management differs from enterprise-side data asset management in that it does not aim purely at pricing and transactions, but rather promotes commercial development and value addition of government open data in the market. In other words, government-side asset management is characterized by public welfare and promotional purposes, adapting to market and commercial demands.

### 4.2 Government Data Asset Management

Government data asset management constitutes an important component of market-oriented and commercial development and forms a crucial link in the

asset-based governance model. However, it represents a highly complex system. One scholar has proposed a "four-in-one government data asset management framework integrating front-end control processes, key management activities, value realization paths, and a trusted data ecosystem" [11]. Generally, government data asset management includes several stages: First, conducting market and user surveys to pre-assess the potential for government data value addition, then establishing a government data asset repository by extracting data with relatively high value-added potential from government databases based on assessment results, and dynamically managing government data through an asset management catalog. Second, constructing an internal rights and management system for government open data assets by confirming ownership, management rights, exchange rights, and usage rights, thereby coordinating inter-departmental collaboration and sharing to ensure the integrity, high quality, and high value of government data assets. Finally, improving government data asset opening platforms to promote social development and utilization, and establishing effective user feedback mechanisms to continuously optimize asset management. Through the establishment of robust asset management approaches, the market-oriented development and value addition of government open data can be strongly promoted.

### 4.3 Value-Added Rights System

The value-added rights system is key to the market-oriented and commercial development of government open data and constitutes a critical link in the asset-based governance model. As is well known, enterprises are the main actors in market-oriented development, and their utilization of government open data assets is not based on simple processing to create use value, but on deep processing to create new use value. To monetize this new value, rights confirmation and pricing of value-added activities are necessary. However, as domestic academia has recognized, since the rights confirmation of enterprise data products and services based on government open data assets extends beyond traditional ownership categories, a new rights system must be constructed [12]. Specifically, because government open data is characterized by free opening and use, asset-based pricing cannot be achieved through ownership. The priceable component is actually the value-added portion created by enterprises through development. Therefore, the asset rights structure for government open data revolves around value addition, with the core right being enterprises' unique data intellectual property rights. Thus, the key to asset-based governance lies in confirming and protecting an enterprise rights system centered on data intellectual property rights. To a certain extent, constructing a sound value-added rights system can greatly promote the development and utilization of the potential economic value of government open data.

## 5. Knowledge-Based Governance Theory Model

The knowledge-based governance theory model is essentially a framework formed around the development and utilization of knowledge embedded in government open data. Built upon the knowledge value of government open data, this model promotes value realization by constructing knowledge development and utilization processes.

### 5.1 Knowledge-Based Transformation of Government Open Data

The knowledge-based transformation of government open data is the prerequisite for developing its knowledge value and constitutes an important foundation for the knowledge-based governance model. In the big data era, a key condition for government open data value governance is achieving the transformation from "big data" to "big knowledge" [28]. However, as big data, government open data is characterized by large volume, multiple sources, heterogeneous structures, and low value density, resulting in relatively low direct usability that requires further development of embedded knowledge to obtain higher value and benefits. In reality, government open data represents the digitization of social relations and traces of social actors' behaviors, containing both explicit and implicit knowledge about social affairs and actors. This knowledge includes, at the subjective level, various needs, expectations, and future action intentions of social actors, and at the objective level, the objective laws of social affairs, thus holding significant value. In the knowledge economy era, data has become an important production factor, essentially because the explicit and implicit knowledge contained within data has become a key driver of economic growth. Therefore, promoting the transformation of government open data from resources to knowledge is of great significance for developing its value.

