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RESEARCH ARTICLE

Xiaohong CHEN, Xiangbo TANG, Xuanhua XU

Digital technology-driven smart society governance mechanism and practice exploration

Abstract A smart society is an advanced form of society following agricultural society, industrial society, and information society, with digital data processing system as its main carrier. However, the governance of a smart society still faces many challenges. In view of this problem, first, this research constructs a smart society governance modernization strategy. Second, the innovation mode of a society governance mechanism driven by digital technology is proposed, including the precise intellectual control of a digital twin, the intelligent ubiquitous sensing of the Internet of Things, the empowerment remodeling of a blockchain and the livelihood service of artificial intelligence. Third, this study systematically explores the practice of smart society governance modernization from the aspects of basic information platform construction, evaluation system construction, application demonstration of epidemic prevention and control driven by big data, support of spatial intelligence and artificial intelligence technology for people's livelihood, smart campus, public resources, and data governance application demonstration to provide theoretical guidance for promoting digital technology innovation in the process of the governance of a smart society.

Keywords digital technology, new infrastructure, smart society, governance system, governance modernization

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Xiaohong CHEN, Xuanhua XU
Hunan University of Technology and Business, Changsha 410205, China; School of Business, Central South University, Changsha 410083, China

Xiangbo TANG (✉)
Hunan University of Technology and Business, Changsha 410205, China
E-mail: birry@163.com

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1 Introduction

With the high-quality development of the economy and society, China's urbanization is continuously accelerating. Rapid urbanization has led to problems in urban infrastructure, urban information integration, integration ability, and the efficiency of urban services. Meanwhile, "urban diseases", such as traffic congestion, air pollution, garbage siege, and unfair distribution of education and medical resources, are also becoming increasingly prominent (Shen and Zhang, 2020). The innovation and development of new digital technologies represented by big data, Internet of Things (IoT), artificial intelligence (AI), blockchain and 5G (Chen, 2018; 2019b), integrated with application innovation in fields of urban governance, such as government affairs, transportation, environmental protection, and medical care, have given birth to new ideas and models of urban governance. Thus, the concept of a smart city emerges.

The integrated and innovative application of new digital technologies provides all-around support for the construction of a smart city; moreover, it creates optimal conditions for solving the difficulties of urban governance and improves the quality of urban development (Chen, 2018). For example, in the construction of a smart city, technologies such as big data and IoT can be used to improve the sharing of underlying government data and operating processes, promote the integration and sharing of data from different departments, and improve the quality of government departments' informatization and collaboration efficiency (Liu, 2017). Technologies such as cloud computing and blockchain technology can be used to improve the security and sharing of all kinds of traffic data, break the isolated islands of information, and implement the sharing of traffic information resources and system interconnection thoroughly (Chen, 2019a). The use of the IoT can comprehensively perceive the construction status of transportation infrastructure and transportation vehicles, which is helpful for the precise management of traffic jams and the unified dispatch of

traffic command (Xu and Zhang, 2020). Technologies such as cloud computing and IoT can be used to implement the monitoring, collection, and storage of patient physiological data and analyze users' medical and health data to implement telemedicine (Fang, 2020). Therefore, as a new concept and model, urban diseases, such as traffic congestion and environmental pollution, are caused by rapid urban development, intelligent transformation, and upgrade of the city. However, the construction of a smart city is mainly reflected in the intelligent upgrading of network hardware facilities and application information systems, which can bring about numerous problems, such as barriers between departments and regions, isolated islands of information, mismatch between smart city supply and public demand, insufficient public participation, and low sense of acquisition (Ding, 2019). It also leads to problems involving the lack of effective information communication and resource sharing among smart cities. All these factors are not conducive to the balanced and coordinated development of cities and cannot fully reflect the people-centered development vision. Nevertheless, the rapid development of new digital technologies on a global scale is highly coupled with industrial development and changes from iteration to iteration. It constantly breeds disruptive innovations and breakthroughs that change the world, pushes economic growth and social development into a new stage, and promotes evolution from a smart city to a smart society.

A smart society is developing rapidly as a more advanced social form following agricultural society, industrial society, and information society. It is a new blueprint for the future social form (Wang, 2018). Compared with smart cities, a smart society is the sinicization and modernization of the smart city concept (Shan, 2018). It owns a broader connotation, with more pursuit of integrated development and greater emphasis on "people-centered development" (Ye, 2017). Building a smart society is an important foundation for meeting the people's growing needs for a better life. It further expands the connotation and extension of a smart city and solves issues such as barriers between different departments and regions, isolated islands of information, and lack of public awareness in the construction of smart cities in the past. In this way, the innovation and surpassing of smart cities is achieved.

Based on the infrastructure and application of information technology, a smart society is a new type of social operation mode driven by the circulation of smart data in production, livelihoods, and governance, with information digital data processing systems as the main carrier. The development of a smart society crucially supports the comprehensive construction of a modern and powerful socialist country. In the report of the 19th National Congress of the Communist Party of China, General Secretary Xi clearly put forward a brand-new concept of a smart society, which is as important as major powers in aerospace and digital China strategies. The Fifth Plenary Session of the 19th Central Committee clearly proposed to strengthen the construction of a digital society and a digital government and improve the level of digital intelligence in public services and social governance. Under the background of major national strategic needs and social governance dilemmas, building a smart society is an important choice for the government to apply scientific and technological means to ensure and improve people's livelihood and strengthen social governance. It becomes an important task for national governance in the new era.

The rapid advancement of the "new infrastructure" provides important support for the construction of a smart society. Different from traditional infrastructure, the unique nature of digitization, platform, and fiction, with continuous exploration in new economic growth points and new infrastructure, has effectively broken the isolated islands of information. Support in intelligence innovation creates markets, promotes the cultivation of new capabilities, facilitates the growth of new driving forces, and promotes a better life for the people. Empowering governance capabilities and other mechanisms can facilitate the development of a smart society (Li, 2020) and provide a new path for the improvement of governance capabilities. It plays an important role in expanding domestic demands, stabilizing growth, promoting people's livelihood, and providing a solid guarantee for the construction of a smart society.

The formation of a smart society has created a convenient, comfortable, colorful, efficient, and intelligent social life. It has also brought some unprecedented risks and opened a new era of smart society governance. Especially as global epidemic continues to spread, the COVID-19 pandemic has put forward severe tests on global governance models, public health emergency management, and stable economic development. The epidemic has exacerbated political risks in social governance, increased social governance compliance costs, and strengthened the trend of digital generalization. In the security generalization trend, the governance of a smart society faces many challenges. First, the logic of life in dual, physical, and virtual spaces becomes intertwined. The virtual and the real are the same; the algorithmic decision-making failure, the protection of personal privacy, the challenge of information ethics, and various intelligent crimes pose a threat to the governance of a smart society in the new era. Second, a new aspect of digital humanity has emerged. Technology companies, platforms, and governments rely on big data mining and analysis techniques to acquire "data portraits" of people, which will also erode individuals' security. Hence, new issues appear, such as privacy, information asymmetry, data gaps, and the technical extension of public power. Third, the value preference of modeling algorithms becomes a challenge. The algorithm-led society cannot fully demonstrate the objectivity and reliability of

"technology neutrality". Moreover, many problems exist, including the algorithm black box, algorithm discrimination, algorithm error, and algorithm autonomy. Fourth, the work scene of human–computer interaction poses challenges. In the work scene of human–computer coexistence and human–computer interaction, the responsibility or risk sharing between humans and intelligent robots, questions on whether robots have an ethical relationship and whether humans' subjective status needs to be rebuilt will be highlighted. Fifth, the application of code regulation is institutionalized. Code regulation has increasingly shown a standardized and institutionalized form. Once an instruction is wrong or unfair, its impact will far exceed human decision making, thus resulting in serious systemic, mechanical, and universal consequences. In addition, the cost of repair is very high, which brings several problems to the smart society governance system. First, the top-level design of smart society governance is not systematic, and the scientific nature of participation mechanism and evaluation system of multiple social entities needs to be improved. Second, big data are difficult to share, and the data management of each department is independent. The willingness to open is weak, and the information systems of various cities are not interoperable. Moreover, the data format is not uniform. Third, the lack of standardization causes smart society governance to experience a wide range of complex issues. In addition, new standards are difficult to cover in a short time. Therefore, research on the modernization strategy and practical exploration of smart society governance must be conducted.

