



**United
Nations**

Department of
Economic and
Social Affairs

Baseline Study on Digital Data Governance in China

(Draft)

The Baseline Study on Project on Digital Data Governance

February 2023



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Preface

The fourth wave of technological revolution is rapidly driving global society towards the digital age. Human civilization is experiencing a rapid, massive, and deep scale of digital transformation. Emergence of new digital technology has fundamentally changed the collection, management, and application of data. As the new energy and engine of economic growth and development, data with its strategic significance attracts attention from nations and governments.

Public data's integral and central role within general data resource, contributes crucially to national economic and production activity, possesses undiscovered economic and social values. Effective utilization of public data not just forms the foundation of a new era of good governance, through transition towards digital economy it is also a pathway towards long-term development and prosperity.

Despite promises of the values of public data, calls to safeguard data security and privacy has never been greater. Better data governance, together with deepened use of public data, is key to strengthening national governance capacity, improving livelihood, and guaranteeing societal operation. How to develop a converged, correlated, integrated, efficiently shareable and orderly exploitable data resource system, to promote the release of data value based on effective data governance, advanced digital technology, enterprise vitality, policy guidance and institutional regulation, to promote the overall strength of the digital economy, to accelerate the pace of digital society construction and to improve the level of digital government construction, are new direction in the field of data governance.

As the largest developing nation, also one of the richest countries in data resources, China initiated its development and construction of electronic and digital governance 40 years ago, from scratch to world's largest data governance system today. As for current stage of digital development, China is on the path of fast-track reform, continuing to push forward integrated planning and construction, further improving digital service capacity, broadening the scale of data sharing and scope of data exploitation; introducing new technology and methods to enhance government ability to perform its function with quality. Developments have assisted improvements in the modernization of national governance system and governance capacity. China has explored a digital development path in line with its national circumstances, accumulated rich experience and successful cases in data governance, and has persistently pushed forward high standard and quality Digital China construction. With these successful experiences, for developing countries, including African countries, least developed countries (LDCs) and small island developing States (SIDS), searching for pathways to improve data governance capacity of government agencies and formulate national digitalization and data governance policies, the Chinese experience can serve as a reference and contribute to mutually beneficial win-win development.

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The report's data governance framework was developed by the Division for Public Institutions and Digital Government of the United Nations Department of Economic and Social Affairs.

Abstract

Data as a resource has become just as important as tangible assets and human resources in the process of governments performing its function. Effective operation of government is increasingly difficult without data. Data-driven government activities ask for better standards in collection, management, and utilization of data. Therefore, under the presence of data security and privacy protection, exploitation, sharing and flow of data to release its value should be policy concerns of all government.

Under the UN DESA project "Developing institutional capacities for digital data management and cooperation to advance progress toward the Sustainable Development Goals", this study based on Data Governance Framework conducts research into China's developments in data governance, focusing on emerging trends and best practices of data governance, data management and coordination. In addition, the project aims to support countries in developing institutional capacities for developing national digital data policies and strategies for ensuring data quality, access, security, privacy, and usage, and for promoting data security through consultation, collaboration, and shared benefits, making available relevant legislative information and toolkits for advancing digital data cooperation agreements through case studies.

Report is organized as follow, **Part 1 – Introduction** lays the ground of the study, includes research proposal and report content, **Part 2 – Contemporary Data Governance in China**, from a macro-perspective accounting four dimensions: Policy, Organization, Personnel and Processes to explain China's data governance top-level design, coordination mechanism, leadership system, and process framework, **Part 3 - China's Data Governance Framework** is analyzed in terms of the central government's policies, measures, actions and exploration and innovations of local governments, where innovation of data governance practices are analyzed in through six elements: data standards and classification, data sharing, openness and utilization, data security, data privacy, data infrastructure, and digital identity, **Part 4 – Digital Governance in China** is summarized through experiences including adherence to the overall layout, coordinated development, people-centered thinking, innovation-driven, multi-party participation, equal emphasis on security and development, centralized and unified leadership, and provided relevant cases studies; **Part 5 - Suggestions** are provided to developing countries on improving data governance capacity, recommendations placed forward include improving the national top-level system design, implementing the concept of systematic and integrated development, consolidating the foundation support for data governance, highlighting the people-centered oriented governance, and building a good data governance ecology.

1. Introduction

1.1 Background

Along with societal progression, data created from development and large-scale application of digital technology has become a factor of production that is closely related to national, social, and economic development. Data resources, especially government data have become a crucial component of national resources, an organic part of national assets with great potential, and an important foundation to support the modernization of national governance system and governance capacity. Data governance results from the collision from global informatization, digitalization, ideals of governance, to its importance in contemporary governance agenda. Possessing advantages of data resource, improving data governing capacity, bringing out public value of data resource are effective paths to enhance international competitiveness. Countries around the world are committed to pushing forward digital development. Major developed countries concerned about digital transformation and data governance have published their strategic plans for digitalization, believing that data governance plays an important role in improving government transparency, enhancing government efficiency, optimizing government functions, and promoting economic development, etc. Data sharing, opening and application will have significant impact on countries' economy, politics, culture, society, and ecology.

In recent years, China has seized the historic opportunities of global digital development and digital transformation, systematically planned, and coordinated the advancement of Digital China and construction of National Cyber Development Strategy. Especially since 2017, China's digital transformation adheres to the historical direction of national development, comprehensively implements new development philosophy, cultivates new momentum by informationization and uses it to push forward new development and to create bright future. The 2020 and 2022 *UN E-Government Survey* show that China's e-government development level continues to improve, online government services has entered the world leading position, China's e-government service platform has become an important channel of conducting business for citizens and large, medium, and small sized enterprises. China's overall data governance capacity continues to strengthen. China further proposes to accelerate the construction of digital economy, digital society, and digital government, and through digitalization to comprehensively drive the transformation of production, way of living and governance.

The proliferation and application of data has transformed governance model and is moving the world in a positive direction, but it is also accompanied with risks and challenges. Therefore, the urgency to improve data governance capacity of public institutions and establish effective data governance mechanism has never been greater. For African countries, LDCs and SIDS, concerns of data security, privacy and ethical issues are particularly prominent, data governance capacity of relevant institutions and digital literacy of public are still deficient. In this light, UN DESA has proposed the project "Developing institutional capacities for digital data management and cooperation to advance progress toward the Sustainable Development Goals", and conducted studies on the development of global data governance framework. Aiming to support data governance capacity of national institutions and assisting formulation of digitalization and data governance policy strategies.

1.2 Research Framework

As the largest developing country, also a country rich in data resources, China's development and construction of electronic and digital governance began 40 years ago, from scratch to world's largest data governance system today. China has explored a digital development path with Chinese characteristics, has accumulated rich experience and successful cases of data governance, and has persistently pushed forward high standard and quality Digital China construction. Local governments have profoundly implemented strategic plan and policy norms of central government, effectively tailored and adjusted local measures based local conditions, and actively explored innovative practices data governance.

Between 2017 and 2021, China's national data production grew from 2.3ZB to 6.6ZB, accounting for 9.9% of global data production, ranking second worldwide; big data industry expanded rapidly, from 470 billion yuan in 2017 to 1.3 trillion yuan in 2021. Openness of public data has made positive progress, from 2017 to 2021, provincial public data open platform increased from 5 to 24, and the number of open-access data sets increased from 8398 to nearly 250,000¹. Central and local governments are actively exploring rules for data governance, cultivating data markets, and promoting data circulation, trading, development, and utilization.

China is the research subject of this report. Methods used in this research include literature research and data analysis, and in-depth analysis is conducted on legal and policy normative documents and survey data. Focusing on emerging trends and best practices of data governance, management, and coordination at national and local levels, and observes the development of data governance in China from both macro and micro perspectives.

Research conducted in this report is based on the following structured framework of data governance:

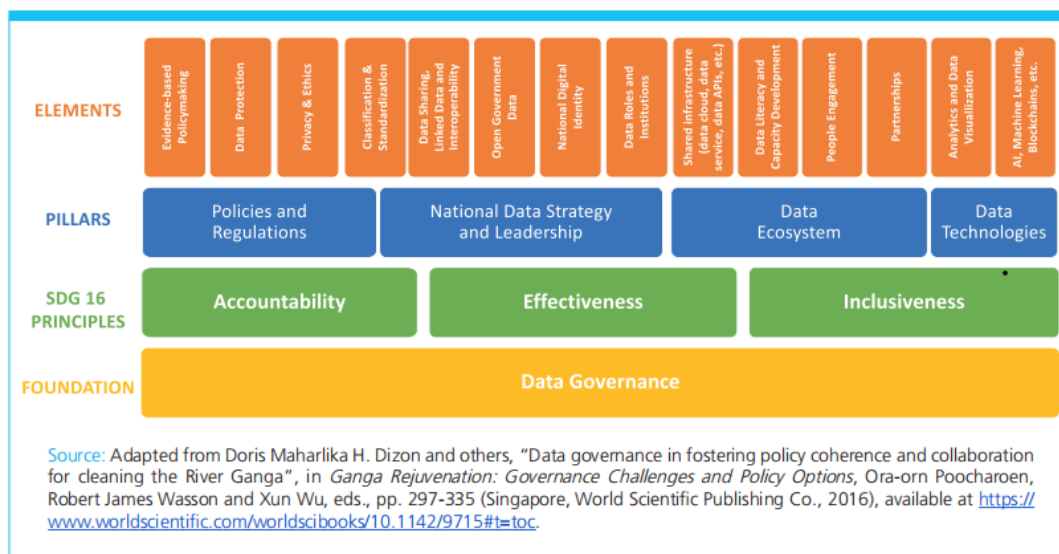
Four (4) pillars of Policy, Institutions, People/Partnerships, Processes

- a) Policy: existing policy and regulatory framework;
- b) Institutions: existing institutional framework
- c) People: existing data ecosystem and mapping of stakeholders
- d) Processes: existing data processes

with a mapping of Six (6) elements:

- a) Data standards and classification
- b) Data sharing, exchange, and interoperability, including open government data
- c) Data security
- d) Data privacy
- e) National data infrastructure

¹ Data from "Digital China Development Report (2021)



1.3 Contents

This report highlights the characteristics of China's comprehensive coordinated development mechanism and integrated construction model, analyzes development trends of data governance. It also provides best practice cases, concludes experience of data governance capacity improvement, and proposes a set of policy recommendations for developing countries, especially LDCs, SIDS and LLDCs, aiming to support them in evaluating the level and challenges of data governance in their countries and to direct attention of, and strengthen government officials and stakeholders understanding on data governance.

This report utilizes four pillars of data governance framework *policies, institutions, people, and processes* to analyze current situation of China's data governance.

- Policy wise, China has accelerated the formation of data governance policy and legal regulation system, attached significance to the construction of network information legal system, and through systematic top-level design to push forward comprehensive data governance development.
- In terms of institution, the integration and coordination of national data governance mechanism promotes collaboration between inter-level, inter-departmental institutional, and provides efficient working mechanism for the national and local data governance development.
- On the personnel side, leadership group system and committee system are the main institutions of China's data governance leadership system, these systems effectively integrate and deploy national and local resources. Establishment of Chief data officer system is under exploration at the national and local level. Construction of digital literacy training system for leading cadres and civil servants, fostering a digital literacy and skills upgrading system for entire population, and establishment of relevant expert committees and think tanks provides personnel guarantees to improve stakeholders' data governance capacity comprehensively and systematically.
- Process wise, for China the *National Integrated Government Big Data System* works as the

general pivot for government affairs data management, the general channel for government affairs data flow, and the general portal for government affairs data services, connecting 32 local government affairs data platforms and government departments platforms. The process of realization of data flow relies on systematic platform construction of data flow processes across levels, departments, and systems, to achieve a nationwide integrated data flow mechanism.

This report analyzes the development and innovation of data governance practices in China based on six elements of the data governance framework: data standards and classification, data sharing, openness and utilization, data security, data privacy, data infrastructure, and digital identity. China has established a comprehensive data governance standard system and in recent years has been vigorously promoting data cataloging and classification, thus clarifying the national data resource system and the existing data stock which provides a basis for data sharing, exchange, openness, and exploitation.

China has built a national government data sharing and exchange platform based on the integration and sharing of government information resources and systems, breaking down inter-departmental data barriers and information silos, and realizing data interconnection and interoperability among national level departments. China also encourages opening of government data and the development and utilization of public data, and is the first country to explicitly designate data as a factor of production in its national policy.

In recent years, China has attached great importance to the value of data and the market allocation of data factor resources, and local governments have established data opening platforms and made many useful explorations in giving full play to the value of data resources and building data factor markets. China's data governance has always insisted on equal importance of security and development, ensuring safe and controllable is the pretense of digital governance development. Promulgation of *Cybersecurity Law*, *Data Security Law*, and *Personal Information Protection Law*, clarifies legal responsibilities of data security, perfects regulatory system, safeguards national security, personal information rights, privacy, social security, and stability, and promotes secure utilization and coordinated development.

China has built the world's largest and technologically leading network and data infrastructure, strengthened the construction of integrated and collaborative data centers, improved the construction of basic database and thematic databases of priority fields, aggregating to provided solid basic security and support for national data governance. Currently, China is planning to push forward the construction of digital identity system entailing resident ID cards, and to accelerate the development of trusted digital identity with Chinese characteristics.