### 5.2 Knowledge Development and Utilization Process

The knowledge development and utilization process is an important channel for mining the knowledge value of government open data and constitutes key content of the knowledge-based governance model. Overall, this process is a knowledge development flow encompassing government data knowledge resource management [16], knowledge discovery [29], and knowledge fusion [15]. Specifically, it includes several aspects: First, according to knowledge-based development requirements, government open data resources must be transformed into knowledge resources through the development and application of relevant knowledge resource management technologies, and dynamically managed through the establishment of a government open data knowledge repository. Second, development value must be identified through social demand surveys, with relevant knowledge resources extracted from the knowledge repository for in-depth analysis to identify hidden knowledge and related skill requirements. Finally, knowledge innovation and creation are achieved through deep knowledge association, integration, fusion, and presentation technologies. By constructing a

sound knowledge development and utilization process, the knowledge value of government open data can be deeply developed and utilized.

### 5.3 Knowledge-Based Governance System

The knowledge-based governance system is an important structure for developing and utilizing the knowledge value of government open data and constitutes the spatial dimension of the knowledge-based governance model. Overall, this system comprises three levels: First, the technical level. Due to the implicit nature of knowledge in government open data, traditional knowledge analysis methods and technologies are no longer applicable, making the innovation of knowledge analysis methods and technologies an urgent task. This elevates methodological and technical knowledge to a position of importance. As the saying goes, "to do a good job, one must first sharpen one's tools," thus the prior transformation of methodological and technical knowledge becomes a leading condition for advancing knowledge-based governance. Second, the organizational management level. Corresponding to technical-level transformations, internal organizational management also requires adjustment, specifically by learning relevant organizational management knowledge to construct an internal data knowledge circulation system for aggregation, exchange, and sharing. Third, the service level. To achieve social utilization of government open data knowledge, a socialized service system for knowledge development and utilization must also be established. This involves continuously absorbing relevant knowledge and skills from the external environment to construct a socialized knowledge system and service system encompassing knowledge opening, product and service development and transaction, and user feedback. In summary, by constructing a sound knowledge-based governance system, the knowledge value embedded in government open data can be effectively developed and utilized.

## 6. Intelligent Governance Theory Model

The intelligent governance theory model is essentially a framework formed around the development and utilization of wisdom embedded in government open data. Built upon an intelligent understanding of government open data value, this model promotes value realization by constructing intelligent management and service systems.

### 6.1 Government Data Intellectualization and Management

Government data intellectualization and management constitute the prerequisite for intelligent governance and form the foundation of this theoretical model. In fact, intelligent data represents a further development beyond resource-based and knowledge-based data. Obtaining intelligent data requires three stages: resourceization, knowledge-based transformation, and intellectualization [19]. Consequently, the management of government open intelligent data has evolved

from government open data resource management and knowledge management. In the resource management stage, government open data acquires a resource form supported by digital technology, characterized by large volume, multiple sources, heterogeneous structures, and low value density, managed primarily through collection, storage, processing, and exchange processes to build a resource database managed dynamically according to resource catalogs. In the knowledge management stage, government open data acquires a knowledge form supported by knowledge development technologies, characterized by clear structure, complete content, and relatively high value, managed by building a knowledge repository based on the resource database and managed dynamically according to knowledge catalogs. In the intelligent management stage, government open data acquires an intelligent form supported by artificial intelligence and other technologies, characterized by contextualization, intelligence, and high value, managed by building an intelligent repository based on the knowledge repository and managed dynamically according to intelligent catalogs.

### 6.2 Intelligent Services Based on Government Open Data

Intelligent services based on government open data constitute important content of intelligent governance and form a key link in this theoretical model. From the perspective of intelligent governance, intelligent services provide users with intelligent solutions through the development and utilization of government open data. This includes two aspects: First, the design and development of intelligent solutions. Based on social demand surveys and analysis, relevant intelligent data resources are integrated for overall intelligent solution design. Second, the provision and optimization of intelligent solutions. Intelligent solution service platforms are built to provide corresponding services to users, with user experience feedback further optimizing solution design and development. From the perspective of differences in value orientation, development actors, and utilization actors, the provision of intelligent solutions based on government open data can be divided into different types. The first is government intelligent solution provision, which involves designing relevant solutions through interaction with data service enterprises and the public to enhance government intelligence levels and provide intelligent, personalized services to government service recipients. The second is social welfare activity intelligent solution provision, which involves designing relevant solutions through stakeholder interaction to enhance the intelligence level of social welfare activities and provide intelligent, personalized services to welfare recipients. The third is economic activity intelligent solution provision, which involves designing relevant solutions through stakeholder interaction to enhance economic activity intelligence levels and provide intelligent, personalized services to economic actors.