This article aims to take smart society governance as the core. It attempts to reveal the challenges and problems faced by smart society governance, construct a strategy for the modernization of smart society governance, propose a digital technology-driven society governance mechanism, and combine the strategy to explain smart society governance modernization and practical exploration systematically. The research not only enriches the existing theories on smart society but also provides important theoretical and practical value for solving the problems and challenges faced by the construction of smart society and promoting the precise development of society governance.

2 Construction of modern governance strategy in smart society

Opportunities have been provided to the construction of a smart society to some extent in terms of the support of the emerging information technology, the disadvantages of smart city construction, the new growth drivers of new infrastructure, and the objective demands of the COVID-19 pandemic. All the factors have strongly promoted a modern social governance system marching toward the 5.0 version. However, opportunities often coexist with certain challenges. Facing the potential threats of smart society governance in all dimensions of human economy and society (Dai and Ma, 2016; Zook, 2017; Hu and Liu, 2018; Razaghi and Finger, 2018; Chi et al., 2020; Zhang and Li, 2020; Curran and Smart, 2021), making good use of big data to drive this "double-edged sword", accelerating the construction of a smart society governance modernization strategy (Liu et al., 2019; Tang et al., 2019; Qu and Zhang, 2020), and providing strong support for governance technology innovation and practical exploration are key issues that need to be resolved urgently to promote the modernization of smart society governance.

At present, the main task of our society is to resolve the contradiction between people's growing need for a better life and unbalanced and insufficient development. The formulation and implementation of a strategy for the modernization of smart society governance must effectively respond to people's real needs (Hu and Liu, 2018; Zhang, 2020). On the basis of the background of socialism with Chinese characteristics, it aims at key subdivisions of people's livelihood, industry, and management of smart communities, smart education, smart logistics, and smart government affairs (Zhang et al., 2019) , focusing on the source to carry out preventive governance. To accelerate the modernization of smart society governance under the premise of centering on the people, scientific and reasonable short-term and long-term goals should be set, and the diversified emerging information infrastructure and corresponding institutional management systems should be fully optimized and upgraded to promote the efficient operation of the data center and the full service of the "city brain". Based on a sophisticated, scientific, and intelligent city management system, the construction of a management system for smart society governance that integrates prediction, rapid response, and comprehensive coordination should be accelerated. Under the Chinese context, the management institution of the co-construction, co-governance, and sharing of smart data should be improved. Centering on governance systems and work layouts, with governance capabilities and systems as the driving force, objective management, project management, and assessment accountability should be promoted to advance the disadvantages of smart city construction and improve the modernization level of smart society governance in stages to world-leading level.

In the first stage of the construction for the modernization of smart society governance, problem and demand orientation should be insisted to carry out the overall layout based on accelerating the improvement of a top-level design (Razaghi and Finger, 2018; Tang et al., 2019). First, the construction should center on the mutual coupling action mechanism among emerging information technologies such as big data, scientific supervision, social security, industrial innovation and development,

and people's livelihood protection. Based on the establishment of a theoretical framework, a theoretical model of a multisubject, omnidirectional, and multidisciplinary system with Chinese characteristics should be constructed. Second, centering on the evolution process and formation mechanism of a smart society, the composition structure of the smart society, the functions of its elements, the relationship among them, and the system structure and high-efficiency operation mechanism are explored to build a new paradigm of this smart society under digital empowerment. On this basis, "futurity" should serve as the purpose to accelerate the integration of a smart city 5G network, space–earth integration networks, and mobile communication networks. Focusing on urban intelligent sensing and high-performance urban computing, with digital twin support platforms that have the IoT as the core (Li et al., 2021), efforts should be made to construct big data resource libraries and data collaborative sharing platforms for government affairs, industries, and enterprises in the smart society to build a smart society governance system based on blockchain construction (Jiang et al., 2019). The government should ease access standards, encourage multi-party participation, further strengthen the government's demand guidance and competition promotion, clarify the relationship between the government and the market (Li, 2020), and comprehensively promote the construction of "new infrastructure" driven by digital technologies to support data storage, transmission, sharing, security protection, and application in smart society.

Pilot projects are important means to achieve governance efficiency and policy innovation (Mei and Liu, 2014; Li, 2019). Based on the top-level design and overall layout of a smart society, vigorously launching the pilot construction of a smart society and actively exerting pilot demonstration are key strategic paths to building a smart society in the second stage of the modernization of smart society governance. Bureaucratic structure leads to barriers in the sharing of data, information, and technology among all sectors of society (Meijer, 2015; Zhang, 2017). Efforts have been made in optimizing and developing new technology, building integrated systems, and breaking the restriction of the "isolated islands of information" to facilitate efficient and orderly data, information, and technology sharing (Misuraca and Viscusi, 2015). On this basis, providing the basic needs of people's livelihood, such as transportation, education, medical care, environmental protection, and emergency management, the promotion of a pilot area for smart livelihood services with emerging information technologies and new infrastructure is of great strategic significance. At the same time, for the core fields of government affairs, public services, and community construction in these areas (Bertot et al., 2016), an integrated online platform for collaborative intelligence must be built. This platform can actively innovate the network services of swarm intelligence to achieve intelligent, precise, and transparent main body and content in the process of social services.

In the third stage, when the modernization of smart society governance is fully completed, the traditional smart city coverage boundary should be broken through, and urban–rural integration and regional linkage should be strengthened (Misuraca and Viscusi, 2015; Sun, 2018; Zhang et al., 2019) to seek in-depth and comprehensive development. Traditional smart city construction has widened the "smart differences" between urban and rural areas to a certain extent (Lin et al., 2015). Owing to the private attributes of emerging information technology, data, and infrastructure in the context of traditional smart city construction, problems of "fragmentation" and "isolated islands of information" emerge (Ding, 2019). By improving top-level design, carrying out pilot construction, and monitoring and evaluating the effects of pilot demonstrations, further improvement should be made in the spatial governance of traditional smart cities, urban–rural integration, and regional joint development. These enhancements form a spatial layout with complementary advantages and high-quality development promote the integration of urban and rural development and improve the equalization of public services.

In addition, cultural prosperity and industrial development provide important support for social prosperity and stability (Li and Liu, 2020). Since achieving the modernization of smart society governance in stages, focus should be put on smart culture construction, such as the development of a standard and safe system that improves smart media integration and a digital intelligent platform for the development, service, and display of cultural and creative industries (Xu, 2018; Wang and Jing, 2019), to carry out digital media technology innovation and promote social culture creativity and communication. Equal attention should be paid to cultural development and innovation, which are the next steps in improving the collaborative service system of the industrial chain and developing a platform-integrated system service model (Xu and Ji, 2017). Aiming at precise demand sensing and flexible manufacturing, a flat and decentralized industrial path should be explored. Furthermore, the open and collaborative innovation of resource organization models and results transformation methods should be promoted. Doing so can help build an industrial chain information sharing and configuration optimizing platform that integrates social flattening, organizational virtualization, information transparency, industrial networking, and resource socialization, which allows the leap from "Smart City 1.0" to "Smart City 2.0" to happen.