China commits to pushing forward in-depth development of digitalization, vigorous development of digital and e-government, responds to development demands of digital age, seizes the opportunities of digital era innovation, exerts the value of e-government and data governance on improving public services supply and the relationship between the government and society and the public, through government practices the efficacy of data governance in China has gradually emerged.

This report illustrates the effectiveness of China's data governance and its successful application through economic regulations, market supervision, social management, public service, ecological protection, and prevention and control of the Covid-19. The Report also summarizes the

development experience of China's data governance, including: adhering to the comprehensive arrangement and coordinated development, people-centered approach to development and establishing an arrangement of inclusive development; adhering to the innovation-driven approach, application-driven and multi-party participation, to equal importance of security and development; and adhering to centralized and unified leadership. Report also presents representative cases of central and local levels government to illustrate in detail the relevant initiatives, actions and practices taken by the central and local governments in China during the process of data governance, which provides a practical reference for developing countries. Finally, this report provides recommendations for developing countries on improvement towards data governance capacity.

2. Contemporary Data Governance in China

2.1 Policy

2.1.1 Legal norms

Rapid development and integration of information technology has brought many changes to societal development, and has also caused new social problems. Facing new developments, the traditional legal system is no longer suitable in the digital era, therefore China has accelerated the construction of a network information legal regulation system adapted to national characteristics, to provide institutional protection for the country's digital development.

In 2016, China promulgated the *Cyber Security Law*, which became the first fundamental law within China's cyber security legal system and the first basic law on the construction of cyberspace jurisdiction. Its accomplishment highlights the significance and seriousness of cyber security to China. The promulgation of *Cyber Security Law* highlights China takes cyber security seriously. In 2020, the *Civil Code* was promulgated.

To meet the characteristics of the development of civil legal relations in the digital era, provisions on e-documents, e-contracts, personal information, data, and virtual assets were made, and for the first time included personal information, data, and virtual assets within the realm of civil law protection. In addition, relevant breakthroughs and amendments have been made on *Secret Protection Law*, *Electronic Signature Law*, *Archives Law*, and other important legal documents to adapt to the development of digitalization.

In 2021, issuance of relevant laws and administrative regulations such as *Data Security Law*, *Personal Information Protection Law* and *Core information infrastructure Security Protection Regulations* have further filled the void in legislative gaps, strengthen the coordination of cyber-information legislation, promote the construction of general cyber information law and regulation framework, and gradual improvements in legal regulation system of data governance.

2.1.2 National policy

China has paid significant attention to digital development and data governance. In recent years, central government and ministries have issued policies concentratedly, with a series of macro planning promoting the construction, improvement, and gradual implementation of the top-level institutional design of national data governance. In 2017, China clearly proposed the construction of *National Cyber Development Strategy*, *Digital China*, and *Smart Society*, and for the first time *Digital China* was written into national guiding documents. In the same year, the *General Plan of National E-governance* was formulated, which confirms the overall framework of China's e-governance development, informatization and digitalization.

In 2019, China proposed for the first-time data is a factor of production, should participate in distribution and has also accelerated the exploration and construction of data foundation system. In 2021, *Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and Vision 2035 of the People's Republic of China* have specifically designated a chapter to deploy "acceleration of digital development and construction of Digital China". Successive issuance of *14th Five-Year Plan for National Informatization* and *14th Five-Year Plan for Digital*

Economy Development and other major strategic plans, has portrayed a beautiful blueprint for the construction of Digital China in the 14th Five-Year Plan period.

To achieve the goal of *Strong Cyber Nation and Digital China* construction and to promote the implementation of top-level design of national data governance and digital construction, to promote implementation of overall macro-plan China has passed a series of directive policies, management norms and supporting measures.

Table 1 Special Policies Related to Data Governance in China

Category	Policy	Time	Publish Subject	Main Content
Data	Action Outline for Promoting the Development of Big Data	2015	State Council	Data as core, target arrangements are made to release data value, establish data element markets, promote data circulation and application, and establish an integrated government data system
	Opinion on Improving the Systems and Mechanisms for Market-based Allocation of Factors of Production	2020	State Council	
	Guidelines for the Building of a National Integrated Government Big Data System	2022	General Office of the State Council	
Information resources and systems integration and sharing	Interim Measures for the Administration of Sharing of Government Information Resources	2016	State Council	Put forward specific requirements for basic principles of information sharing, for both supply and demand sides of information sharing. Provides technical operational guidelines for information sharing, aiming to link up "information silos" within departments
	Guidelines for Cataloging Government Information Resources (Trial)	2017	National Development and Reform Commission, Cyberspace Administration of China	
	Implementation Plan for Integration and Sharing of Government Information Systems	2017	General Office of the State Council	
	Interim Measures for the Management of Application, Authorization and Management Use of Service Interfaces of the National Data Sharing and Exchange Platform	2018	National Development and Reform Commission	
Government Services	Guiding Opinion of the State Council on	2018	State Council	To Comprehensively improve levels of

	Accelerating the Construction of National Integrated Online Government Services Platform			standardization and convenience of government services, to provide efficient and convenient government services to enterprises and the public, optimize business environment, accelerate the construction of a national integrated online government services platform, the construction of a public satisfied service-oriented government and provide a specific policy foundation
	Several Provisions of the State Council on Online Government Services	2019	State Council	
	Opinions of the General Office of the State Council on the establishment of "good and bad reviews" system of government services to improve the level of government services	2019	General Office of the State Council	
Digital Government	Guiding Opinions on Strengthening the Building of a Digital Government	2022	State Council	Clearly defines the objectives and principles of digital government construction, key tasks, and promotion mechanisms, etc. It is the first national-level guiding document that systematically regulates and deploys the construction of digital government in China
Data Security and Personal Information Protection	Provisions on the Cyber Protection of Children's Personal Information	2019	Cyber Administration of China	Continuously consolidate national governance security guarantees and personal information rights protection system, and deepen the construction of environment for rule of law for cyber information
	Cloud Computing Services Security Assessment Measures	2019	Cyberspace Administration of China, the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the Ministry of Finance	
	Measures for Cybersecurity Review	2021	Cyberspace Administration of China, National	

			Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Public Security and 13 other departments
	Measures for the Security Assessment of Outbound Data Transfer	2022	Cyberspace Administration of China

2.1.3 Local policy regulation

Local governments in China have profoundly implemented the central government's strategic plans and policy norms, according to local context local governments has taken effective measures to actively explore innovative practices of data governance, and have issued policies and plans to promote better development of data governance. In general, local policy environment of data governance has continuously been optimized.

By the end of June 2022, 25 provincial governments in China (80.6%) have issued digital government-related plans, programs, or opinions². In terms of legislation, several provinces and cities has enacted data-related laws and regulations. More than ten provinces and cities, including Shanghai, Guangdong, Fujian, Shandong, Guangdong, Anhui, Zhejiang, Jilin, Shanxi, Hainan, Tianjin, and Guizhou, have officially promulgated relevant data regulations. Contents of each local data regulation focus on building an integrated and smart public data platform, maximizing the circulation and development, utilization of public data, and establishing a secure protection system for public data sharing.

2.2 Institutions

2.2.1 National data governance coordination mechanism

In the process of developing e-government and digital government, China has established a coordination mechanism and system among relevant functional departments at the national level. Data Governance coordination mechanisms includes e-governance coordination mechanism, Government data sharing coordination mechanism and the Inter-ministerial joint meeting for promoting development of big data. Functional department that is responsible for coordination of national network security and informatization is Cyber Administration of China.

In 2016, the Cyber Administration led the establishment of e-governance coordination mechanism and formulated the plan for national e-governance. In recent years, Cyber Administration has coordinated the development and construction of data infrastructure, data resources, standards and norms, business applications, government services, general support, policies, and regulations

² Data from the search and statistics of public information on government websites

at the national level, fully mobilized and gathered related functional departments, coordinated connections between all parties, and promoted the formation of a long-term mechanism for data governance development. Cyber administration has also guided localities to establish data governance coordination mechanisms to assist all levels of data governance institution realizing functions.

Table 2 Foundations of the National Data Governance Coordination Mechanism

Name of the integrated coordination mechanism	Main Purpose
National E-governance coordination mechanism	Form a coordinated and effective mechanism for decision-making, construction, communication, and liaison to better promote the construction and development of e-governance in China
Government data sharing coordination mechanism	Clarify relevant management agencies and key responsibilities to ensure strong coordination, clear responsibilities, smooth operation, standardized management, and safe and ordered sharing of government data.
Inter-ministerial joint meeting mechanism for promoting development of big data	Further strengthen the coordination and collaboration of national data governance efforts to accelerate developments of big data.

Based on the coordination mechanism, China has established a coordination meeting system, the main content of the meeting is to study and coordinate major policy planning and project construction etc., members included relevant departments responsible for national e-government internal and external network construction management, government information resources management, technical support, industrial development, project approval and audit, operation and maintenance of funds management and standards management.

2.2.2 National-level data governance institutions

The General Office of the State Council coordinates the construction and management of national integrated government affairs big data system, the integration of the formation of the National government big data platform, it also establishes perfected big data management mechanism, standards and norms, security, and protection system. Departments of the State Council have designated government data institutions, which have roles in coordination and management of departmental data, vertical management of business systems and interconnection of the national government big data platform.

Central ministries and commissions set up big data centers or information centers, responsible for data governance, departmental digital construction, and support operation of government functions.

- The Office of E-Government under the General Office of the State Council is responsible for national e-governance, integrated online government services and data management, while the Office of Government Information and Government Openness is responsible for work related government websites, new media for government affairs and government openness etc.

- The National Information Center (National E-Government Extranet Management Center), a public institution directly under the National Development and Reform Commission, is responsible for NDRC's government informatization construction, management of National e-Government Extranet, and the development of policy and theoretical research related to big-data.
- The Cyber Security Industry Development Center (Information Center of the Ministry of Industry and Information Technology), a public institution directly under the Ministry of Industry and Information Technology, undertakes research on development strategies, planning, policies and standards related to national cyber security industry, and also data monitoring, publication and analysis, security testing, commercialization of findings, and cyber information technology protection for agencies of Ministry of Industry and Information Technology.

2.2.3 Local-level data governance institutions

It has become a common practice of local government to specify a designated data governance agency for government data governance and big data application. At present, 31 provinces (including autonomous regions and municipalities directly under the central government) have followed the requirements for government data management and development specifying departments for government, which are responsible for formulating big data development plan and policy measures, organizing and implementing the collection, combination, governance, sharing, opening and security protection of government data, and coordinating and promoting the development and utilization of data resources³. Localities through practice continues to explore, improve, optimize, and adjust the function government services and data governance institutions, and continues to innovative practices.

Current data governance departments of local governments at the provincial level can be classified into three modes of organization:

1. Independent Data Management Organizations, represented by Big Data Administration or Big data center. Among them, the institutional characteristic of the Big Data Authority is relatively diverse, administrative entity, public institutions entity and legal entity are the three institutions. In terms of management content, the big data management bureau focuses on the overall management of local government data.
2. Data Management Bureaus operated by departments with related functions of data management. They are mainly local-level Department of Industry and Information technology (also listed as Economic and Information Technology Bureau), in addition to the is responsible for the functions of informatization, it also manages government big data.
3. Management Office of government affairs data operated by agencies and offices with data management-related functions.

³ Data from the "National Integrated Government Affairs Big Data System Construction Guide

2.3 Personnel

2.3.1 Leadership

In China, the Committee system and Leadership Group system are the main forms of data governance leadership system. The Political Bureau of the 19th CPC Central Committee has conducted several collective learning on implementation of national big data strategy to accelerate the construction of Digital China, Strong Cyber Nation, on the application of new technologies such as big data, artificial intelligence, blockchains, quantum technology, and on the development of the digital economy, to continue enhance digital leadership.

In order to strengthen the centralized and unified leadership of the development of national cyber security and informatization and enhance decision-making and coordination responsibilities, in 2018 China has changed the Central Leading Group on Cyber Security and Informatization into the Central Committee on Cyber Security and Informatization, it is responsible for leading national level top-level design, overall layout, coordination, overall promotion, supervision and implementation of work related to cybersecurity and informatization. The Central Cybersecurity and Informatization Commission is headed by the President, and its workworn office is Cyber Administration of China. Localities also set up Cyber security and informatization Leading group, achieving unified leadership on local cyber security and informatization.

The "Guiding Opinions on Strengthening the Building of a Digital Government" sets out to set up a leading group on digital government construction, coordinating and guiding the construction of digital government. It is headed by leaders of the State Council, the General Office of the State Council sets a leading group office, responsible for organization, promotion, and implementation of national top-level design ideas at departments and localities, and establishes sound digital government construction leadership and coordination mechanism. The leading group system is a political advantage under China's Socialist system which can "pools effort to accomplish big task". It establishes a sound coordinated national response mechanism, maximizes cohesion in development, enhances policy transmission and communication effectiveness, guarantees the efficient implementation of digital government construction, better serves economic and social development and key strategies of the nation.

In order to promote the implementation of related work in the process of data governance, the establishment of steering group has become an important measure to strengthen organizational leadership and work guarantee. For example, in order to promote the integration and sharing of government information resources and government information systems, China has established the steering group for government information system integration, sharing and implementation, and has established inter-ministerial coordination mechanism, focusing on strengthening coordination at the working level, operational level, and implementation level and orderly procession of work.