## 7. Reflection on Theoretical Models and Composite Reconstruction

Multiple theoretical models provide diverse preparatory conditions for answering questions about constructing an overall understanding framework for government open data value governance. It is foreseeable that this situation of divergent development among multiple models will continue. However, we cannot simply remain at the level of dispersed advancement among multiple models; instead, we need to actively initiate a theoretical dimension of holistic reconstruction. That is, based on reflecting upon multiple theoretical models, we must adopt a comprehensive approach to achieve theoretical consciousness in constructing an overall understanding framework for government open data value governance.

### 7.1.1 Value Chain Governance Model: From Supply-Side Dominance to Dynamic Supply-Demand Equilibrium

Current domestic understanding of the value chain governance model primarily remains within a supply-side dominant cognitive framework, which is related to the relatively low level of government open data value governance in China. However, the mismatch between supply and demand inherent in this supply-side dominant framework requires that analytical focus not be placed solely on the supply side, but also on the demand side, achieving dynamic matching between supply and demand. In other words, the development trend of the value chain governance model is shifting from supply-side analysis to dynamic equilibrium analysis of both supply and demand. Achieving this dynamic equilibrium requires simultaneous advancement in both structural and process dimensions. Structurally, a dynamic equilibrium matching system must be built. The value realization process of government open data contains a complex demand structure, including not only end-user demands but also various derivative demands generated during data development. Therefore, the supply side must provide not only final data products and services but also various derivative products and services. Only through effective matching between demand and supply structures can the potential value of government open data be maximally developed and utilized. Process-wise, a whole-process mechanism for dynamic supply-demand matching must be constructed, integrating end-user demands and derivative demands throughout the entire government open data supply process to effectively grasp various needs through whole-process participation, thereby enhancing supply precision and targeting. In summary, only by shifting to a dynamic supply-demand equilibrium analysis framework can the potential value of government open data be comprehensively and effectively developed and utilized, achieving value expansion.

### 7.1.2 Ecosystem Governance Model: From Structural Analysis to Contextual Analysis

Although the ecosystem governance model provides an important analytical method from an ecosystem perspective, it remains at a general structural-functional analysis level. From a development trend perspective, this model needs to expand to more specific levels, shifting from structural analysis to contextual analysis. This transition is not easy and requires attention to two aspects. First, contextual problem analysis must be refined. Initiators of government open data value development need to identify problems from contexts, further subdivide contextual problem structures through interaction with different stakeholders, accurately identify problem types, precisely articulate problem content, and promote consensus on contextual problems among multiple stakeholders. Second, multiple stakeholders must be mobilized to develop data products and services around solving core contextual problems and their derivatives, forming a co-construction and sharing ecosystem for government open data value governance with reasonable division of labor, coordinated cooperation, and orderly advancement.

### 7.1.3 Asset-Based Governance Model: From Rights Construction to Market Construction

Although the asset-based governance model has specific significance, it generally remains at the level of asset management and rights construction, without understanding government open data asset governance from a deeper market promotion perspective. From a development trend perspective, this model needs to deepen from asset management and rights construction to market construction. This requires building two markets: an internal market and an external market. Building the internal market essentially involves establishing and improving internal government data governance incentive mechanisms to encourage government departments to provide more high-quality government open data assets. This is primarily achieved by designing a funding input and performance distribution mechanism based on basic data asset management costs plus evaluation of social utilization effectiveness of open data assets, motivating government departments to conduct more proactive value management oriented toward asset utilization. Building the external market involves improving the circulation system for government open data, enterprise data intellectual property protection system, data consumer rights protection system, and data market governance legal system to promote asset utilization. This requires constructing a value-added service market for government open data with a sound rights system, as well as market supervision and legal remedy systems, on the basis of establishing and improving public service systems for government open data assets.