3 Digital technology drives institutional innovation in society governance

A smart society provides smart responses and assisted

decision making for various events, such as epidemic prevention and control, livelihood protection, public safety, ecological protection, and the resumption of enterprise work, thus creating a higher quality living environment for residents. Typical cases of different social events are selected to summarize the behavioral characteristics and influencing factors of the subjects of the society governance mechanism. Then, through big data analysis of relevant typical events, the mechanism for forming the behavior of the subjects of the society governance system is explored. Finally, the typical behavioral characteristics and evolutionary laws of the subjects for different types of events are observed. Information technology and digitalization, digital twin, AI, blockchain, IoT, and other key technologies are also taken into account in the innovation of the social multi-dimensional collaborative mechanism and social science decision-making mechanism, as shown in Fig. 1.

3.1 The digital twin enhances precise smart control capabilities of the city

The concept of digital twin first appeared in the field of industrial manufacturing, making full use of sensors, operating history, and other data to build a digital twin system in virtual space to map physical objects and reflect the whole life cycle. With the in-depth implementation of the national digital strategy, local governments are accelerating the pace of the implementation of a smart society. Corresponding to the society in physical space, building a digital twin city in the Internet virtual space will become an important foundation for the construction of the smart society and an inevitable stage in the development of digitalization and intellectualization of society.

Previously, control and construction in the real world were very difficult because of the enormous scale. The digital twin digitally maps the physical world and forms a visible, controllable, and manageable digital twin society by covering people, vehicles, objects, space, and other social data in the whole area, to "smarten" the city accurately. The significance of the digital twin is it allows tasks that are very costly and difficult to achieve in the real world to be implemented quickly and at a low cost in the virtual world. Whether it is a map for regional planning or a chessboard for social governance, the digital twin

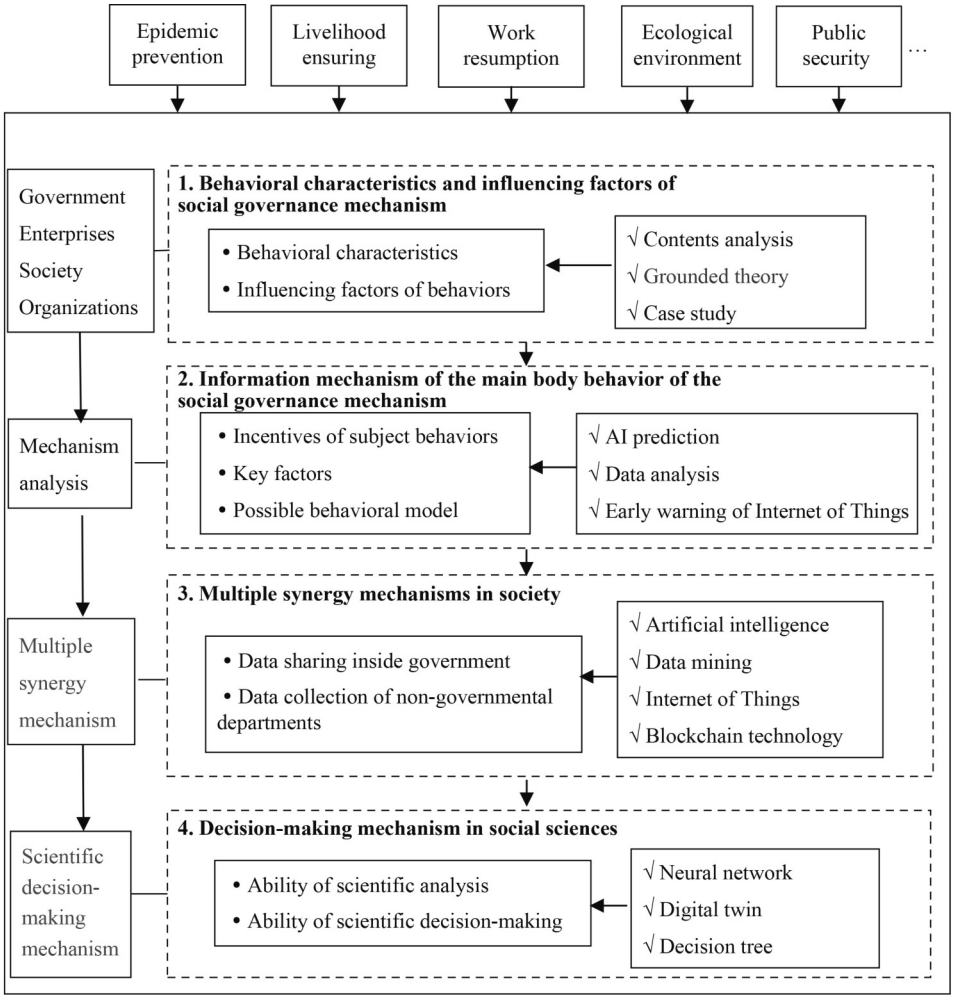

Fig. 1 Society governance mechanism driven by digital technology.

serves as the infrastructure for a smart society, using digital virtual mapping to simulate all elements of society and all processes in space and time, thus enabling the information interconnection between departments and systems and promoting the operation of smart social management under the new infrastructure tide.

(1) Applications of the digital twin

The digital twin is built from the edge to the cloud, integrated virtualization of all elements of social space, real-time and visualization of social status, and collaborative and intelligent urban management decision making, thus forming a smart social brain. It has several functions, such as predictive analysis center, social information center, and cognitive learning center, which can enhance the precise and intelligent control for a smart society and effectively improve social planning, construction, management, and services.

The smart society built by the digital twin utilizes a social information model and multiple data collections superimposed on the model to create an accurate, dynamic, and visualized digital twin social brain (Li et al., 2020). Through intelligent analysis and simulation, it can gain insight into the complex operation laws of society, the intrinsic correlation of social problems, the self-organized implicit order, and the influence mechanisms that are not easily discovered by humans. Moreover, it formulates global optimal strategies, solves various persistent problems in society, and forms a global uniform dispatch and collaborative governance model. Via technologies such as smart large-screen digital sandboxes and stereoscopic projections, the comprehensive operating situation of all areas of society can be displayed in a single map, which can be presented hierarchically according to different subjects. Thus, it helps social decision makers, managers, and general users to observe and experience the current situation of social development and analyze trends and patterns from different perspectives.

(2) Digital twin addresses real world social problems

Social problems, such as traffic congestion, air pollution, and public health and safety, have brought numerous obstacles to healthy social development. Using modern science and technology to solve social development problems by building a digital twin society has become the inevitable course.

The rational and efficient handling of various social emergencies cannot be done without the scientific formulation and effective deployment of social management plans. Strengthening the response speed and handling ability of events through powerful tools is an important means of enhancing social management. The digital twin technology integrates data from social surveillance video, law enforcement terminals, and other sources to monitor traffic congestion, air pollution, public health, and safety emergencies, thus being able to locate and identify alarms quickly for various alarm events. The system automatically filters the video surveillance and law enforcement personnel around the events. Furthermore, it visually presents and deploys the relevant elements of the social management plan and the command process in a variety of ways. Then, it displays and dynamically conducts the deployment of linkage resources, resource distribution, action routes, key targets, etc. The system also integrates video conferencing, remote monitoring, image transmission, and other application systems or functional interfaces, which can realize the one-button direct calling and collaborative dispatching of multi-linked resources, strengthen the ability of social management departments to conduct flat command and dispatch, and enhance the skill, proficiency, and efficiency of handling emergencies.