2.3.2 Chief Data Officer

Currently, Cyber Administration plans to select several provincial governments as pilot for chief data officer system, then spread the establishment of chief data officer system nationwide. Guangdong, Jiangsu, Zhejiang and Liaoning Provincial Governments, several City Governments, and some enterprises has gradually implemented chief data officer system, aiming to accelerate the construction of data governance system, to raise awareness of data strategy and to promote the development of data industry.

In 2021, in order to accelerate reforms on marketization of data factor allocation and improve coordination mechanism of government data sharing, Guangdong Province issued "Pilot Work Plan for Chief Data Officer System", selected Guangzhou, Shenzhen, Zhuhai, and other 10 municipalities, as well as the Provincial Public Security Department, the Department of Human Resources and Social Security and other six provincial departments to carry out pilot tests. The plan clarifies work mechanism for Chief Data Officer. Under the unified leadership of Provincial and City Digital Government Reform and construction steering group, each pilot city, county (city, district) establishes chief data officer for each level of governments and department, and in principle, chief data officer position should be concurrently held by administrative leaders or above level who oversee digital government reform and construction. In addition, the plan also contains rules for chief data officer evaluation system, provincial government services data management bureau shall organize pilot prefecture-level cities and related provincial departments to evaluate the performance of the chief data officer. In 2022, Guangdong Province issued the *Guideline for the construction of chief data officer in Enterprises*, it encourages enterprise of various industries that has sufficient digital foundation, larger scale of data resources, outstanding data products and service capabilities to establish Chief Data Officer.

2.3.3 Cadres and civil servants

Improving digital literacy level leading cadres and civil servants is a significant concern for China. Based on the existing cadre training system, capacity enhancement mechanism and Master of Public Administration (MPA) training system, China has implemented targeted digital capacity development and enhancement work to cultivate leading cadres and civil servants at all levels to have the capacity to "speak with data, make decisions with data, manage with data and innovate with data".

The Action Plan for Improving General Digital Literacy and Skills

- a) enhance the digital governance capabilities of leading cadres and civil servants
- b) increase information training for leading cadres and civil servants
- c) enrich online training resources in the fields of digital economy, digital society, and digital government
- d) improve the digital governance ability of party members and leading cadres, and plays an important teaching and training content of party schools (administrative colleges) at all levels

- e) guide leading cadres and civil servants to utilize internet to understand public opinion and carry out their work, and enhance the ability to learn, understand and use the internet
- f) increase inspection of digital ability in selection and appointment of civil servants
- g) improve digital literacy of leading cadres and civil servants clearly with the establishment of a full participation training system, and promote the training of all leading cadres by levels, categories, and stages
- h) establish a classified and leveled digital skill training system for civil servants, and carry out training in a comprehensive and differentiated manner.

2.3.4 Public

From 2017 to 2021, the size of China's Internet users has grown from 772 million to 1.032 billion, the Internet penetration rate has increased from 55.8% to 73%, especially the Internet penetration rate in rural areas reached 57.6%, the difference between urban and rural areas narrowed by 11.9%; the average monthly mobile Internet household traffic (DOU) reached 13.36GB/household-per-month in 2021, 7.7 times more than in 2017; construction of national smart education platform has accelerated, all primary and secondary schools (including teaching points) has connected to internet⁴. National level of informatization continues to rise. Attention has been given to improvements of national digital literacy, China sees the enhancement of national-wide digital literacy and skills as the requirements of the digital era, a strategic task in improving citizen quality and promoting well-round human development, a definitive path to realize *Strong Cyber Nation from Large Cyber Country*, and a key initiative to bridge the digital divide and promote common prosperity.

China is focusing on developing digital infrastructure, optimizing digital resource supply, improving guarantees to digital environment, and building a digital literacy and skills development and cultivation system that covers the whole population, combine urban and rural areas, is fair, sustainable, and resilient. 2021, Cyber Administration issued the "Action Outline for Enhancing General Digital Literacy and Skills", which clearly puts forward the development goals, main tasks, and key projects for enhancing digital literacy and skills for all. In 2022, China launched its national digital literacy and skills enhancement platform (<http://www.chinadata.cn>). The platform service model is based on "resource collection, online learning, information dissemination and community exchange" as its core, it bridges the "digital divide", enhance digital participation, and promote balanced and inclusive development of data governance.

2.3.5 Experts and think tanks

To promote the healthy and coordinated development of national e-government, in 2018, Cyber Administration, together with the National Development and Reform Commission, the Ministry of Industry and Information Technology, the National Standards Committee and other departments, jointly established the National E-Government Expert Committee, and established an expert consultation system. The national e-government expert committee consists of 37 well-known

⁴ Data from "Digital China Development Report (2021)"

experts from central and local governments, enterprises and institutions, research institutes and other fields, including academicians and scholars. The main task of the expert committee is to research and judge the trends of international e-government development, to study major issues in national e-government construction and management, to guide the development of e-government pilot, to provide advice for the development of national e-government strategic planning and major engineering construction, and to provide policy recommendations on e-government for the Central Cyber Security and Informatization Leading Group⁵. The Expert Committee participates in data governance through policy consultation, project research, performance evaluation and so on, and promotes the professionalization, scientific, democratization and standardization of China's data governance and management, advances the healthy, coordinated, and sustainable development of national data governance, and promotes the modernization of the national governance system and governance capacity.

Under National E-government Coordination Mechanism, General Pilot Work of National E-government and local e-government coordination mechanism, each provincial government has established its own E-government Expert Committee and Consultation system, these systems listen and receive expert opinions on data governance planning, major project evaluation, policy consultation, standards, and specifications. Some local governments have also set up expert think tanks. For example, Guangdong Province has introduced expert think tanks and third-party consulting organizations joining with the Central Party School (National School of Administration) to set up the Guangdong Institute of Digital Government Research, and established "Digital Government" reform and construction Expert Committee, which attaches significance to expert consultation, guarantees policy and ensures scientific decisions, and gathers efforts in solving problems and challenges encountered in development.

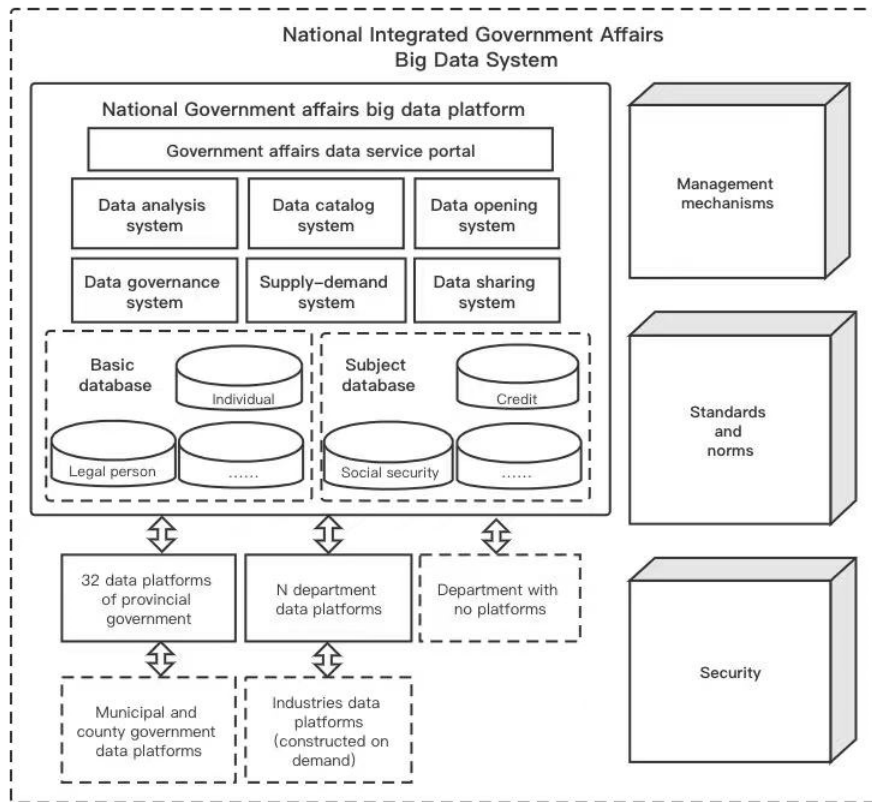
2.4 Process

2.4.1 General framework of data governance

The Guide to the Construction of the *National Integrated Government Big Data System (The System)* provides an in-depth and detailed elaboration of the government affairs data governance system and processes. The *System* includes three types of platforms and three "support". The structure of the platforms is "1+32+N". "1" refers to the *System* integrated platform. "32" refers to the platforms of 31 provinces (autonomous regions and municipalities directly under the Central Government) and Xinjiang Production and Construction Corps, responsible for data convergence, integration, sharing, opening, development, and utilization, further connecting with the national platform. "N" stands for the data platforms of departments of the State Council. Departments that have not yet built government data platforms can be supported by the national platform to provide services. The three "support" include management mechanisms, standards and norms, and security arrangements.

⁵ Information from the State Internet Information Office public news

Figure 1 The framework of the national integrated government affairs big data system⁶



2.4.2 Cross-level and cross-department data flow mechanism

Relying on the integrated government service platform and the integrated government big data platform, the interconnection of the national with the local and departmental platform hubs has promoted the formation of a cross-level and cross-department data circulation mechanism in China. The National Government Affairs Big Data Platform is constructed by integrating the existing sharing platform, open platform, supply and demand docking system, basic database, theme database, arithmetic facilities, and disaster backup facilities. In addition, it also built new system components such as data service, data governance, data analysis, government affairs cloud monitoring, and data security management.

It mainly includes the national government data service portal, two types of database (the basic database and the subject database), six core systems (data analysis system, data catalog system, data opening system, data governance system, the supply-demand system, and data sharing system), as well as other related application support components including standard algorithm models, government block chain services, government cloud monitoring, data security management, arithmetic facilities, and disaster recovery facilities. The National Government Affairs

⁶ Source from the "National Integrated Government Affairs Big Data System Construction Guide

Big Data Platform is the core node of the national integrated government affairs big data system. The government data in the local and departmental platforms should be in accordance with the standard of the national platform.

Figure 2 Relationship between the national platform and departmental/local platforms⁷

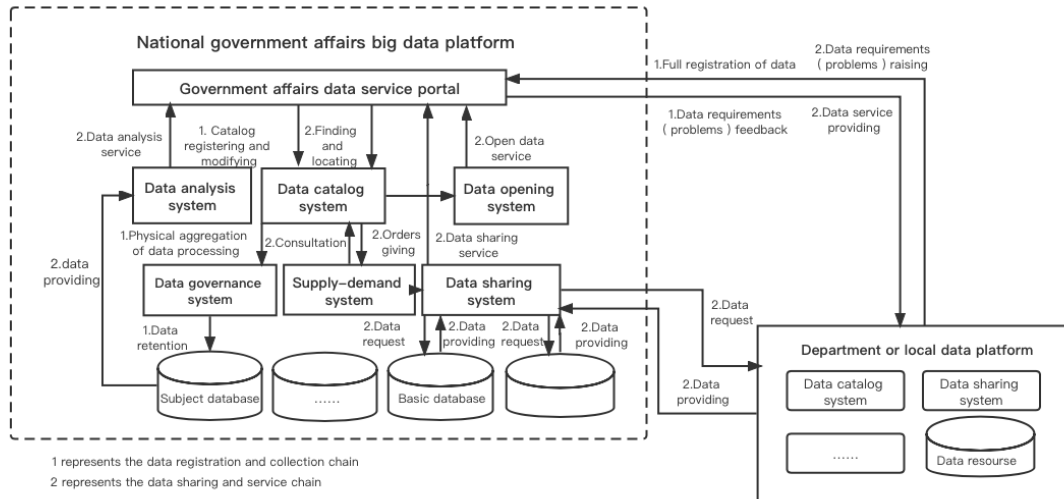
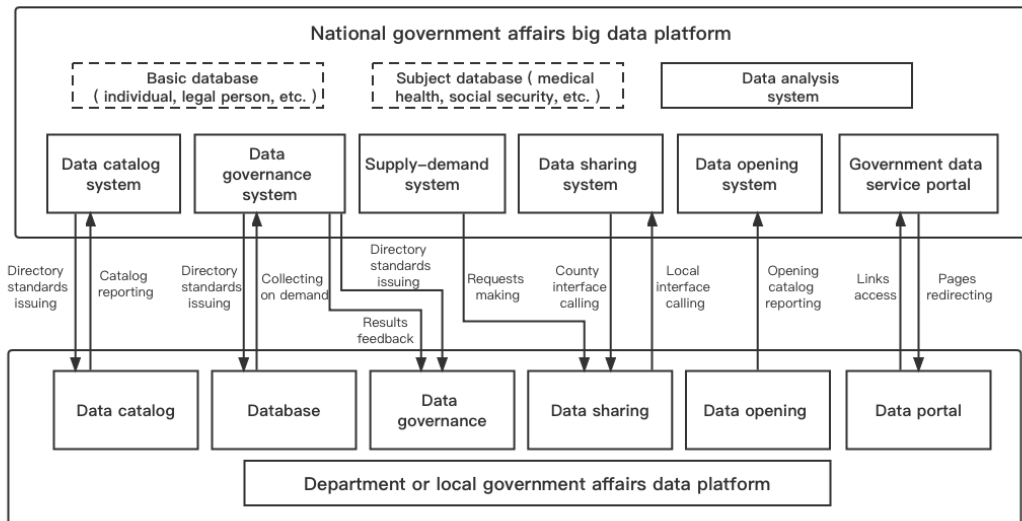


Figure 3 Relationship between the national platform and related systems of local and departmental platforms⁸



2.4.3 Data flow mechanism between systems

China's data governance circulation mechanism promotes the integration and application of data resources through interconnection and sharing between the national integrated government affairs

⁷ Source from the "National Integrated Government Affairs Big Data System Construction Guide
⁸ Source from the "National Integrated Government Affairs Big Data System Construction Guide

big data platform system and related systems, thereby integrating government data, public data, and social data.