### 7.1.4 Knowledge-Based Governance Model: From Methodological Knowledge to Content Knowledge

Although the knowledge-based governance model is significant for developing the knowledge value embedded in government open data, domestic research on knowledge development, management, and services primarily focuses on knowledge creation methods for government open data, emphasizing methodological and technical knowledge while relatively neglecting substantive content knowledge. From a development trend perspective, while methodological and technical knowledge for government open data value development has made considerable progress, the creation of substantive content knowledge also requires in-depth exploration. First, methodological and technical knowledge must be integrated with specific contexts of government open data value governance to identify explicit and implicit knowledge on both demand and supply sides, creating a substantive content knowledge structure for contextual affairs governance. Second, based on this substantive content knowledge structure, knowledge products and services for solving relevant substantive problems must be developed and tested for quality from the perspective of substantive content knowledge. Finally, by establishing a user evaluation and feedback mechanism for knowledge products and services, relevant knowledge demands and resources can be further collected to promote the updating of substantive content knowledge and the upgrading of knowledge products and services.

### 7.1.5 Intelligent Governance Model: From Intelligent Services to Intelligent Governance

Although intelligent data and intelligent services have powerfully promoted intelligent governance of government open data value, they generally remain at the level of resources, products, and services. In fact, in the big data era, the importance of data does not lie in its massive volume, but in the fact that big data can be transformed into "big wisdom" under the premise of data technology innovation. That is, the big data era is essentially a wisdom society built upon data development, with data becoming an important driving force for such society. Therefore, when understanding government open data value from a wisdom perspective, its governance acquires significance at the level of overall social intelligent governance. The purpose of intelligent governance is to realize the political, social, and economic wisdom values embedded in government open data, and the realization of these wisdom values will bring about a new intelligent social form and governance model. For example, from a political wisdom perspective, government open data was initially intended to promote political democracy, build transparent government, and protect citizens' rights to know, participate, and supervise. However, as the intelligent value-added effects of government open data are fed back to government itself, government governance also becomes more intelligent. From an economic wisdom perspective, the initial economic value of government open data was informational, but as intelligent governance develops, government open data has become an

important strategic resource for data service enterprises to develop intelligent solutions, forming a wisdom economy based on government open data. Overall, intelligent governance of government open data value will form a composite intelligent civilization encompassing intelligent economy, intelligent society, and intelligent politics, with government open data as an important strategic resource. Therefore, research on intelligent governance of government open data value needs to expand from governance of intelligent resources, products, and services to in-depth exploration of intelligent civilization forms and their governance from a broader perspective.

### 7.2 Composite Reconstruction of Multiple Theoretical Models

In fact, the five typical theoretical models are not isolated from each other but exist in relationships that are both separate and interpenetrating. The value chain governance model reveals the process dimension of government open data value governance, while the ecosystem governance model reveals its structural dimension. These two dimensions constitute the basic dimensions of government open data value governance, and the structural-process coordinate system formed by them provides the fundamental logical space for constructing an overall knowledge framework. The asset-based, knowledge-based, and intelligent governance models, meanwhile, reveal the value form and evolution dimension of government open data value governance. Embedding the value form and evolution dimension into the structural-process coordinate system reveals a complex evolutionary model of government open data value governance. Based on this, I propose that an overall understanding framework for government open data value governance can be constructed from the perspective of four value forms and their evolution: resource, asset, knowledge, and wisdom.