(3) Digital twin provides data support for decision-making

With the advent of the era of big data, a large amount of data resources have been accumulated in various departments of social management. Moreover, data indicators in various areas of social management have been intuitively and effectively analyzed and researched. The laws behind the data have also been mined. Thus, providing support for decision making is of great significance in building a digital twin society and promoting the construction of a smart society.

The digital twin can fully connect with the existing information system data of various departments of social management. It can be combined with professional analysis algorithms and data models in social management subdivisions to provide statistical charts, distribution charts, relationship charts, spatial statistical charts, spatial distribution charts, spatial relationship charts, etc., for comprehensive operational data in the fields of resources and environment, infrastructure, transportation, social governance, population and people's livelihood, industry and economy, social opinion, public security, etc. In addition, it can carry out multidimensional analysis and judgment. It also supports the combination of a data analysis cockpit for comprehensive display. In this way, the digital twin can realize the parallel monitoring and analysis of multiple indicators, help users to understand the correlation behind complex data, and provide comprehensive data support for social managers' decision making and research.

3.2 IoT for intelligent ubiquitous sensing in a smart society

The IoT is a network where things are connected to objects used for information exchange and communication based on information carriers, such as the Internet and traditional telecommunication networks. Specifically, it is a huge network formed by combining various information sensing devices, such as radio frequency identification (RFID) devices, infrared sensors, global positioning systems, laser scanners, and other devices, with the Internet. It completely breaks the perception and constraints in

traditional thinking such as time and space, and its application aims to connect all items with the network to achieve intelligent identification, positioning, tracking, monitoring, and management.

(1) The construction of ubiquitous sensing for the IoT

The IoT construction content will take an all-optical network and a 5G network as the main body to build a sensing society platform and gradually build a comprehensive sensing, ubiquitous interconnection, and highly intelligent integrated smart society management system in the fields of social infrastructure, resources and environment, society and people's livelihood, economy and industry, and municipal governance. Some examples are smart street lights that collect weather information and charge electric vehicles and command traffic systems that manage traffic flow while acting as electronic street signs.

The IoT uses human signs and traces, object states and locations, network texts, and images as ubiquitous sensors through the data fusion of smart IoT, public service networks, and social governance networks. This fusion helps the system to perceive the operating status of society, understand the emotions and needs of residents, discover the laws of social operation, and discern the problems in society.

(2) The IoT supports the application of society governance

In the field of smart transportation, the IoT technology is mainly used in vehicle speed detection, dynamic setting of traffic lights, license plate recognition, and smart traffic diversion. Pressure sensors and acceleration sensors are used to collect parameters when vehicles pass. They calculate vehicle speed to achieve smart monitoring of vehicle speed, ensure the standardization of traffic, and detect and prevent problems in time.

In the field of social infrastructure construction, the IoT technology is mainly used in surveillance cameras, digital billboards, smart street lights, and map navigation applications. For example, smart street lights use the IoT technology and wireless communication technology to achieve the remote control and efficient management of street lights. Smart street lights can change the traditional street lamp management mode by controlling the brightness and lighting mode according to the actual scenarios, thereby saving energy and reducing consumption.

In the field of the construction of social logistics services, the IoT uses RFID technology to track the real-time location of items. For food items, the application of RFID technology can build a system to trace the origin of food materials and to provide customers with open and transparent food source information.

In the power supply field, through the IoT technology and sensor technology, sensors can be installed on every device through the links of the power system. A complete information transmission chain can be obtained from the power supply link. Therefore, power distribution can be more scientific and optimal, thus promoting the optimal deployment and scientific use of resources.

In the social education field, the IoT technology is applied to smart campuses. Sensor technology and IoT technology comprehensively monitor and record the campus environment, using RFID technology and image recognition technology to identify vehicles and people going in and out to prevent trespassing in the campus.

3.3 Blockchain reshapes the governance structure of a smart society

Blockchain has developed rapidly and has been widely applied in recent years. Its technology and application attributes are inseparable. Blockchain is a new application mode that integrates distributed data storage, peer-to-peer technology, hash encryption algorithm, as well as other computer technologies. Its essence is a distributed shared database that uses decentralization and trustless methods to maintain a data book of technical solutions. The characteristics of blockchain technology are decentralization, trustlessness, traceability, transparency, and security, which can effectively overcome the current problems of government data governance. The introduction of blockchain technology into the field of governance brings profound changes to its concept, mechanism, and institutional system.

(1) Government data governance by blockchain solves data islands

Government data governance is a way to comprehensively manage the availability, integrity and security of government data. The core technologies, such as the irreversible distributed ledger system of the regional chain, complex mathematical algorithms, asymmetry, and encryption technology, are used to solve problems of authenticity, security, and openness. Therefore, blockchain technology owns significant advantages in government data management.

First, a distributed data system of blockchain helps to improve data quality. In traditional governance systems, interactive behaviors of social subjects often require "trusted" government acting as intermediary organizations to coordinate or issue certifications. In this way, the government turns into a highly centralized organization that monopolizes 80% of high-density and high-value data. In a closed ring structure, data cannot be directly circulated in the whole society under the authority and intermediary role of the government, thus affecting real-time acquisition and data authenticity. A point-to-point distributed data system is built between stakeholders through the blockchain, where each entity accesses the system. Various social activities are recorded into the blockchain, and transactions are confirmed. It allows the information of related social affairs to be broadcasted, matched, verified, and identified in a large range rapidly. Notably, the information and data of any governance

activity can only be completely written into the blockchain after it has been verified and approved by other entities through network-wide broadcasting.

Second, peer-to-peer technology and smart contracts of the blockchain help to accomplish data sharing. Peer-to-peer technology accomplishes data-sharing throughout all networks and solves the problem of intermediary third parties for data sharing to realize the real data sharing. A blockchain information management platform enables government organizations at all levels to grasp a large amount of real data in a timely manner from the whole society. Grasping such data helps to understand public opinion and social needs fully and provide data support for government decision making. The blockchain does not require the credit endorsement of the participants. However, it uses mutual trust algorithms to create credit, generate trust, and reach consensus. In addition, the smart contract technology breaks the separated data standards and statistical methods, and it replaces the traditional data protocol. By writing a designated unified code in the development contract, the system will infer the implementation conditions of the contract to ensure the execution of the contract. As a result, peer-to-peer technology and smart contracts expand the scope, speed, and extent of data sharing, thus improving its timeliness and standardization attributes.

(2) Blockchain enables decentralized application

The internal structure of traditional enterprises and government departments is mostly in the shape of a pyramid. The negotiation and decision-making affairs within the department span several levels, which are of very low efficiency. At present, with the demands of enterprises and government departments for emerging information technology and software increasing, the pyramid model has gradually evolved into a flat organizational structure. The multicenter characteristics of the blockchain are fully accomplished. Flat organization enables streamlined administration and decentralization, thus guaranteeing the individual power of each node. In this way, the efficiency of internal processing is highly improved and achieves decentralization. In this perspective, streamlining government structures is conducive to the innovation of social governance modernization.

(3) Immutable blockchain improves credibility

Data privacy and integrity are important components of data security. In data flows of large-scale and high-frequency transmission, information lags, asymmetry, and even malicious misinterpretation are inevitable. Asymmetric encryption technology, zero-knowledge proof algorithm, hash algorithm, and other technologies are applied to achieve data security and privacy. Among them, asymmetric encryption algorithm can verify the data source to protect data security. Anonymous algorithms, such as hash algorithms, can protect data privacy from leakage. At present, hash algorithm is vital in capturing the address of the previous block, recording data summary, finding the address of the interactor, constructing the Merkel data structure, etc. In addition, the data of the blockchain is stored in a distributed chain structure to ensure multiple backups of data and improve the fault tolerance and security of the database. At the same time, the immutable attribute of blockchain technology can strictly ensure the authority and authenticity of the information released, thus effectively avoiding rumors. Information transmission and release based on blockchain technology can trace information trends throughout the process to lead correct public opinion, thereby consolidating the credibility of relevant departments.