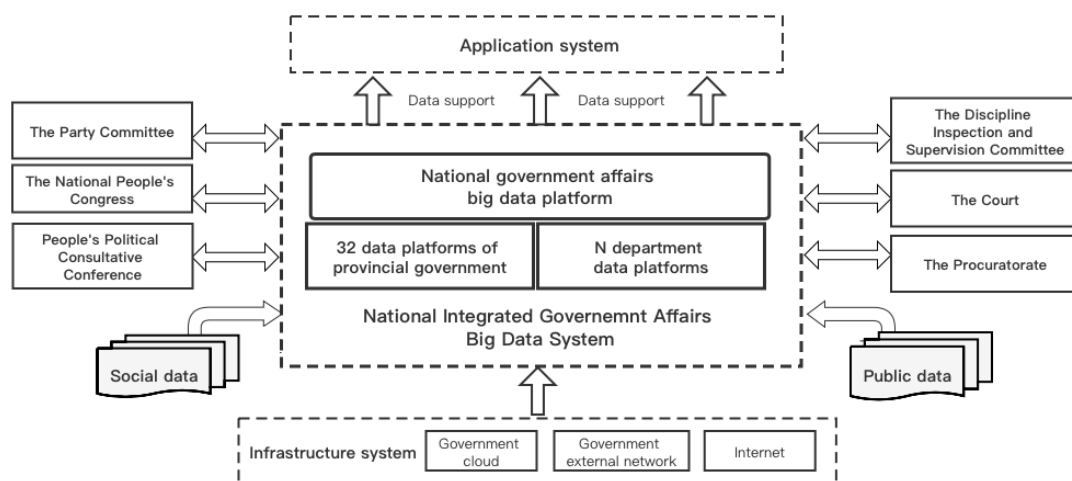
First, it integrates the existing data sharing channels such as the national integrated government service platform and the national data sharing and exchange platform. It makes full use of the national integrated government service platform and the national "Internet + supervision" system, optimizes the portal of government data services, builds a unified government data catalog, demand standards, and data sharing and exchange rules, providing coordinated and efficient government data services for the whole country.

Second, sharing of classified data is carried out by the national e-government intranet. The sharing and exchange of data between the government intranet and the government extranet is promoted. Therefore, the effective interaction between non-classified data and the government intranet is realized, and the declassified data can be shared safely and opened in an orderly manner through the national government big data platform.

Third, the national integrated government affairs big data system can connect data from the party committee, the National People's Congress, the Chinese People's Political Consultative Conference, the Discipline Inspection and Supervision committee, the court, the procuratorate, the military, etc.

Fourth, to promote the integration and utilization of public data and social data, the national integrated government big data system can connect public data collected or created by public service providers (water supply, power supply, gas supply, public transport, and others) and other information platforms.

Figure 4 Relationship between national platforms and related systems⁹



⁹ Source from the "National Integrated Government Affairs Big Data System Construction Guide

3. China's Data Governance Framework

3.1 Data Standards and Classification

3.1.1 A systematic data standard system

In 2020, to strengthen the top-level design of e-government standardization and promote the implementation and application of e-government, the General Office of the State Administration for Market Regulation and five other departments jointly issued the "Guide to the Construction of National E-government Standard System". The framework consists of seven parts: general standards, infrastructure standards, data standards, business standards, service standards, management standards, and security standards.

Figure 5 The Framework of E-government Standards System¹⁰

General standards	Infrastructure standards	Data standards	Business standards	Service standards	Management service	Security standards
<ul style="list-style-type: none"> • Term • Handbook • Reference model 	<ul style="list-style-type: none"> • Hardware facilities • Software facilities • Network 	<ul style="list-style-type: none"> • Metadata • Classification and coding • Database • Information resource catalog • Data format • Opening and sharing • Development and utilization • Data management 	<ul style="list-style-type: none"> • Process • System 	<ul style="list-style-type: none"> • Infrastructure • Applications 	<ul style="list-style-type: none"> • Maintenance and operation • Test and evaluation 	<ul style="list-style-type: none"> • Security management • Security technology • Security products and services

The data standards include metadata, classification and coding, database, information resource catalog, data format, opening and sharing, development and utilization, and data management. Among them, the first five serve as the foundation of e-government data standards, providing the basis for constructing various e-government databases. Specifically, **database standards** contain standards for basic database and subject database, **opening and sharing standards** mainly clarify the data requirements, **technical requirements and management requirements** specify the hierarchical structure and exchange mode of information exchange, and support the establishment of a timely and secure exchange system of government information resources; **development and utilization standards** mainly include the data requirements, business requirements, service requirements, management requirements and security requirements for utilizing public data resources; **data management standards** generally provide a basis for government data service management and personal data management.

3.1.2 Data cataloging and classification

¹⁰ Source from the "National E-Government Standards System Construction Guide

In 2017, National Development and Reform Commission and Cyberspace Administration of China issued the Guide to Publishing Government Information Resource Catalogue. The national standard GB/T21063 "Catalogue System of Government Information Resources" stipulates in detail the overall framework, technical requirements, core metadata, classification of government information resources, coding rules of government information resources identifiers and technical management requirements. The catalog of government information resources is the basis for realizing the sharing of government information resources, business collaboration, and data opening, and serves as the rationale for information sharing among government departments and the opening of government data to society. The compilation of the government information resources catalog covers the classification of government information resources, metadata description, code planning and cataloging, and the organization, process and requirements of related work. Among these, the classification of government information resources catalog is composed of classification of resource attributes, classification of classified attributes, classification of shared attributes and hierarchical attributes, etc.

Table 3 Classification of Government Information Resources

Classification	Specific Catalog Properties	Examples
Classification of resource properties	Catalog of Basic Information Resources	National basic information resources include national population basic information resources, legal entity unit basic information resources, natural resources and spatial geography basic information resources, social credit basic information resources, electronic license basic information resources, etc.
	Catalog of Subject Information Resources	The Catalog of government information resources formed by multi-departmental joint projects around the same subject area of economic and social development. The areas include but are not limited to public services, health security, social security, food and drug safety, production safety, price regulation, energy security, credit system, urban and rural construction, community governance, ecological and environmental protection, emergency stability maintenance, etc.
	Catalog of Departmental Information Resources	Departmental information resources contain information resources of the Party Central Committee, the Standing Committee of the National People's Congress, the State Council, the National Committee of the Chinese People's Political Consultative Conference, the Supreme People's Court and the Supreme People's Procuratorate's government departments, and information resources of provinces (autonomous regions and municipalities directly under the Central Government), municipalities under the plan and their government departments at all levels.
Classification of classified properties	Catalog of Classified Government	The sorting, compilation, management, and application of the catalog of classified government information resources and the catalog of non-classified government information

	Information Resources	resources shall rely on the national data sharing and exchange platform (government affairs intranet) and the national data sharing and exchange platform (government affairs extranet), respectively
	Catalog of non-classified government information resources	
Classification of Shared Properties	Unconditional sharing	The corresponding catalogs of government information resources that can be provided for shared use by all government departments belong to the unconditional sharing category
	Conditional Sharing	The corresponding catalogs of government information resources that can be provided to relevant government departments for shared use or only partially provided to all government departments for shared use belongs to the conditional sharing category
	Not to be shared	The corresponding catalogs of government information resources that are not suitable for shared use by other government departments belong to the category of not sharing
Classification of Hierarchical properties	Departmental Government Information Resources Catalog	Departmental government information resources catalog prepared by the government departments
	National Government Information Resources Catalog	National government information resources catalog organized by the National Development and Reform Commission

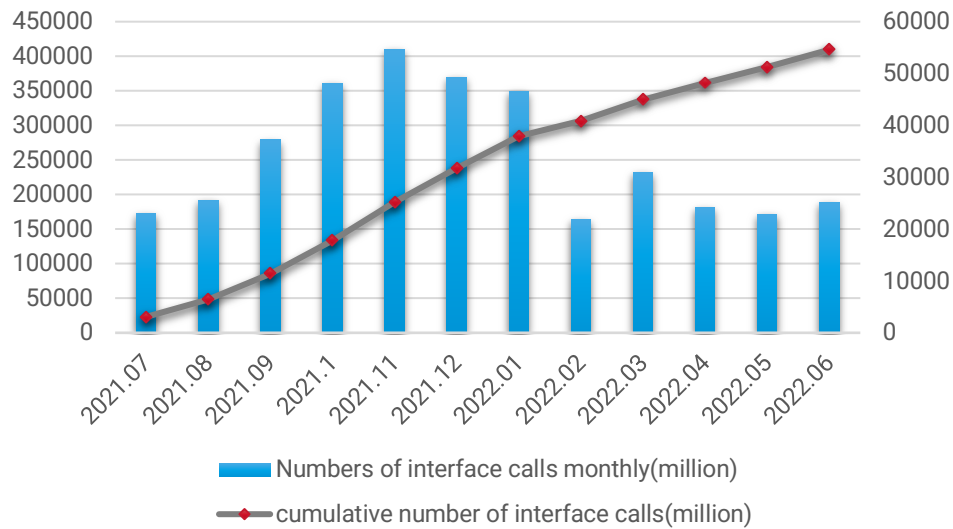
3.2 Data Sharing, Opening, and Utilization

3.2.1 Data sharing

In recent years, China accelerated the pace of public data sharing by continuously releasing shared data interfaces and updating data entries. As of June 2022, the national data sharing and exchange platform has accumulated more than 680,000 online directories, released more than 1,000 shared interfaces, and provided more than 7.8 billion inquiries/verifications¹¹. China has built a nationwide government network with the largest number of government departments services.

¹¹ Data from the national data sharing and exchange platform

Table 4 National data sharing and exchange platform query/verification interface calls (July 2021 to June 2022)¹²



3.2.2 Data opening

In 2015, the "Action Plan for Promoting Big Data Development" proposed building a unified open platform for national government data and gradually opening government data sets to society in relevant key areas. In 2018, the Work Plan for the Pilot Program of Opening Up Public Information Resources was issued, which decided to carry out the pilot work of opening public information resources in Beijing, Shanghai, and other places. In 2021, the national "14th Five-Year Plan" proposed to strengthen the opening and sharing of public data. In the same year, the *Data Security Law* was promulgated, providing for the first-time legislative provisions on open principles, catalogs, platforms, and other matters. In recent years, China has made positive progress in data opening. From 2017 to 2021, the number of open data platforms at the provincial level has increased from 5 to 24, and the number of open data sets risen from 8,398 to nearly 250,000¹³.

In addition to the traditional model of providing government data directly through open websites and platforms, some local governments have innovated the data opening mode. Under the premise of security and privacy, they explore ways to expand the scope of government data that can be opened through targeted stakeholders and specific areas. Take the opening of Beijing's real-time public transport data as an example, at the end of 2019, the Beijing Municipal Commission of Transportation took the lead in connecting the real-time bus data of many companies in Beijing, and built the Beijing Transportation Green Travel Integration Service Platform (MaaS platform) to provide real-time bus data. Gaode map, Baidu Map, Tencent Map, and other Internet transportation service products have been connected. The public can easily see the arrival time of

¹² Data source: National data sharing and exchange platform

¹³ Data from "Digital China Development Report (2021)"

vehicles and the level of congestion on their commonly used mobile map apps, which has significantly improved the public travel experience.

3.2.3 Data utilization

Data has enormous potential in transforming and upgrading enterprises, urban governance, and public governance. It has become an innovative driving force for the development of the digital economy, which is an essential way for China to enter a new development stage, to implement new development philosophy, and to build a new development paradigm. The scale of China's big data industry is proliferating, from 470 billion yuan in 2017 to 1.3 trillion yuan in 2021.

China is also the first country to explicitly include data as a factor of production in its national policy¹⁴. In 2019, the Fourth Plenary Session of the 19th CPC Central Committee proposed for the first time to involve data as a factor of production in distribution. In 2020, the Fifth Plenary Session of the 19th CPC Central Committee further emphasized the significance of data factors. In the same year, the *Opinions of the State Council of the CPC Central Committee on Building a Perfect Institutional Mechanism for Market-based Allocation of Factors* was issued, which is the first central government document on the market-based allocation of factors. The reform direction is proposed around the five factors (labor, capital, land, science and technology, and data). Data is listed separately as a factor of production, and data becomes a new factor of production, which plays a fundamental and supportive role in the development of digital economy.

The document also clearly puts forward the specific requirements of "accelerating the cultivation of data factor market" and emphasizing the need to promote the opening and sharing of government data to enhance the value of social data resources, and strengthen the integration and security protection of data resources. In 2021, the State Council issued the *14th Five-Year Plan for Digital Economy Development* and proposed the strategic task of "accelerating the construction of data factor market rules, cultivating market players, improving governance system, and promoting the market circulation of data factor".