The overall understanding framework for government open data value governance consists of four layers: resource governance, asset governance, knowledge governance, and wisdom governance. Although these layers are distinct, they exhibit an evolutionary relationship—a process of evolution from resource to asset to knowledge and finally to wisdom. First, the resource form is the initial form of government open data value. In this form, although government open data is considered to contain enormous potential value, governance generally adopts a simple supply-demand model due to unclear demand-side needs and supply-side technological constraints. However, the resource form is foundational, as other forms can only emerge based upon it. Second, as the enormous potential economic value of government open data is recognized, its form transforms from resource to asset. In the asset form, the economic value of government open data is highlighted, making the construction of asset rights and market systems important tasks, forming a relatively complex system for data asset allocation, utilization, and governance. To a certain extent, the asset form is a crucial dynamic form that provides important momentum for government open data value governance. Third, as understanding of the nature of government open data deepens, it acquires a knowledge form. Compared with the

external nature of resource and asset forms, the knowledge form represents an internal understanding of government open data. Moreover, as knowledge development technologies advance, knowledge-based governance approaches have emerged. Requiring greater creativity and innovation than the previous forms, the knowledge form becomes the innovative form of government open data. Finally, through deep development and wide application of government open data value, it acquires an intelligent form based on the previous three forms. The intelligent form is the most advanced, encompassing yet transcending the previous three forms through integrative synthesis. Consequently, government open data value governance obtains a holistic form.

In fact, government open data value governance in the big data era revolves around the construction of an intelligent civilization form, making its overall understanding framework essentially an intelligent civilization paradigm. Although government open data value governance begins with resource governance, its ultimate goal is to achieve wisdom governance. This value form transformation simultaneously promotes the transformation of the entire social form toward an intelligent civilization. That is, with government open data as the premise and big data, artificial intelligence, and other technologies as support, by promoting the transformation of government data from resources to assets, knowledge, and wisdom, the potential value of government open data can be fully tapped and released to form an intelligent governance pattern. However, promoting social transformation toward an intelligent civilization through government open data value governance is not achieved overnight but is a highly complex social process. Since the current overall understanding framework for government open data value governance remains immature, it requires steady and solid advancement. The most urgent current tasks involve four aspects: First, at the resource governance level, deeply promoting dynamic equilibrium between supply and demand to strengthen the foundation of government open data resources. Second, at the asset governance level, accelerating the construction of asset rights and market systems for government open data to promote efficient circulation and value addition. Third, at the knowledge governance level, accelerating the improvement of knowledge development, exchange, and utilization systems centered on substantive content knowledge to promote value creation activities based on knowledge innovation. Fourth, at the wisdom governance level, accelerating the improvement of intelligent governance systems encompassing intelligent technology innovation, intelligent solution development, and intelligent contextual application to promote the construction of intelligent economy, intelligent culture, intelligent society, and intelligent politics.

## References

[1] Yi Ming, Feng Cuicui, Mo Fuchuan, Duan Yaoqing. Value Discovery of Government Data Assets: Conceptual Model and Implementation Path[J]. E-Government, 2022(1): 27-39. [2] Fu Xiwen, Zheng Lei. The Value of Open Government Data: Research Progress and Prospects[J]. Library and Informa-