(4) Blockchain reshapes traceability in social credibility

The convenience brought by Internet information technology requires a more reliable credit system of the entire society. Blockchain technology has changed the mode of recording, storing, and transmitting information. A specific individual blockchain can record and store all related credit information. Each piece of information can be traced forward until each record is generated. Stored information will be synchronized to the entire system in real time. On this basis, credit reporting agencies not only obtain information but also share it in real time. Social credit information management based on blockchain technology can aggregate messy and scattered credit information, further dig out individual social credit status, and create an innovative social credit system with a more reasonable structure and more stable performance.

As the blockchain technology becomes increasingly mature, it will deeply reconstruct the social governance structure. The application in social governance will evolve to autonomous and fair governance. First, from the controlling stage to the autonomous stage, distribution weakens the authoritarian values of hierarchy, closure, and control, and it strengthens the autonomous values of equality, openness, collaboration, and sharing. Second, from the efficient stage to the equal stage, the fundamental goal of blockchain application is to protect transactions, create value, and ensure the fairness, legitimacy, security and privacy of transactions. Ultimately, it makes integrity and fairness a core value.

3.4 AI guarantees services for the people's livelihood in a smart society

AI is booming. With deeper application in social and living areas, it has become the new engine of economic growth and international competition. It is also an effective tool for promoting smart society construction. AI is applied in diverse scenarios, such as in the construction of smart transportation, smart medical, smart government, smart education, and other smart social systems. With its great potential in facilitating real economy, guaranteeing jobs, and protecting people's rights to participate in politics, AI livelihood is the future.

(1) AI guarantees the basic necessities of living

Ensuring people's basic necessities of living is to enable them to enjoy a higher quality of life and to provide them with food, education, sanitation, transportation, and other life guarantees.

In terms of smart transportation, China has entered a stage of development and application from the exploratory stage of AI+ smart transportation. AI enables cars to detect and analyze road conditions, identify lane lines and traffic instructions, etc., which not only free drivers' hands, but also realize the interconnectedness of people, cars, and society by collecting big data streams. In this way, the efficiency and smoothness of the roads are improved, and traffic accidents caused by human errors are reduced.

In terms of smart medical care, AI is deeply integrated with medical care, thus becoming an indispensable assistant. Intelligent consultations, medical imaging-assisted diagnosis, disease risk prediction, and intelligent assistive devices are the medical processes where AI has been penetrated and applied. In this way, patient data are quantized, and reliable diagnosis and effective medical solutions are provided. AI+ Medical Surgery not only increases the success rate but also enables continuous breakthroughs in traditional minimally invasive techniques to benefit patients. AI allows the medical industry chain to be further optimized and the medical industry to be of higher efficiency and higher levels. Thus, the era of medical intelligence begins.

In terms of smart education, the combination of education and AI will accomplish the diverse needs of different students. Online education can break the three-dimensional limitations of traditional education in time, place and space. Moreover, it can make better use of educational resources, thus facilitating education equity.

(2) AI guarantees employments

Ensuring employment is a major issue involving thousands of household and individual developments. People's livelihood must provide everyone with opportunities of employment, study, development, and success. Only with employment can wealth be created to provide funds for other aspects of people's livelihood.

In recent years, AI has been deeply integrated with real economy and widely used in people's livelihood, thus significantly improving work efficiency. Production and life in all aspects have been changed profoundly. In smart manufacturing, smart home, smart city management, and other scenarios, AI technology has been widely used and has become an important engine for digital industrialization and industrial digitization. Robotics and automation have reduced the risk of the so-called 3D work: Dangerous, Dirty and Dull, which are risky, repetitive, and physical.

At the same time, in terms of consumer service perception, voice recognition, natural language processing, and other technologies are applied to solve the problems regarding the long wait for manual service transfer in service hotlines. Calls are answered automatically, and the manual transfer time is reduced. Hence, self-service has been the trend and can meet the diverse needs of consumers.

(3) AI guarantees people's rights and interests in government and public affairs

AI guarantees people's political rights and interests by making use of AI and other technical tools to rebuild the connections between the government and the various subjects of society. In the process of practicing popular governance, solving problems, such as the lack of public perception of the city, low sense of gain, and low satisfaction, is the main issues. Thus, the modernization of national governance must be promoted.

At present, at the level of technological development, AI remains weak. It is also a stage of perceptual intelligence and cognitive intelligence. The political rights guaranteed by AI should focus on restructuring the connection between the government and the subjects of society to improve a sense of gain and satisfaction. Therefore, the current main idea of AI development is as follows. Individuals' information and demands must be obtained accurately, and they must be centralized in a timely manner using cloud computing and distributed edge computing. Such precision and timeliness provide technical tools and information support for the refined governance of mega cities.

Detailed implementation methods are aggregating emergency departments to establish a handling mechanism for the management linkage platform; applying information integration and systematic analysis to handle public crises and maintain social stability quickly; connecting government services, portal websites, hotlines, and citizen service halls to build a comprehensive government information platform and meet one-stop service needs; integrating service functions in the field of public service and supervision to establish a full-mode social service management and supervision center; and meeting public needs for unified government supervision.

In general, new technologies such as AI have become important forces in guaranteeing people's rights in public affairs. AI provides better solutions to problems in social governance, industry management, application services, etc. For example, government data management departments use AI technology to monitor real-time data, discover abnormalities in time, and formulate targeted management measures. People can participate in system operations while enjoying government and corporate services, putting forward demands, providing feedback information, and evaluating services, thereby enjoying more convenient and better services. In the future, AI will play a greater role in government and public services to help build a better life.

4 Practical exploration of the modernization of smart society governance

This section explores the practice of the modernization of smart society governance. First, by collecting big data in various fields, such as resources and environment, public healthcare, government management, and smart transportation, a basic information platform for smart society governance is built. Second, building an evaluation system for the modernization of smart society governance technology and capability further improves the top-level design of the smart society. Third, the governance body can also implement a series of practices in epidemic prevention and control and people's livelihood protection based on spatial and temporal big data and AI technology, smart campuses, public resources, and data governance application demonstration. The article has achieved a series of research results, which are described below.

4.1 Construction of basic information platform for smart society governance

Given the acceleration of the modernization process of cities and large population gathering, the contradictions in urban social governance have become increasingly prominent. Finding methods to give full play to the advantages of information technology in social governance has become the key to building a smart city. In the report of the 19th National Congress of the Communist Party of China, General Secretary Xi clearly mentioned the smart society and put it alongside digital China and other strategies. The development of this smart society is an important support for comprehensively building a modern and powerful socialist country. In recent years, emerging information technologies, such as big data, IoT, AI, blockchain, and 5G, have developed rapidly around the world. They have continued to be highly coupled and deeply superimposed with industrial development. In addition, they continue to nurture disruptive innovations and breakthroughs that change the world and promote economic growth and social development into a new stage.