In 2022, the CPC Central Committee and the State Council issued the *Opinions on Accelerating the Building of a National Unified Market*, which put forward requirements such as "accelerating the cultivation of a data factor market". The Commission for Comprehensively Deepening Reform of the CPC Central Committee passed the *Opinions on Building a Data Based System to Better Play the Role of Data Factors*. It is of great significance to improve the market-based allocation mechanism of data factor.

In recent years, the government has continued to issue policy documents to emphasize the importance of data. By taking data as a key factor of production and building a data-based system,

¹⁴ Data from "Digital China Development Report (2021)"

China promotes the confirmation, pricing, and circulation of data as well as the market-based allocation of data factors, so as to promote high-quality economic and social development.

In order to meet the needs of the development of the local digital economy, Cyberspace Administration of China, in conjunction with relevant departments implemented pilot projects in Guangdong, Shanghai and other eight provinces and cities. These provinces and cities formulated policies and standards and created more than one hundred applications in finance, transportation, and health care. In addition, Beijing International Big Data Exchange and Shanghai Data Exchange have been inaugurated one after another, accelerating the development of data trading models.

Moreover, the government-authorized operation of public data promoted the release of government data value. The "14th Five-Year Plan" has put forward new requirements for the circulation of government data resources, pointing out that government data authorization and operation should be carried out on a pilot basis to encourage third parties to deepen the mining and utilization of public data. Currently, many local governments in China are implementing a model in which data management and data operation are separate.

3.3 Data Security

Data governance in China always adheres to the equal importance of security and development. Based on a holistic approach to national security, data governance in China focuses on the whole life cycle of data management and the responsibility of relevant stakeholders. The introduction of *Network Security Law* and *Data Security Law* of China aimed at clarifying the legal responsibilities, improving the regulatory system, and further guaranteeing national security, data security, social security, and stability.

3.3.1 Data security policies

In recent years, China has formulated many laws and policies on data security: *Network Security Law*, *Data Security Law*, *Personal Information Protection Law*, *Regulations on the Security Protection of Critical Information Infrastructure*, *Network Security Review Measures*, *Security Assessment Measures for Cloud Computing Services*, *Data Exit Security Assessment Measures*. Among them, the *Data Security Law*, as a fundamental law in the field of data security in China, adheres to the equal importance of security and development and is consistent with the *Network Security Law* and other laws. It has established the basic systems of data security protection and formed the top-level design of data security. *The Regulations on the Security Protection of Critical Information Infrastructure* establishes the basic system for the security protection of critical information infrastructure. *The Personal Information Protection Law* provides a more systematic, targeted, and operable legal compliance for personal information protection.

3.3.2 Data security system

The *Data Security Law* establishes institutional arrangements for data security protection and clarifies rules on data classification and grading, crucial data protection, security risk assessment, data security emergency response, cross-border data flow, and data transaction management. In addition, the *Data Security Law* has a specific chapter on the security protection of government data. China's data security protection system is based on data classification, security review, and other specific system requirements. It clarifies the rights, obligations, and legal responsibilities of all parties in the whole process of data transfer. Focusing on the whole life cycle management of data, with "people, data and scenes" management as the core, government agencies should establish and improve the work responsibility mechanism and formulate data security management specifications such as access rights control of government data, abnormal risk identification, security risk disposal, behavior audit, data security destruction and index evaluation. Internal data security testing and external certification should be carried out to promote the effective implementation of data security management norms.

3.3.3 Data security technology

China has strengthened regular data security testing and technical protection, and established a data-oriented information security technology protection system. It makes full use of electronic authentication, data encryption storage, transmission and application mean to prevent data tampering, promote data desensitization use, to reinforce important data protection, to enhance personal privacy and commercial secret information protection, to strictly control data access behavior, and finally to realize logging process and refined authority management. A data security situational awareness platform has been built to mine and sense various threat events, enabling timely blocking of high-risk operations, changing passive defense to active defense, improving risk prevention capability, optimizing security technology application mode, and enhancing security protection monitoring level.

3.3.4 Network security system and capacity building¹⁵

China's cybersecurity capacity is being continuously strengthened, and several important systems have been established, such as security protection for critical information infrastructure, network security review, cloud computing services security assessment, and network security vulnerability management. The cybersecurity standard system has been increasingly improved, with more than 300 national standards formulated and released. The national network security emergency work system has been constantly improved, and the scale of the network security industry is growing rapidly. Cybersecurity discipline development and talent training has been accelerated significantly with national cybersecurity talent and innovation base in operation, more than 60 universities setting up cybersecurity colleges, more than 200 colleges setting up cybersecurity undergraduate programs, and more than 20,000 students majored in cybersecurity graduating every year. The ongoing National Network Security Week and other activities have created a good atmosphere for the whole society. Data security management and personal information protection have been

¹⁵ Data from "Digital China Development Report (2021) "

significantly strengthened, and special campaigns have been organized to address the illegal collection and use of personal information by apps. By the end of 2021, eight National Cyber Security Publicity Weeks have been held in a row, creating a good atmosphere for jointly safeguarding cyber security across the country.

3.4 Data Privacy

In order to standardize the use of data and give full play to the value of data, in recent years, the protection of personal information and privacy has become the focus of China's data governance policies and legislation.

3.4.1 Policy system of privacy protection

In the currently effective laws in China, a combination of specialized and decentralized legislation is used for personal information protection. The *Civil Code* defines the basic contents such as the attributes of personal information rights and interests, principles, and responsibilities of personal information handling, while the *Personal Information Protection Law* gives specific norms in the form of special laws, single-act laws, and comprehensive laws with personal information handling as the core. There are also regulations on personal information protection scattered in many laws: the *Data Security Law*, the *Criminal Law (2020 Amendment)*, the *Network Security Law*, the *E-Commerce Law*, the *Law on the Protection of Consumers' Rights and Interests*, the *Law on Punishment for Public Security Management*, and the *Law on Prevention and Control of Infectious Diseases*, as well as the *Interpretations on Several Issues Concerning the Application of Law in Handling Criminal Cases of Infringing Citizens' Personal Information* issued by the Supreme People's Court and the Supreme People's Procuratorate.

The introduction of the *Personal Information Protection Law* provides a comprehensive legal basis for the protection of personal information, the obligations of information processors, and the responsibility of government authorities. In addition, some policies make special provisions for specific groups, for example, the *Regulations on the Protection of Children's Personal Information Network* aim to protect the security of children's personal information.

3.4.2 Processing principles of personal information

The processing of personal information includes collection, storage, use, handling, transmission, provision, disclosure, deletion. The principles of personal information processing proposed by *China's Personal Information Protection Law* include the following:

First, the processing of personal information shall follow the principles of legality, legitimacy, necessity, and integrity, and personal information shall not be processed through misleading, fraudulent, or coercive means.

Second, the processing of personal information shall have a clear and reasonable purpose, and directly related to the purpose of processing in a manner that has the least impact on the rights and interests of individuals. The collection of personal information shall be limited to the minimum extent necessary to achieve the purpose of processing, and personal information shall not be collected excessively.

Third, the processing of personal information shall follow the principles of openness and transparency. The rules for handling personal information shall be public, and the purpose, manner, and scope of handling shall be clear.

Fourth, the processing of personal information shall ensure the quality of personal information and avoid adverse effects on the rights and interests of individuals due to inaccurate and incomplete personal information.

In addition, a particular chapter is set for the handling of personal information by national authorities. State organs shall, in order to perform their statutory duties, process personal information in accordance with the limits of authority and procedures prescribed by laws and administrative regulations, and shall not exceed the scope and limits necessary for the performance of their statutory duties.

3.4.3 A classification system of personal information and privacy

The current law of China has basically established the classification protection mode of personal information. Personal information can be divided into private information and non-private information, and can be divided into sensitive personal information and non-sensitive personal information. Private information and non-private information carry different legal interests, while the main difference between sensitive personal information and non-sensitive personal information lies in the processing rules. Different types of personal information are subject to different rights provisions, handling rules, rights relief methods and responsibilities. Private information and sensitive personal information carry higher legal interests and should be protected more strictly by law.

3.5 Infrastructure

3.5.1 A collaborative and innovative data center system

China has accelerated the construction of a national integrated big data collaborative innovation system with the core of deepening the reform of market-oriented allocation of data elements, aiming to optimize the layout of data center construction and promote the intensification of computing power, algorithms, data and application resources and service innovation. Meanwhile, it deepens government-enterprise, industry and regional collaboration to support the digital

upgrading of various industries and the digital transformation of industries. In recent years, China has achieved higher quality data transmission services by continuously optimizing the layout of data centers and the layout of national Internet backbone direct connection points, promoting the construction of new Internet exchange centers, improving the quality of interconnection between telecom operators and Internet enterprises, and enhancing data center cross-network and cross-territory data interaction. China also promoted the establishment of data center direct connection networks among regional data center clusters and increased monitoring of data center network quality to improve network communication quality.

The Guidance on Accelerating the Construction of a Nationwide Integrated Large Data Center Collaborative Innovation System sets out a clear development goal that by 2025, data centers nationwide will form an integrated pattern of infrastructure with reasonable layout and green environment. Specifically, East-West data centers should achieve structural balance, and the operational electric energy utilization efficiency of large and super-large data centers should be reduced to less than 1.3; several industry data brains and city data brains should be established nationwide, and arithmetic resources and data resources started to transform to intellectual resources across the society.

3.5.2 An integrated construction model¹⁶

The basic capacity of China's national e-government extranet has been continuously improved, and has achieved 100% coverage in administrative regions above the county level, with a coverage rate of 96.1% in townships. The basic support capacity of the government affairs cloud has been consolidated, and the cloud infrastructure of 31 provinces (autonomous regions and municipalities directly under the Central Government) and Xinjiang Production and Construction Corps has been basically completed, and more than 70% of prefectural-level cities have built government affairs clouds, and government affairs information systems have been gradually migrated to the cloud, with the initial formation of an intensive construction pattern. China has set up a national integrated government data sharing hub. Relying on the national integrated government service platform and the national data sharing and exchange platform, China has set up a data sharing and exchange system covering departments under the State Council, 31 provinces (autonomous regions and municipalities directly under the Central Government), and the Xinjiang Production and Construction Corps. Unified management of government data catalogs, unified release of data resources, unified acceptance of sharing demands, unified docking of data supply and demand, unified handling of data objections, and unified promotion of data applications and services have been achieved. The national integrated government data sharing hub has been connected to 5,951 government departments at all levels, and released 9,565 data resources from 53 State Council departments, supporting the sharing and utilization of more than 310 billion times. Governments at all levels have accelerated the planning and layout of information infrastructure, accelerated the construction of an integrated government service platform, promoted the integration of government information systems, and continued to invest funds in the construction of e-

¹⁶ Data from the "National Integrated Government Affairs Big Data System Construction Guide

government related systems and platforms in various fields and industries, all of which have laid a solid foundation for data governance.

3.5.3 Basic and thematic databases

China has stepped up its efforts in coordinating the sharing of government affairs data. State Council departments in development and reform, public security, natural resources, and market supervision jointly built and continuously improve national basic databases (population, legal persons, natural resources, economy, and electronic licenses, etc.). Several thematic databases (medical and health care, government services, social security, ecological and environmental protection, credit systems, emergency management, state capital supervision, etc.) have also been built by different government departments. All these databases will be integrated into the national integrated government big data system.

Based on their own government data platforms, local government are also actively building subject databases for epidemic prevention and control and economic monitoring, promoting the full authorization and independent management of data resources by region and subject. At present, a catalogue system of government affairs data covering the national, provincial, city and county levels has taken shape. Relying on the national integrated government affairs service platform, various regions and departments have released over 3 million government affairs data catalogues and over 20 million information items. Basic databases of population, legal persons, natural resources, and economic data have been basically completed, playing an important supporting role in optimizing government services and improving the business environment. Departments of the State Council have actively promoted the establishment of theme databases in such fields as medical and health care, social security, ecological and environmental protection, credit systems, and work safety to provide strong support for the government's performance of its duties in economic operations, government services, market supervision, and social governance.

3.5.4 Continuous consolidation of data infrastructure construction¹⁷

China adheres to the concept of efficient, practical, intelligent, green, safe, and reliable infrastructure construction. First, China plans to continue to strengthen 5G, gigabit optical networks, the Internet of Things and other next-generation communication network infrastructure. 5G development will lead development. Gigabit optical broadband networks will be built in over 300 cities across the country, and both rural and urban areas will enjoy the same speed. By the end of 2021, 1.425 million 5G base stations have been built, accounting for more than 60 percent of the world's total, with 355 million 5G users. Second, China steadily promotes the construction of data and computing infrastructure. The average annual growth rate of computing power in the past five years exceeded 30% and the scale of computing power ranked second in the world. The national new computing power network pattern accelerated to improve under the strategy of creating a full swing to channel more computing resources from the eastern areas to the less developed western region. Thirdly, the scale deployment and application of IPv6 has been accelerated, and the IPv6 support capacity of network facilities and terminal equipment has greatly

¹⁷ Data from Digital China Development Report (2021)

improved. By the end of 2021, the total number of IPv6 address resources ranked first in the world, and the number of active IPv6 users reached 608 million. The penetration capacity of China's digital infrastructure system has been further enhanced, and the efficiency of energy utilization has been further improved, providing strong infrastructure support for the construction of a Digital China.