tion Service, 2020, 64(9): 122-132. [3] Ren Fubing, Sun Meiling. Research on the Process and Mechanism of Value Addition of Government Open Data Based on Value Chain Theory[J]. Information and Documentation Services, 2021, 42(4): 56-63. [4] Ma Renjie, Jin Yiding. Research on the Path of Government Data Utilization from the Perspective of Value Realization[J]. Library Science Research, 2018(13): 39-44+18. [5] Fu Xiwen, Zheng Lei. Value Measurement of Open Government Data: A Comparative Study of Characteristics and Methods[J]. Library and Information Service, 2020, 64(19): 140-152. [6] Zheng Lei. The Value Creation Mechanism of Open Government Data: An Ecosystem Perspective[J]. E-Government, 2015(7): 2-7. [7] Yuan Hong, Wang Tao. System Dynamics Analysis of the Sustainable Development Path of Government Open Data Ecosystem[J]. Library and Information Service, 2021, 65(17): 13-25. [8] Tang Changle. Research on Influencing Factors of Value Co-creation of Government Open Data Based on Grounded Theory[J]. Library Journal, 2021, 40(11): 22-30. [9] Hao Wenqiang. Stakeholders in Government Data Opening: Definition, Classification and Management Strategies[J]. Modern Information, 2021, 41(7): 137-145. [10] Zhu Ze, Duan Yaoqing, He Dan. System Simulation Evaluation of Data Asset Value for Government Data Governance[J]. Library Tribune, 2021, 41(6): 100-105. [11] Xia Yikun, Guan Qian. The Connotation, Element Framework and Operation Mode of Government Data Asset Management[J]. E-Government, 2022(1): 2-13. [12] Shang Xixue. Construction of Data Revenue Rights System in Government Data Opening[J]. Journal of East China University of Political Science and Law, 2021, 24(4): 59-72. [13] Tan Xiao, Li Hui, Xu Haiyun. Review of Knowledge Discovery Research Based on Deep Fusion of Multi-dimensional Data Knowledge Content and Association[J]. Journal of Science and Technology Intelligence Research, 2021, 3(4): 58-68. [14] Li Xuhui, Fan Meihui. Knowledge Association in Big Data[J]. Information Studies: Theory & Application, 2019, 42(2): 68-73+107. [15] Zhang Xinyuan, Qiu Junping. Research on Knowledge Fusion Framework in Big Data Environment[J]. Library Science Research, 2016(8): 66-70+43. [16] Ye Yingping, Chen Haitao, Chen Hao. Knowledge Management Process, Technical Tools, Models and Countermeasures in the Big Data Era[J]. Library and Information Service, 2019, 63(5): 5-13. [17] Yuan Li, Xu Lixin, Yao Leye. Research on Knowledge Creation Mechanism of Government Data Opening[J]. Information Studies: Theory & Application, 2022, 45(2): 78-84. [18] Hu Qian, Li Mengting, Huang Jia'e. Research on Industry Knowledge Services Based on Big Data Mining[J]. Information Studies: Theory & Application, 2021, 44(8): 90-94. [19] Zhang Yunzhong, Liu Jialin. Review of Smart Data Research: Conceptual Analysis, Value Orientation, Key Technologies and Application Framework[J]. Library and Information Service, 2021, 65(10): 141-150. [20] Wu Yawei, Zhang Xiangxian, Lu Heng. Research on Evaluation System of Smart Data Service Capability for Think Tank Needs[J]. Information Studies: Theory & Application, 2022, 45(1): 77-85. [21] Zhang Airong, Lü Na. Research on the Relationship Among Big Data Capability, Service Chain Integration and Government Smart Service Performance[J]. Soft Science, 2021, 35(9): 8-13+46. [22] Li Guangqian, Zhang Xueyi, Zhao Jianhang. Construction Requirements and Optimization Suggestions for

Government Data Resource Management System[J]. Reform, 2022(1): 119-128. [23] Zhai Jun, Li Xiaotong, Lin Yan. Research on High-value Government Data in the Context of Open Data—From the Perspective of Data Supply[J]. Library Science Research, 2017(22): 76-84+54. [24] Mo Zuying, Ding Yiya. Research on the Construction of Public Feedback Mechanism for Government Data Opening[J]. Journal of Intelligence, 2021, 40(3): 162-167+60. [25] Chen Chaobing, Jian Tingting. Public Participation Model in Government Data Opening: Theoretical Construction and Case Demonstration[J]. Library and Information Service, 2020, 64(22): 58-67. [26] Wang Wei, Wang Jing, Zhang Mengjun. Analysis of Influencing Factors for Open Government Data Value Realization from an Ecosystem Perspective[J]. Library Theory and Practice, 2020(1): 1-7. [27] Tang Changle, Qiu Li. Research on Stakeholders and Implementation Models of Value Co-creation of Government Open Data[J]. Secretary, 2021(3): 69-81. [28] Wu Xindong. From Big Data to Big Knowledge: HACE+BigKE[J]. Computer Science, 2016, 43(7): 3-6. [29] Cui Jiawang, Li Chunwang. Review of Knowledge Discovery Technology Based on Linked Data[J]. Library & Information, 2016(5): 119-125+136.

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