The strategic research on the modernization of the governance system and capabilities of a smart society centers on building a digital twin city based on big data mining, geographic information system (GIS), and other information technologies. It also explores an urban digital base of "things-connected, data-connected, intelligence-connected" and the principle of "overall planning, joint construction and sharing". A set of standards and the regulations system of urban operation are built, incorporating data from various fields, such as smart transportation, resources and environment, public healthcare, and government management. In addition, research also deals with the systematic planning of an "urban neuron system", the scientific deployment of video images, monitoring and sensing, control execution, and other perception terminals. The wide application of new technologies, such as building information modeling (BIM), GIS, 5G, AI, network slicing, and cloud GIS, has been highlighted to upgrade the level of urban innovation greatly. The construction of digital infrastructure is accelerated, and multisource heterogeneous big data mining and integration are conducted. Furthermore, digital platforms, such as AI, blockchain, and industrial Internet are created. Digital applications in various fields, such as economic development, citizen life and urban governance, are firmly supported as well. The architecture of the smart society platform is summarized in Fig. 2 by referring to Foresti et al. (2020).

As shown in Fig. 2, the whole diagram of the smart society platform is composed of five layers, including the perception layer, storage layer, data layer, platform layer, and the uppermost user layer. The perception layer is constructed with various kinds of sensors to enable the infrastructure to perceive the tremendous data (e.g., trajectory, web data, surveillance data, etc.) of the smart society. The storage layer uses hardware virtualization, storage virtualization, and network virtualization to ensure the efficiency and safety of the perceived data sharing and storing. The data layer provides the capability to process the public and private thematic data generated from different applications in a smart society. The above platform layer incorporates the multisource and heterogeneous big data fusion and mining components and the on-line analytical processing (OLAP) and on-line transaction processing (OLTP) technologies to provide a business with intelligent services. With the comprehensive-constructed infrastructure, the uppermost user layer can consume the perceived data and well-organized smart society services.

4.2 Construction of smart society governance technology and capability modernization evaluation system

Constructing an assessment system for the technology and capability of the modernization level of smart society governance will systematically improve the top-level design of social governance. A smart society emphasizes people, service, and management as the lead, and it focuses on key areas, such as smart management, smart livelihood, and smart industry. It provides residents with a safe, stable, smart, and efficient life through technological support surroundings. On the basis of the principles of system complexity, functional multiplicity, and evaluation multiplicity (Chen et al., 2020), comprehensive consideration is given to the eight capabilities of overall planning, coordination and linkage, decision-making and command, implementation and execution, security prevention and control, monitoring and early warning, resource sharing, and emergency response. From the overall planning

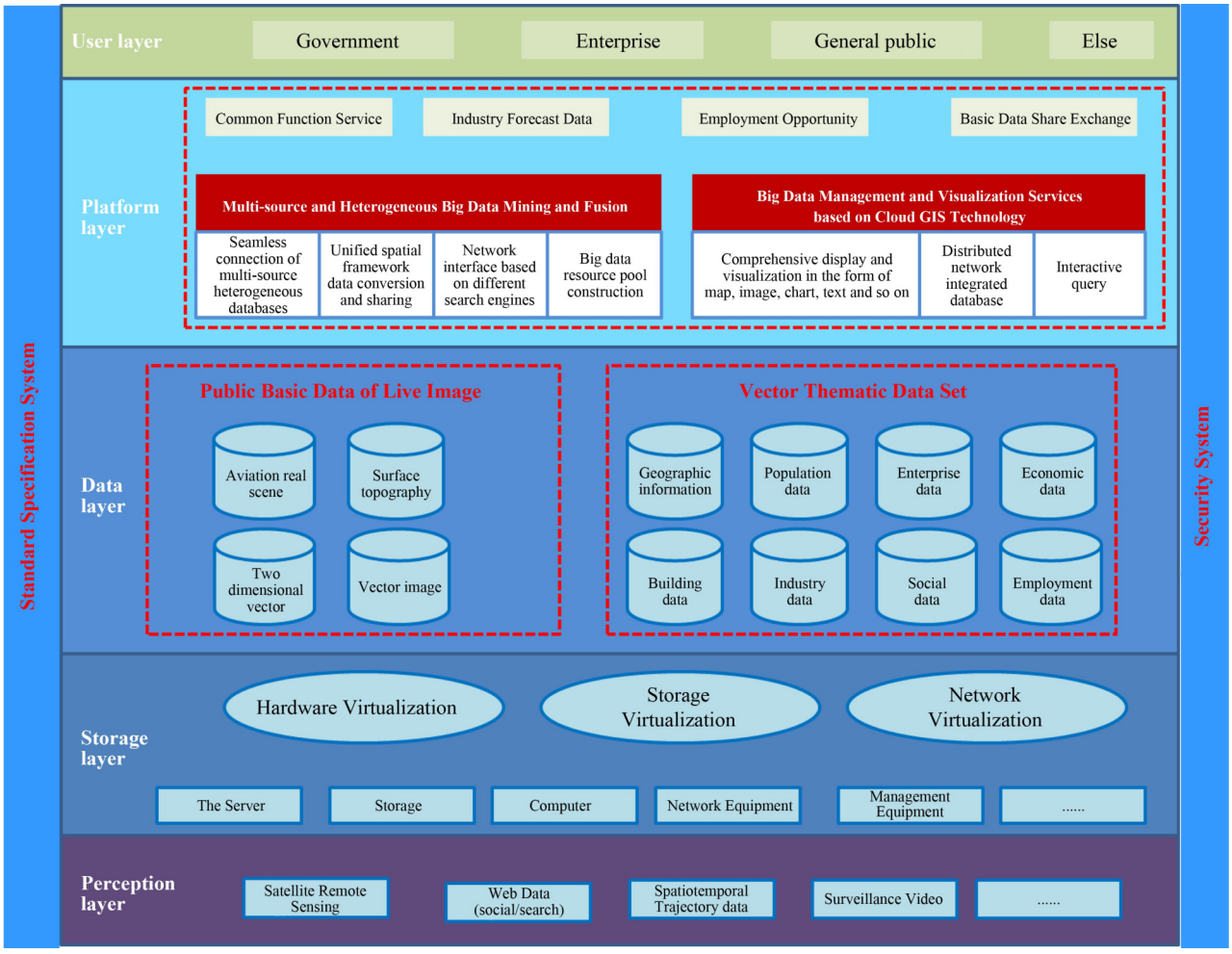

Fig. 2 Structure diagram of smart society platform construction.

mechanism of the smart society, other developments emerge, including government service coordination and linkage capability, level of decision data service, city development and planning consistency level, security prevention and control facility coverage, financial security monitoring and early warning capabilities, construction level of public information platform, and perfect emergency response mechanism. The management technology and capability level of the smart society are measured in 33 aspects (including the degree indicator). The evaluation index system is shown in Table 1.

Using this evaluation index system, 11 typical cities in the northeast, northwest, central, southeast, and southwest regions in China are selected as evaluation objects. Methods such as big data analysis and improved entropy weight method are used to carry out multidimensional evaluation (Postranecky and Svitek, 2017; Xu et al., 2018), thus reflecting the existence of a relatively complete governance in each region. According to the relevant department indicator statistics in 2019, the comprehensive scores of 11 cities are shown in Fig. 3. Judging from overall score, the modernization gradient of smart society governance technology and the capabilities of each city is evident. The modernization levels of the smart city governance technology and capability of Shenzhen, Shanghai and Chongqing are in the leading position. The level in Wuhan and Changsha are in the second echelon. In addition, Jinan, Kunming, Changchun, and Urumqi are in the third echelon. Meanwhile, the modernization level in Zhuzhou and Xiangtan needs to be further improved. From the distribution and scores of each city, the development of China's smart society is characterized by features of high in the east and low in the west.