3.6 Digital Identity

China attaches great importance to the construction of digital identity, and has introduced a series of laws, regulations, and standards to guide and regulate the construction, application, and research of digital identity technology. With the world's largest number of Internet users, a rich Internet industry and model, and the rapid development of the digital economy, digital government and digital cities, the construction of digital identity system must adapt to China's conditions. It is necessary to consider both online business and offline applications, to serve domestic Internet users and support overseas users, to meet urgent needs and to lay a good foundation for the long-term construction of the digital identity system, and to take special groups into account, such as the elderly who cannot use smartphones.

3.6.1 Phased construction of digital identity system

Based on national legal basic identity documents represented by resident ID cards and international standard machine-readable travel documents, China is accelerating the development of credible digital identity with Chinese characteristics using new generation information technologies such as artificial intelligence and network security and data protection.

China will promote the development of digital identity in two stages: first, consistent with the requirements of the *Personal Information Protection Law*, China will actively construct a centralized national digital identity infrastructure, issue authoritative digital identities, provide services such as identity identification and biometric matching, and support cross-region, cross-business and cross-level identity recognition. The second step is to establish a "blockchain+" digital identity alliance chain with the state-issued trusted digital identity symbol as the root identity and authoritative verifiable credentials as the identity attribute statement. China will innovate technologies such as identification algorithms, privacy calculations, high concurrent transactions, etc. It will gradually develop to support various distributed applications and build an advanced digital identity system with hybrid architecture.

3.6.2 Development of digital identity based on resident identity cards

At present, the framework of China's digital identity technology system based on the electronic application of the resident ID card is clear. Relying on national legal identity documents such as the resident ID card, the number of the document is transformed into a desensitized digital identity symbol using a state-secret algorithm, which can be applied, called and presented by mobile devices in the form of a secure data file or QR code by downloading and installing a special APP. Combined with biometric identification and other "person-certificate consistency" verification, the

government will provides services such as identity registration, authentication, and data sharing. Through the upgrade, expansion, and transformation of the "Internet + Trusted Identity Platform", we will provide online identity authentication public service characterized with "4H" (high availability, high security, high simultaneity, and high performance) to support economic and social development.

4. Digital Governance in China: Practices and Cases

4.1 Digital Governance: Practices and Achievements

➤ Economic development and regulations

China accelerated the use of big data to strengthen the monitoring and diagnosis of the economy and enhance the government's research and judgment capabilities. China continues to deepen the application of digital technology in macro-control decision-making, economic and social development analysis, investment supervision and management, and digital economic governance, and gradually improves the digital level of government economic regulation. Various localities have used big data technology to strengthen economic monitoring and early warning, enhance the full coverage of statistical monitoring and comprehensive analysis of the whole cycle of economic operation, and continuously improve the ability to study and judge the patterns of economic operation digitally.

➤ Market supervision

Through data sharing, China aims to reduce the burden of enterprises and improve its regulatory capacity. Using the front-to-end filing and merging technique with a data sharing mechanism, data sharing promotes market supervision with human resources, social security, customs, commerce, and other business departments. It has created a synergy to reduce the filing of reports for the annual inspection and reduce the burden on enterprises, which helps optimize the business environment. Government makes full use of the information database of legal persons to support local and departmental supervision of corporate irregularities, industry dynamic monitoring, and auxiliary decision-making analysis to prevent business risks.

➤ Municipal regulation and social governance

In recent years, China promotes the construction of "One Network Management Platform" (*yiwangtongguan*), which is to put city management on an integrated platform. To better regulate its municipal operation, China combined "one network management platform" with its social credit system and database for optimal function. With big data algorithm modeling and analysis, the "one network management platform" improves its governance capacity level in urban operations. Through data integration, the platform is used to support emergency disposals and to carry out a risk analysis of related enterprises such as hazardous chemicals, minerals, and natural disaster monitoring and early warning, thus improving the efficiency and quality of social governance and emergency management. Through the credit status analysis, the promotion of the social credit system reveals the credit strengths and weaknesses, reducing the overall credit risks and nurturing the culture of integrity and good faith.

➤ Public services

China continues to promote innovation in government services and improve its efficiency. All regions and departments make full use of data resources to optimize the efficiency of government services. Data resource innovates the service modes of special tax deduction, inter-provincial school transfer, precise poverty alleviation, and inclusive finance to enhance satisfaction and expand the sense of access of enterprises and the public. At present, the online availability rate of

government services has reached over 90%, and the "Government Online-Offline"(yiwangtongban) service has been accelerated.

➤ Environmental protection

China constructed an ecological and environmental protection theme database to strengthen environmental monitoring and emergency response capabilities, covering data on environmental quality, pollution sources, the environmental protection industry, environmental protection technology, and others. Through cross-sectoral data sharing, this database can support ecological quality monitoring, emergency response to environmental incidents and 23 other applications to ensure that the carbon peak and carbon neutral goal will be realized.

➤ Epidemic prevention

Data is exceptionally vital in epidemic prevention. Timely response to the data sharing needs raised by various regions is crucial. China promotes the interoperability and sharing of multiple types of epidemic prevention data across areas, departments, and government levels. Currently, 31 provinces (including autonomous regions and municipalities directly under the central government) have shared health codes, nucleic acid testing, vaccination, isolation control, and other epidemic-related data more than 300 billion times to implement precise prevention effectively.

4.2 Development Practices and Cases

4.2.1 Comprehensive layout and coordination

China's data governance always adheres to the centralized and unified leadership of the central government, fully implements the overall layout of **five-sphere integrated plan** (*wuweiyiti*)¹⁸ and coordinates the strategic layout of **four comprehensives** (*sigequanmian*)¹⁹, resolutely obeys and serves to achieve its two centenary goals, give full play to the driving and leading role of information technology for economic and social development, strongly support the development of the national cause, and become an active explorer and practitioner of the road of socialism with Chinese characteristics.

China's data governance gives full play to the advantages of the socialist system with Chinese characteristics, strengthens policy synergy, up-and-down linkage, and resource integration, addresses critical issues in key areas, extensively solicits opinions and suggestions from all parties, formulates and introduces strategic plans for data governance in various fields and regions, creates a sound ecology with the participation of multiple subjects, comprehensively, systematically, and

¹⁸ Five-sphere integrated plan is a strategic plan layout, meaning to advance economic, political, cultural, social, and ecological development simultaneously.

¹⁹ Four comprehensives depict a modern governance with building a moderately prosperous society, deepening reform, advancing the rule of law, and strictly governing the party.

coordinately promotes national data governance capabilities, and continuously achieves progress, results and breakthroughs.

Case 1: Government information system integration and sharing action

In 2017, the General Office of the State Council issued the Implementation Plan for the Integration and Sharing of Government Information Systems, officially blowing the trumpet for the integration and sharing of government systems. The relevant departments have carried out the integration and sharing of government information systems according to the unified deployment of the State Council. Followed by the National Development and Reform Commission and other relevant departments, State Council has issued several policy measures, including four meetings of the Leading Group for the Promotion and Implementation of the Integration and Sharing of Government Information Systems and more than twenty meetings of the Organization and Promotion Group for the Integration and Sharing of Government Information Systems. This has continuously and deeply promoted the integration and sharing of government information systems.

As of 2019, 61 departments and units of the State Council have cleaned up more than 400 "zombie systems" that have not been used for a long time, and have integrated a total of more than 2,000 small and scattered systems, connecting information silos within departments and promoting the integration of government information systems. It has built a national integrated data sharing and exchange platform, opened the information systems vertically managed by 42 State Council departments, eliminated 3,066 information silos, implemented the first batch of data sharing responsibility lists, and completed the mission of "network access with data access." The first batch of the data sharing responsibility list has been implemented and therefore realized, the sharing and interaction of data resources across departments, regions, and levels²⁰.

4.2.2 Development in a people-centered ideology and a universal and inclusive pattern

China's data governance always insists on enhancing people's well-being and promoting human development, expanding new achievements of information for the people, and providing more inclusive, convenient, high-quality, and efficient digital services. Strengthen the protection of personal information, increase the fight against network crimes, and safeguard the legitimate rights and interests of the people. China put people's safety and physical health in a prominent position, giving full play to the crucial role of digital technology in helping to combat poverty and rural revitalization, support the normalization of epidemic prevention and control, and promote shared prosperity. China continuously improves the digital inclusion and universality of the economy and society to increase people's accessibility, happiness, and security in data governance construction and development.

Case 2: National integrated government services platform

²⁰ Data from the government website news

In March 2022, the State Council issued the Guidance on Accelerating the Standardization and Facilitation of Government Services. It is proposed that the initial completion of the national integrated government services platform would be fully completed by the end of 2022. According to the relevant statistics of the General Office of the State Council, the national integrated government services platform continues to improve, and the capacity of "Government Online-Offline"(*yiwangtongban*) has been significantly enhanced. As of June 2022, there were more than 950 million registered users of the national integrated government services platform, including more than 580 million registered users of the national government services platform, with a total usage of more than 62 billion times. The completion of the integrated government services platform has significantly improved the service level of government services, promoting 90.5% of provincial administrative licensing matters to achieve online acceptance and the average commitment time frame compressed by 51%²¹.

Meanwhile, at the local level, governments have introduced programs related to the construction of government services platforms and actively promoted the digital integration of government services. As of June 2022, following the base hub of the national government service platform, the local governments create links in between, forming the construction of a national, provincial, municipal, and county-level coverage of the government services system. At present, 31 provinces (including autonomous regions and municipalities) and Xinjiang Production and Construction Corps have built government services platform, 30 of which have covered provinces, cities, counties, townships and villages, and the percentage of areas with online government services is as high as 93.75%, and the scope of "village access"(*xiangcuntong*) for government services has been expanding. The scope of "village access" to government services has been expanding, which promotes the extension of government services to the countryside grassroots²².

4.2.3 Innovation-driven and foundation-based

The development of digital China always adheres to innovation-driven values and the modern development concept that China always values. China has been actively using cloud computing, blockchain, artificial intelligence and other technologies to improve data governance and service capabilities. This accelerates the digital transformation of the government, provides more digital services, and promotes the realization of scientific decision-making, precise management, and intelligent services. China has been actively building technological innovation systems, strives to achieve breakthroughs in advantageous areas and significant technologies, and continuously improves digital development capabilities.

China plays the active role of government departments and various enterprises in digital infrastructure construction and digital service supply, appropriately over-deploys digital infrastructure, orderly promotes the digital transformation of infrastructure, and comprehensively improves the accessibility and affordability of digital services. These deployments accelerate bridging the digital divide and the release of digital dividends, solidifying the foundation for the prosperity and development of the digital market.

²¹ Data from "China Internet Report 2022

²² Data from "China Internet Report 2022

Case 3: Comprehensive national e-government pilots

Piloting is one of the effective ways of policy innovation and promotion in China. It is also the primary measure of China's practical innovation in the data governance process. In 2017, the Cyberspace Administration, the National Development and Reform Commission, and other relevant departments jointly carried out a national e-government comprehensive pilot project in response to the problems of insufficient coordination and planning, low level of business collaboration, and lack of government services in local e-government at that time. China took a comprehensive consideration of e-government based on the existing foundation, considering of different management mechanisms and various regions, identified in Beijing, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong, Shaanxi, Ningxia, to carry out a two-year national e-government comprehensive pilot work. At the end of 2019, the pilot areas of e-government coordination capacity had been significantly enhanced, and the level of infrastructure intensification was improved considerably. Government information resources are basically shared in an orderly manner on demand. In addition, the convenience of government services has significantly increased. As a result, China explored a set of local realities of the e-government development model.

4.2.4 Application-driven with joint participation

China's data governance focuses on giving full play to the advantages of the country's mega market and massive data resources, constantly expanding digital application scenarios, and promoting new products, services, and technologies in the digital field to accelerate iterative development. China has been scientifically grasping the relationship between the government and the market. The government has guided the government, enterprises, society, and other parties to participate in a right way, thus forming a high-level benign development model in which demand pulls supply and supply creates demand, effectively stimulating urban and rural Digital transformation and information consumption potential, and constantly strengthen and expand the national digital economy. From the needs of enterprises and people, to the government management and service scenarios, China establishes an orderly data flow with business applications driven, strengthening data empowerment, promoting cross-sector and cross-level business collaboration and applications, and making government data better serve enterprises and people.

Case 4: Data governance pattern in Guangdong ---- *"government-led, public-private partnership, and social participation"*

In the digital government development and data governance process, Guangdong Province is building a new pattern of "government-led, public-private partnership and social participation" for joint construction and sharing. By strengthening the cooperation between government and enterprises and giving full play to the role of market players, the "government + market" model is designed according to the structure of "Office-Center-Platform." The "Office" is the Guangdong Provincial Government Services Data Management Bureau, which coordinates and promotes the construction of digital government, reform of the administrative approval system, and supervision of public resource transactions. "Center" is based on the principle of "separation of management and operation" the Guangdong Provincial Government and giant enterprises break through the information technology engineering and project construction commission relationship and follow the traditional public-private partnership. It set up a digital government construction and operation

center with enterprises as the main body, establishing a new cooperation model of "separation of management and operation" with Tencent and three major telecom operators jointly, which is called Digital Guangdong Network Construction Co. The "Platform" includes government cloud, big data, capability center, and government applications to break information silos. At the same time, Guangdong Province has introduced experts, think tanks, and third-party consulting organizations to establish expert committees and joint scientific research institutions to carry out project construction planning, project implementation consulting, and project management specifications. This action provides theoretical research support, work support, and experience summary for digital government construction and government data resource management innovation in Guangdong Province, forming a diversified data governance and innovation ecology.