Figure 4 shows the scores of each dimension of smart society governance technology and capability modernization in 11 cities. Generally speaking, cities have advantages in coordination and linkage capabilities, decision-making and command capabilities, and monitoring and early warning capabilities. However, they are lacking in emergency response capabilities. An imbalance exists in the level of smart city governance technology and capability modernization among various cities. Shenzhen demonstrates good performance in all aspects, while Xiangtan has poor performance. Different smart cities have different

Table 1 Smart society governance technology and capability modernization evaluation index system

First level indicators	Second level indicators	First level indicators	Second level indicators
Overall planning capability	Smart city coordination mechanism	**Monitoring and early warning capability**	Financial security monitoring and early warning capabilities
	Smart city management mechanism		Natural disaster monitoring and early warning capabilities
	Smart city infrastructure investment and construction capabilities		Production and economic safety monitoring and early warning capabilities
Coordination and linkage capability	Government service coordination and linkage ability		Urban ecological safety monitoring and early warning capabilities
	Ecological environment coordination and linkage ability		Urban traffic monitoring and early warning capabilities
	Coordinated development capabilities of industrial clusters		Network public opinion monitoring and early warning capabilities
Decision-making and command capability	Decision data service level		Public safety monitoring and early warning capabilities
	Big data intelligent analysis model level	**Resource sharing capability**	Public information platform construction level
	Decision support system construction level		Resource sharing database construction level
Implementation and execution capability	Consistency between urban development and planning level		The level of social opening and utilization of public information resources
	Policy service level		Sharing rate among information resource departments
	Public participation level	**Emergency response capability**	Perfection of emergency response mechanism
Security prevention and control capability	Coverage rate of safety prevention and control facilities		Emergency facilities coverage
	Construction level of safety prevention and control platform		Professional level of emergency team
	Degree of synergy of safety prevention and control systems		Emergency handling speed
	Data security prevention and control capabilities		Construction level of emergency platform for major emergencies

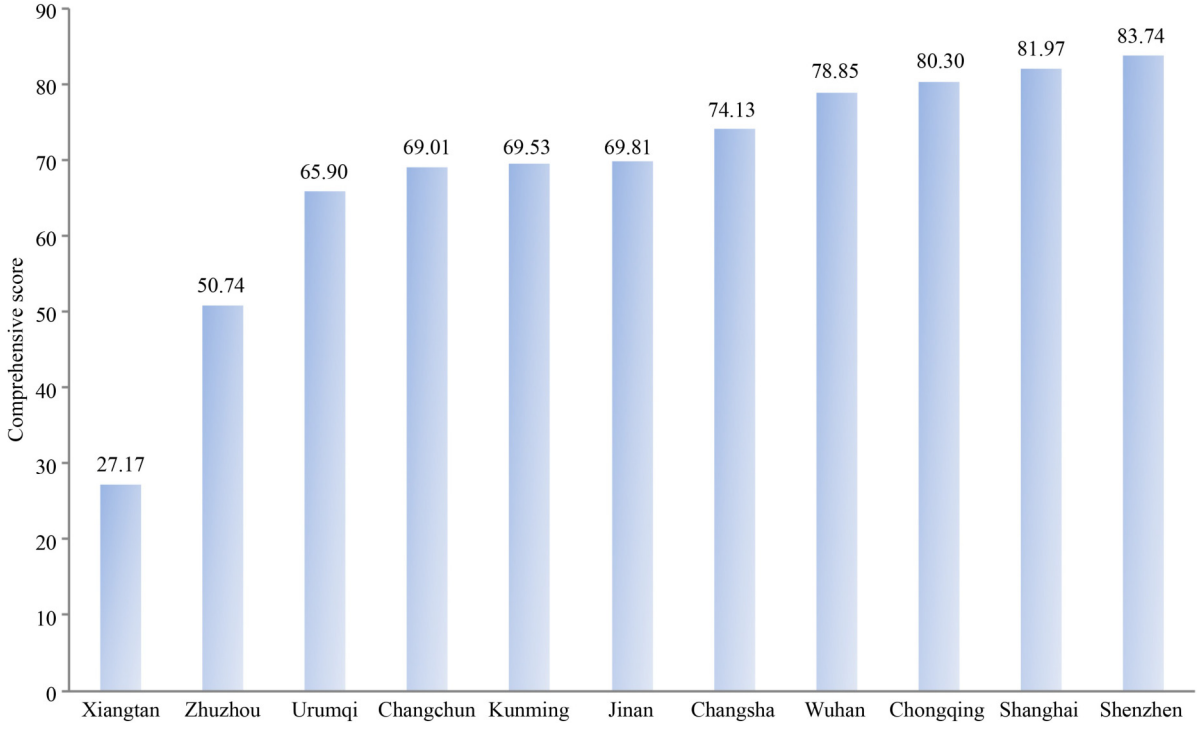

Fig. 3 Comprehensive score of 11 cities for smart society governance technology and capability modernization (Data source: Indicator statistics of relevant departments in each city in 2019).

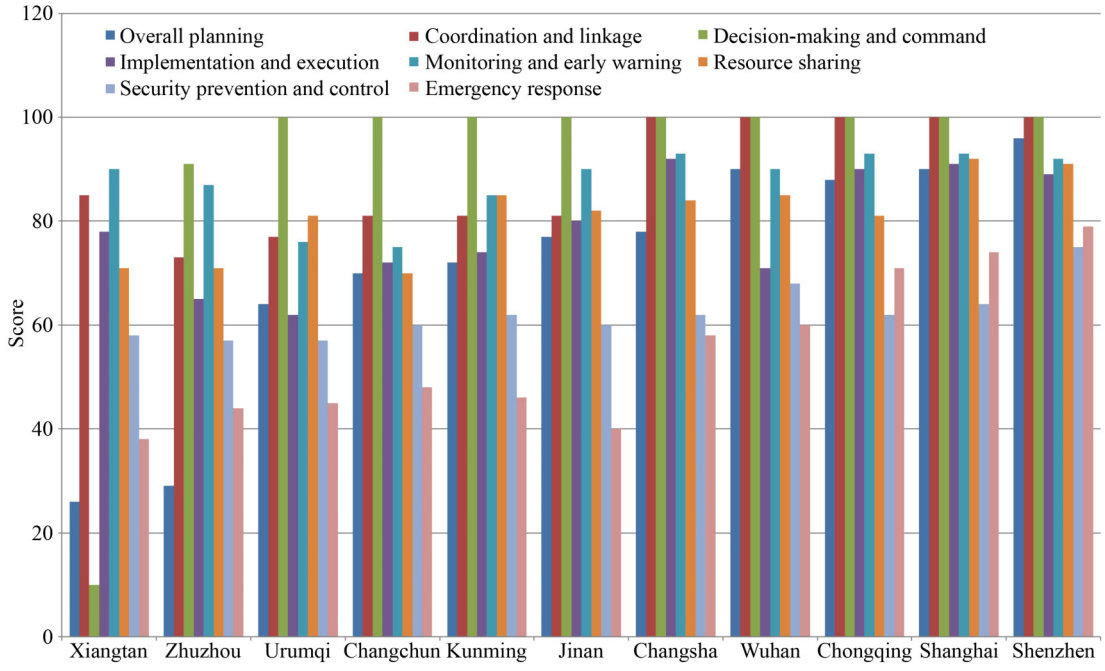

Fig. 4 Scores in all dimensions of the modernization of technologies and capabilities for smart society governance in 11 cities.

emphasis on urban governance technology and capability modernization. Shanghai, Shenzhen, Chongqing, Wuhan, and Changsha focus on coordination and linkage as well as decision-making and command capabilities, while Jinan and Zhuzhou focus on the construction of decision-making and command as well as monitoring and early warning capabilities. Urumqi and Xiangtan paid attention to monitoring and early warning as well as coordination and linkage capabilities. Constructing an evaluation index system for the modernization of smart society governance technology and capability can visually present the weak areas of the development of a smart society in a city. Then, targeted opinions are put forward. This evaluation index system plays an important role in quickly coordinating the establishment of an integrated smart society governance management system, basically forming a new governance model with Chinese characteristics and era characteristics, realizing sustainable development, and providing data for the evaluation support of China's smart society governance technology and capability, scientific methods, and decision-making suggestions. Specifically, an Optimized Intra/Inter-Class Structure based Variational Few-Shot Learning (OICS-VFSL) model is proposed as smart society governance technology to improve the microservice-oriented society services across different systems (Liang et al., 2021).