4.2.5 Development, safety, and security

China's data governance has always adhered to the integration of development and security, as safeguard data security can ensure sustainable development, while development can promote security. Focusing on the major matters deployed by the central government, China always put the major problems faced in the field of information technology first, analyzing the outstanding obstacles, enhance systematic thinking and bottom-line thinking mechanism, comprehensively strengthening the network security system and capacity building, and constantly building a solid national network security barrier to effectively enhance the stability, security, and sustainability of data governance.

China adheres to the overall national security principle and applies the bottom-line thinking of network security around the whole life cycle of data security management to promote security cooperation and enhance digital governance. Using safe and reliable technology can encourage the standardization of government data security systems and sustain the coordinated development of security and utilization.

Case 5: The Global Initiative on Data Security

In 2022, China proposed the Global Initiative on Data Security. The Initiative believes that to address new issues and challenges and jointly build a peaceful, secure, open, and cooperative. Orderly cyberspace and global digital governance should emphasize development and security equally and take a balanced approach to technological progress, economic development, and the protection of national security and public interests.

China reaffirmed that States should foster an open, fair, and non-discriminatory business environment for mutual benefit, win-win outcomes, and joint development. At the same time, States have the responsibility and right to ensure the security of critical data and personal information bearing on their national safety, public security, economic security, and social stability. China welcomes governments, international organizations, ICT companies, technology communities, civil organizations, individuals, and all other actors to make concerted efforts to promote data security under the principle of extensive consultation, joint contribution, and shared benefits. China also underscored that all parties should step up dialogue and cooperation based on mutual respect and join hands to forge a community with a shared future in cyberspace featuring peace, security, openness, cooperation, and order. China believes that States should handle data security in a comprehensive, objective, and evidence-based manner and maintain an open, secure, and stable supply chain of global ICT products and services. In addition, China believes that States should encourage companies to abide by the laws and regulations of the State where they operate.

Moreover, China considers that States should not request domestic companies to store data generated and obtained overseas in their territory. At the same time, States should respect the sovereignty, jurisdiction, and governance of data of other States and shall not obtain data located in different States through companies or individuals without other States' permission.

4.2.6 Centralized and unified leadership

China's data governance has always adhered to the principle of centralized and unified leadership, given full play to the central government's leading role of overseeing the overall situation and coordinating all parties, comprehensively implemented the State Council's significant decisions and deployments, and adhered to and strengthened the central government's overall leadership in all areas of data governance throughout the entire process of digital government reform and institutional innovation.

Establishing a sound leadership system and mechanism has created a solid synergy to promote the development of data governance, providing a fundamental guarantee to enhance the level and effectiveness of data governance nationwide. China insists on global planning, integrated layout, and holistic ideology. These give better play to the central and local, focus on the whole process of government data collection, processing, sharing, opening, application, security, storage, and archiving, effectively breaking the institutional bottlenecks that hinder the sharing and opening of government data. China promotes the centralized construction and data sharing mechanism simultaneously, applies the orderly circulation and utilization of data, and improves the efficiency of data allocation.

Case 6: National integrated data governance model

Under the centralized and unified leadership of the central government, China has integrated and built a national integrated big data system for government affairs with uniform standards, reasonable layout, and coordinated management. It follows safety first, promotes reliability, strengthens data convergence and integration, and encourages sharing, opening, development, and utilization. It enables the orderly flow of data by the law and gives full play to the important role of government affairs data in improving the government's ability to perform its duties, supporting the construction of digital government, and promoting the modernization of the national governance system and governance capacity. The government data will play an essential role in improving the government's ability to perform its duties, supporting the construction of digital government, and promoting the modernization of the national governance system and governance capacity.

➤ ***Integrated management***

China strives to improve the management system of government data and establish and improve the coordination mechanism for sharing government affairs data. It has formed a new pattern of a national integrated management system of government data with clear responsibilities, orderly division of labor, and muscular coordination among various regions and departments.

➤ ***Integrated data directory***

To promote the establishment of an integrated data directory that includes the full coverage of all regions and departments, China is establishing its data catalog system based on departmental catalogs and regional catalogs with real-time synchronization. It aims to ensure timely update mechanisms are achieved, and government data can be managed within an integrated system.

➤ ***Integrated data resources***

According to the rule of integrating the government data as much as needed and as much as possible, China continues to strengthen the quality control of the government data within its full life cycle, which indicates the guarantee of the feedback, traceability, and accountability of problematic data. This will boost the construction of traceable data governance and systematic data governance. A national integrated government data resource system with integrated management, orderly scheduling, and reasonable distribution is under construction.

➤ ***Integration of sharing and exchange***

An integrated national government data sharing and exchange system covering national, provincial, and municipal levels are under construction. It aims to provide unified and standardized sharing and exchange services and efficiently meet the data-sharing needs of various regions and departments.

➤ ***Integrated data services***

The national government data service portal is under construction. China aims to build a standardized, coordinated, and efficient service portal that provides nationally integrated government data and related services. Completing that will strengthen the basic capabilities of digital applications, increase innovative applications, and promote the development and utilization of digital resources.

➤ ***Integrated arithmetic facilities***

China is building a national integrated big data center that provides:

1. A collaborative innovation system.
 2. Perfecting the arithmetic management system of big data for government affairs.
 3. Integrating and building disaster recovery facilities of the national integrated big data system.
- These rules will optimize the construction layout of the national government affairs cloud, improve the operation level of government affairs cloud resource management, and enhance the arithmetic support capacity of big data for government affairs in various regions and departments.

➤ ***Integrated standards and specifications***

China is compiling fully compatible standards for essential data elements, cloud resource control, data docking, data quality, data reflow, etc., and continuously develops specifications for supply and demand docking, data governance, operation, maintenance management, and other stages. These promote constructing a national integrated big data standard specification system for government affairs.

➤ ***Integrated security***

China ensures that "data" is the core element of security, strengthens the primary responsibility of security, and improves data security protection and monitoring. China has been enhancing the whole data management process, forming a nationwide integrated government big data security system with system specification, technical protection, and operation management.

5. Suggestions: Data Governance in Developing Countries

5.1 Design: The National Digital System

At present, data resources have become the strategic core resources of a country. A country's data resource richness and information capability will directly affect its position in the world. As the global digitization process continues to accelerate, each country is following the development trend of new technologies and making further explorations in strengthening the integration of government data, algorithms, computing power, scenarios, and other elements. Global digital development shows the digitalization of the whole process and field of government activities under data-enabled conditions. Government services and governance are also offering new development trends that are more concise, refined, and accurate.

However, while seeing the remarkable achievements in global digital governance, it is crucial to recognize that developing countries' current top-level data governance design still needs to be improved and enhanced. By promoting the interface and integration between top-down top design and bottom-up bottom logic, developing countries can grasp the direction of national data governance development and thus continuously improve the government's data leadership and governance capabilities.

5.1.1 Strategy and planning

Data governance should focus on leading the innovation and development of the governance model from the perspectives of the government organization model, governance system changes, and resource allocation mechanisms. The country should insist on planning first and introduce digital government development strategies and development plans at the central level as soon as possible to draw a grand blueprint for digital development in a more scientific way.

Developing countries urgently need to formulate national-level data governance development strategies, master plans, and programs and then clarify national data governance's development goals and construction priorities. Developing countries should coordinate the allocation of resources, explain the pace of advancement, and then refine the implementation of responsibilities. A relevant department should be established at the national level to be responsible for the overall promotion of data governance to effectively solve the problem of the absence of a competent data governance agency at the national level.

Developing countries should establish a data management mechanism and reasonably divide the responsibilities and authority of different units to prevent the convergence of duties due to the physical convergence of data and avoid the unclear responsibility for data security due to vague authority and responsibility. It should coordinate the relationship between multiple subjects, establish a data governance ecology with the participation of various parties and benign interaction, and study and formulate the qualification threshold conditions for data governance operation subjects. Developing countries should reasonably slice the scope of outsourcing digital construction content and promote the peaceful development of data governance operation subjects.

5.1.2 Laws, regulations, and policies

First, legislation administrators should comprehensively sort out existing laws, regulations, and policies and then promote the establishment's current rules, regulations, regulatory documents, reform, abolition, and interpretation.

Second, developing countries should accelerate the legislation and regulation of advanced technologies such as artificial intelligence and blockchain and improve legislation in key areas and industries where these technologies are applied. With laws enacted, developing countries could establish their security policy and regulatory system to clarify regulatory subjects and objectives, ensuring regulatory requirements are reasonable and feasible.

Finally, developing countries should strengthen data legislation. Sound laws and regulations on data resource management and apparent authority and responsibility for using government data resources can provide a legal guarantee for data development and utilization. Therefore, the country should improve its laws and regulations on data classification and protection. Legislative administrators should formulate corresponding legal penalties for information leakage and privacy infringement caused by data misuse. At the same time, developing countries should accelerate the improvement of the relevant legal framework and standard specification system, absorb local practical experience into legal norms or policies, and evaluate the implementation of applicable legal norms and procedures in various departments worldwide.

5.1.3 A governance model that suits your country

Developing countries are currently in a major digital transformation process and must promote the modernization of data governance systems and governance capacity. Developing countries should consider the existing national design and development, draw on national development experience, and take a path of data governance with national characteristics. The central government should take the initiative and understand the overall picture, then coordinate all parties, plans, and national data governance system designs. These actions will promote the establishment of a coordinated and linked institutional mechanism for data governance and form a continuous promotion synergy for the implementation of the top-level design of national data governance.

Second, departmental coordination. The legislature, administrative agencies, and judicial institutions should play their sectoral advantages, improve various departments' digitalization and data governance functions, compact departmental data governance responsibilities, map sectoral data resources, and break the data silos. Departments should implement a data management mechanism similar to "one-time collection only, sharing mechanism, a guarantee of unique data source, and multiple calibrations," dig deeper into the value of data to drive business innovation, and take the initiative to open data to society.

Third, developing countries should mobilize the enthusiasm of various parties in society and give full play to their resource advantages and technical advantages to realize the effective convergence, efficient flow, and comprehensive utilization of data resources among the government, enterprises, and society.

5.1.4 Standardized data system

The standard data specification is an essential prerequisite and basic guarantee for data governance. Therefore, developing countries should focus on improving data quality, comprehensively strengthening data standardization, and refining the standard specification

related to data catalog construction, collection, aggregation, sharing, and opening. States should improve the current situation of non-uniform data formats, non-standardized data catalogs, and untimely updates. Data management standards based on the perspective of the whole life cycle of data should be established to improve the integrity, homogeneity, timeliness, and availability of shared data.

Missing standards and specifications should be sorted out and supplemented promptly. States should strengthen the implementation of standards by promoting management mechanisms for planning, project creation, implementation, auditing, evaluation, and supervision, so as to give full play to the leading role of data standardization in realizing sharing functions as well as guaranteeing the role of data quality management.

Some developing countries already have established certain standardization achievements in data governance, but the degree of application of standards is limited. It is necessary to strengthen the promotion of standards further, select major regions and areas to carry out national standardization pilot construction, run the assessment and evaluation of national standards, and implement the supporting role of standards for data governance.

5.2 Holistic Development and Systematic Thinking

5.2.1 National data governance approach: systematic thinking and whole-of-government approach

Developing countries should always uphold holistic and systematic thinking to promote data governance in an integrated manner to avoid problems such as fragmentation and information silos at the early stage of construction. It is necessary to consider the context of strengthening and improving the government's governing capacity and leadership while developing its data governance approach. States should vigorously promote the construction of digital government, enhance data governance capacity, and promote the digital transformation of government. It needs to be oriented toward sharing and utilization, thus breaking down information barriers to build a national government data resource-sharing system.

At the same time, optimal infrastructure utilization should be promoted. The relationship between industry clouds built by vertical systems and regional clouds built by horizontal local regions should be coordinated. Developing countries should strengthen the management system for the construction of major digital projects, improve the system for allocating and using funds for the construction of major national digital projects, and coordinate data technology standards and management specifications to avoid fragmentation, duplication of constructions, and waste of resources.

5.2.2 Data governance capacity enhancement: comprehensive and deep integration of digital government construction

Developing countries should promote the innovation of government management, social governance models, and the construction model centered on departmental operations. The construction model should be changed to a data sharing and business collaboration atmosphere to continuously improve government digitization, scientific decision-making, and network security

and build a service-oriented government with apparent authority, accountability, coordination, and efficiency.

Digital government construction is an essential part of national digital transformation and development and is a core part of the digital economy, digital society, digital culture, and digital ecology. It is necessary to give full play to the leading role of digital government and integrate digital government construction with data governance capacity building to comprehensively drive and improve data governance and build a digital economy industrial system with reasonable structure. Through an innovative social governance model, an intelligent and professional digital society will be constructed, promoting a spiritually civilized and content-rich digital culture. Generally, it will support nurturing a digital ecology in which people and nature live harmoniously.

5.2.3 Coordination mechanism with strong integration and appropriate division

A global data governance coordination mechanism should be established at the national level. At the same time, each local department should give full play to the role of the data governance coordination mechanism at its level of government. This means that the lead department for data governance coordination should be clearly defined, and coordination should be carried out for issues and problems involving the overall situation and fundamental nature of data governance. All government departments need to play a joint role and clarify their responsibilities.

At the same time, developing countries should define the accountability of each authority, including the digital development authority, the data authority, and the business function authority. The relationship of authority and responsibility should be clarified in planning and approval, project construction, fund management, performance evaluation, and personnel arrangement. The digital development authority should be responsible for planning and construction, the data governance authority should be accountable for data-related management, and the business function department should be application development oriented.

5.2.4 Data channels

Data is the core element of digital government, so it is vital to ensure the unhindered flow of data for the development of digital government. Developing countries should break down institutional and institutional barriers to data sharing and increase the breadth and depth of data sharing, promote the orderly flow of data at all levels of government, and allow data to nourish all areas of economic and social operation.

Developing countries should integrate data development and utilization of personal information protection and public security. At the same time, the government should strengthen the management of the whole life cycle of data collection, storage, use, processing, transmission, provision, and disclosure and accelerate the construction of a system of rules for data property rights, circulation, distribution, and governance. This will cultivate and regulate data trading platforms and market entities, thus promoting the efficient flow of data resources.

Developing countries should deepen the opening of government data, establish, and improve the national public data opening system, and improve the quality and level of data opening while ensuring data security – citizens' privacy could be enhanced through introducing a third party combined with social media and public assessment. There is an urgent need to promote the integration of government data and social data, explore the pricing mechanism for data resource

allocation, and encourage the construction of a labor-based distribution system for data. This will create a good social atmosphere for data sharing and circulation and guide the safe and orderly circulation of data. The government should support the application of new technologies, such as blockchain and artificial intelligence, in data sharing and circulation and provide adequate technical support for the credible circulation of data.

5.3 Consolidation of Data Governance Foundation

5.3.1 Advancement of digital infrastructure construction

Developing countries should accelerate the construction of intelligent and agile, green and low-carbon, and secure controllable digital infrastructures to release information for economic and social development. They should promote the expansion and speed-up of fiber-optic networks and the large-scale application of 5G and continuously promote the optimization and growth of urban and rural broadband networks. They should encourage the upgrade of digital government network infrastructure based on the construction and management requirements of the internal and external networks of e-government and improve the bearing capacity, service capacity, and implementation capacity.

Developing countries should promote the optimal layout of arithmetic power, upgrade the network node level of national data center clusters, and encourage the integration and innovation of new infrastructure. They should establish direct data connection channels, optimize the communication network structure, and promote national arithmetic power's integrated and coordinated development. There is an urgent need to accelerate the scale deployment, converged applications, and innovative applications of IPv6, improving the overall IPv6 scale deployment and application level.

5.3.2 Accelerate data collection and basic database construction

Developing countries should promote the construction of a national big data platform and logical access and physical convergence of data resources based on the government data directory to gather national government data resources and carry out integrated management. The data resource repositories jointly constructed by various departments and self-built by different regions and departments should logically converge into the national big data platform in total volume. From the national databases of population, legal persons, natural resources, and economy to the data of medical and health care, government services, social security, ecological and environmental protection, credit system, emergency management, state capital supervision, and other subject libraries, all of these should be unified and converged into the integrated national government big data system for management.

Local governments should rely on the government data platform to coordinate and promote the collection of government data in regional areas to achieve multi-level local government data convergence and integration and gain access to legislation, judicial, and other institutional data as needed. The convergence and integration of industry data are also necessary, as they will benefit industrial development.

5.3.3 Strengthen the construction of infrastructure capacity of big data for government affairs

Developing countries should promote the construction of the data service capacity of the national big data platform for government affairs and the data platforms for government affairs in various regions and departments. To upgrade the technical support for nations' innovation in the data's integration and application, developing countries should take the initiative to build big data processing and analysis systems, and cultivate capabilities such as data computing, sub-domain hierarchical user management and data sandbox model development. At the same time, big data, artificial intelligence, and other technics should be fully utilized to build an algorithm model, so that control library integrating natural language processing, video image parsing, intelligent question and answer, machine translation, data mining and analysis, data visualization, data open authorization, data fusion calculation, and other functions to provide standardized and intelligent data services.

Developing countries can promote the construction of a national standard and unified government blockchain service system by stimulating the "blockchain + government services," "blockchain + government data sharing," and "blockchain + social governance application innovation" to establish and continuously improve the data in security, supply, and sharing.

5.4 People-centered Governance

A good and sustainable digital governance should adhere to a people-centered ideology, proactively adapt to the main contradictions faced by the national society, and make the promotion of people's welfare the center of promoting the development of digital government transformation and data governance.

The country should adhere to the demand-oriented and service-oriented approach and establish data governance and orderly flow drawn by business applications from the needs of enterprises and the public. There is an urgent need to strengthen data empowerment and promote cross-sector and cross-level business collaboration so that government data can better serve enterprises and the people, boosting high-quality economic and social development.

5.4.1 Focus on public concerns and business needs

Improving service efficiency is one of the main goals of data governance, which should focus on the people's most concerned and realistic interests. Well-developed digital administration should address people's immediate needs and focus on optimizing the business environment and improving service efficiency.

Developing countries should establish a national integrated government service system and, through this system, solve the problems of enterprises and people's needs. States should use data analysis to gain an in-depth understanding of service needs, allocate service resources precisely, and promote the efficiency and quality of government services. States need to continuously promote the innovation of intelligent and convenient service modes to improve the quality of government services. The construction should focus on high-frequency matters, optimize government processes, and promote the transformation and upgrading of service models. Local governments should be encouraged to actively explore construction management, service model, and process optimization to carry out more personalized and characteristic service innovation, further promoting the deep integration of data governance innovation achievements with government services. They should continuously enhance the support capability of the integrated

data governance system for deepened government service reform and an optimized business environment.

5.4.2 Enhance inclusive service supply capacity and narrow the digital divide

Accelerate and deepen the application of digital technology in education, healthcare, employment, social security, cultural tourism, and other social fields. Replenish the research and development, upgrade, and application of age-appropriate intelligent terminals to fill the supply gap of social services, optimize the social service experience, and continuously meet the new expectations of the masses for a better life. Promote the equalization of essential public services and make high-quality governmental, educational, cultural, and medical resources more widely available so that the public can share digital benefits to the greatest extent.

While comprehensively promoting the standardization and facilitation of government services, full consideration should be given to the usage habits and office needs of the elderly, the disabled, and other disadvantaged groups. At the same time, developing countries should continue to carry out the aging and accessibility transformation of government service platforms at all levels to provide convenient and fast government services for disadvantaged groups and help them share digital life. Focus on high-frequency matters and service scenarios involving daily life, such as travel, medical treatment, consumption, and recreation, while strengthening the construction and application of intelligent technologies. Preserve traditional service means and methods and actively promote proximity services, active services, proxy services, and priority services for disadvantaged groups.

5.4.3 Establish a development pattern of diversified participation and shared governance

Creating an open government data governance environment can help promote the participation of people and organizations in public policies and affairs, enhance government transparency and improve society's trust in government, and is, therefore, a necessary part of improving national data governance.

In addition to the government, enterprises and social organizations also hold many data resources with high public value. Government institutions also need joint digital governance with local enterprises and social organizations. Local governments should be encouraged to explore operation modes and management means of government-enterprise cooperation and accumulate experience in program design, infrastructure construction, business application development, operation, and maintenance services to utilize government information and data resources from all ends fully.

It would be helpful to establish a national and local e-government expert consultation system, which could strengthen the investigation and research, carrying out expert consultation on complex issues. In addition, through the construction and operation of an open data platform and government service platform, the government should further strengthen the interaction and communication with the public and guarantee the public's right to know, participate, express, and supervise. It is necessary to facilitate the government to listen to public opinion, understand people's livelihood, and resolve potential social conflicts. Consequently, government and the public should enhance communication, which could promote the credibility of the government. It indicates that the public and third parties participate more extensively in the design and evaluation of public goods and public services, thus improving the service experience and better meeting the needs of the public.

5.4.4 Improving governance effectiveness with data application innovation

The government should promote the construction of smart cities and digital villages while actively building an interconnected and open urban data brain. In addition, the government should accelerate the construction of an intelligent planning and management platform that is perceptible, capable of learning, good at governance, and self-adaptive, creating a digital urban-rural collaboration and innovative decision-making governance model.

Database construction can focus on urban governance, environmental protection, ecological building, transportation, food safety, emergency management, financial services, economical operation, and other application scenarios to provide diversified shared services for multi-industry and multi-cross-scene applications. Based on big data analysis and sharing capabilities, the database combines and integrates economic operation data, establishes an economic operation monitoring and analysis system that could instantly analyze and predict economic operation trends, further enhancing the systemic, accurate, and scientific nature of economic operation research and decision making.

Database construction can fuse and integrate grassroots governance data to establish grassroots governance operation analysis and early warning model. Through big data analysis, we can dynamically perceive the state and trend of grassroots governance, monitor early warning, prevent, and solve all major risks, and effectively improve social governance. Database construction can bring together multi-source data such as urban population, logistics, and information flow and establish an urban operation vital signs indicator system. The government should adopt a deep learning big data model to realize overall perception, global analysis, and intelligent disposal of urban operation status, boosting the urban governance level. At the same time, the collection of databases around industrial development, market supervision, social assistance, public health, emergency response, and other fields will help promote the application of comprehensive analysis of big data for government affairs and provide data support for the government's precise policy-making and scientific command.

5.5 Building A Good Data Governance Ecology

5.5.1 Emphasis on digital literacy and digital leadership development

Developing countries should enhance digital literacy and skills for citizens, coordinate academic education, vocational education, and digital skills education on digital issues, and promote lifelong digital learning for all. This would be beneficial for people to cultivate digital innovation and entrepreneurship creation ability and enhance the digital skills of each specialized group.

At the same time, the government should improve the policy support and financial guarantee mechanism, increase investment in digital literacy in many aspects, and create a long-term mechanism to support digital literacy and skills enhancement. Emphasis should be placed on strengthening the digital literacy of local government leaders first, enhancing digital leadership of leading cadres, conducting training on data governance capabilities of leading cadres, and strengthening training and cultivation of leading cadres, digital leaders, and professional and technical talents at all levels. Enhance their awareness and ability to acquire, analyze, and apply data well to provide an inward impetus for the comprehensive construction and development of national digital reform and a lasting momentum for national data governance's long-term and stable growth.

5.5.2 Research and development

Developing countries should pay attention to independent research and development of key technologies, firmly grasp the core technologies of national digital development, and improve the national new technology industry, comprehensive data governance capacity, and international competitiveness. Countries should adhere to the combination of self-reliance and open cooperation to strengthen national laboratories in the field of information technology. That means paying more attention to the role of universities and research institutes and implementing several forward-looking and strategic national science and technology projects to accelerate breakthroughs in basic and general technologies.

Developing countries should enhance the innovation capacity of software and hardware technologies, layout strategic and frontier technologies, and focus on the core technologies to fight the battle. Take the initiative to build an open and flexible institutional system and innovation environment, and jointly build an innovation mechanism for enterprises of various scales in the digital field to promote a collaborative development and a vibrant industrial innovation ecology. Continuously stabilize the mechanism of "industry-university-research-application," support high-level research universities to cultivate cross-composite talents in digital fields, and enhance the ability of higher education to serve the development of regional digital technology innovation.

5.5.3 Strengthen the environmental protection of health and safety

The international situation is currently changing. Meanwhile, the cyber security crisis cannot be ignored. It is vital to adhere to the bottom line of security. As a result, developing countries should first adhere to the concept of secure development. Then construct a network information security management system and form a network security mechanism on a routine basis, which are essential prerequisites for promoting healthy and safe sustainable development of data governance.

Developing countries should attach importance to both development and, at the same time, improve regulatory norms. Establish an all-round, multi-level and three-dimensional regulatory system, and put regulation and governance throughout innovation, production, operation, and investment. In addition, anti-monopoly and anti-unfair competition should be strengthened to prevent the disorderly expansion of capital, maintain fair and orderly competition in the platform economy, and protect the legitimate rights and interests of market players, practitioners, and consumers. Technical rules and governance systems regulating all kinds of scientific research activities should be formulated.

Developing countries should put national security and people's information protection in the first place, improve the network security protection system and capacity, strengthen the security protection of critical information infrastructure, and maintain cross-field network security information sharing mechanisms. This means an all-around improvement in the level of data security management, which can be achieved by improving data security management, risk assessment, testing, and certification. To sum up, strengthening the protection of personal information and focusing on illegal and irregular collection and use of personal data will effectively safeguard most Internet users' legitimate rights and interests.

5.5.4 Strengthen international cooperation and exchange

In general, developing countries should focus on opening to the outside world, actively build and participate in bilateral, regional, and international cooperation platforms in the digital field, and actively participate. For instance, countries can make full use of the role of the World Internet Conference and other platforms, to strengthen pragmatic cooperation with emerging market countries and developing countries in general and build digital international cooperation relations with high quality. Individual countries should actively participate in the formulation of international rules and technical standards in cyberspace, maintain and improve the multilateral digital economy governance mechanism, and promote the establishment of a fair, reasonable, and transparent governance and rule system.