4.3 Big data-driven application demonstration in epidemic prevention and control

The key issue in advancing epidemic prevention and control is how to use existing methods to help fight the epidemic. As a new generation of technology and means, big data has many advantages, such as massiveness, multisource, and versatility. We can make full use of big data technology to enhance the effectiveness of epidemic prevention and control. The COVID-19 pandemic in China has highlighted the problems of imperfect social governance systems, insensitive emergency response mechanisms, and untimely control. The core lies in the existence of big data-based emergency management and monitoring systems, public health safety systems, and online public opinion monitoring and early warning, which remain seriously insufficient. To this end, we have carried out research from four aspects, namely, the spreading model and risk assessment of the COVID-19 driven by big data, the real-time monitoring and analysis of online medical big data, the monitoring and early warning of the epidemic situation, and the management of the flow of people, to provide important support for the formulation of epidemic prevention and control policies.

In terms of coronavirus transmission models, using big data technology and other related solutions can accurately locate the spread of the epidemic, which plays an important role in preventing and controlling the spread of the epidemic and mitigating risks. For example, after a big data investigation, a patient found that he had been in contact with at least three potential patients from key epidemic areas. On the basis of the integration and fusion of multisource nonmedical big data, the authors established a holographic high-precision image of the spread of COVID-19 for basic epidemiological feature inference, transmission risk measurement and early warning,

epidemic development trend prediction, and prevention and control measures optimization to provide a basis for decision making. The risk source model can predict infection cases nationwide at least one week in advance, and the accuracy rate is very high ($R^2 = 0.927$, where R is a measure of the goodness of fit of the regression, representing the fraction of the total variation of the data explained by the used model). The results can be used to assess the size of the epidemic risk in various regions and provide a basis for emergency plans and related decision making in the early stage of the epidemic. In addition, statistical analysis and machine learning methods are used to assess the spread of the new type of coronavirus in different regions of the country, establish risk source models, and evaluate epidemic risks from a certain source spread to various places.

In terms of real-time monitoring and analysis of online medical big data, medical institutions must set up reasonable systems to ensure the smooth progress of medical policies in the process of medical management. Therefore, medical institutions must rationally use big data technology to ensure the real-time monitoring and analysis of materials. The authors collected public data on online medical services and environmental quality, then, independently developed the online medical big data real-time monitoring and analysis platform. The data sources of this platform include: (1) The online medical service platform "Good Doctor" (haodf.com): 9337 hospitals in 392 regions of 31 provincial areas of China; nearly 100000 medical departments; more than 50000 pieces of doctors' consultations and patients' comments; and access to real-time data such as web traffic. (2) National Air Index Service Platform (air-level.com): More than 100000 pieces of daily real-time air quality data (air quality index (AQI), air quality level, $PM_{2.5}$, PM_{10}, and primary pollutants) from 1573 monitoring stations in 379 major cities across China. The system builds a method for medical big data intelligent analysis to realize the dynamic monitoring of the number of key diseases based on the population base, spatial distribution analysis and visual display, and real-time monitoring of the entire disease in a typical area, thus setting multi-stage thresholds to predict and early warning of key diseases. Through medical and health big data, it provides five core functions: The analysis of the regional distribution of key diseases, the analysis of the time series of key diseases in the region, the analysis of regional incidence rate of diseases and medical resource allocation, the analysis of environment and disease correlation, and the optimization analysis of the effectiveness of online medical platforms. It provides support for the allocation of medical resources across the country and support for disease prevention decisions in various regions.

In terms of epidemic monitoring and early warning, the platform aims at the epidemic warning information of various regions and departments. Moreover, the platform realizes the visual display of epidemic information, including multiple dimensions such as diagnosis, suspicion, and cure. Public health information is a key part of emergencies. The establishment of an emergency information system for epidemic alert and control can increase the intensity of defense against the epidemic. Currently, based on infectious disease surveillance data, China has established an infectious disease surveillance and early warning system based on different big data sources (Zhu et al., 2016), including domestic and foreign epidemic monitoring, COVID-19 epidemic regional risk assessment and analysis, early warning analysis for public health emergencies, epidemic public opinion analysis, and infectious disease regional monitoring and analysis.

Finally, the human flow factor and its control must be the most important factor affecting the epidemic development trend. Therefore, if enough human flow information can be obtained, it will play a vital role in the analysis and modeling of the epidemic. Given the flow of people from different places, the degree of risk is different. On the one hand, the prevention measures will differ in different periods or different regions for the entry of foreign population. On the other hand, the control of internal personnel and the awareness of the internal personnel's own prevention will also affect the spread of the epidemic. Studies have shown that accurately grasping population mobility within the limits of related laws is one of the most effective big data methods for predicting the development of an epidemic in the early outbreak and mid-stage.

4.4 Space intelligence and AI technology support people's livelihood

With AI involved in the construction of a smart society, the intelligentization of people's livelihood services is the key point. Beneficial service to the people is viewed as a bellwether of the construction of a smart society. The combination of transportation, medical care, education, finance, and other fields with AI can continuously improve the level of intelligent social services and improve the efficiency of serving people's livelihood. Smart livelihood can also promote the continuous development of a smart society. The functional value of an intelligent society is mainly manifested in urban planning, intelligent medical care, intelligent transportation, intelligent government affairs, intelligent education, and intelligent finance.

In terms of urban planning, urban planning empowered by AI will effectively reduce errors in urban planning forecasts and decision making. By combining technical signals with algorithms and video surveillance data, AI+ Urban Planning can comprehensively collect city information and realize real-time cognition, search, prediction, and optimized decision making.

In terms of intelligent transportation, China has entered

the actual development and application stage from the exploratory stage of AI+ Smart Transportation. Cars under AI technology can detect and analyze road conditions, identify lane lines and traffic instructions, etc. AI not only frees the hands of the driver but also reduces traffic accidents caused by human factors.

In terms of smart medical care, the quantification of patient data will be realized through AI empowerment, and the simulated doctor can make a reliable diagnosis of patients and provide effective medical solutions. AI+ Medical Surgery not only increases the success rate of surgery but also enables continuous breakthroughs in traditional minimally invasive techniques to benefit patients.

In terms of smart government affairs, based on the Internet and big data, AI can better solve many problems in social governance, industry management, and application services. The management department of government data uses AI technology to monitor data in real time, discover abnormalities in time, and formulate targeted management measures. For the public, while enjoying government and corporate services, they can participate in the operation of the system, put forward demands, feedback information, and evaluate services, thereby enjoying more convenient and better services.

In terms of smart education, the combination of education and AI will meet the diverse needs of different students, and Internet education can break the three-dimensional limitations of time, place, and space of traditional education. Moreover, it can make better use of educational resources and make progress in securing fair access to education.

In terms of smart finance, with the in-depth application of a series of technologies, such as computer vision, machine learning, natural language processing, robotics, and speech recognition in the financial field, the financial industry is undergoing an unprecedented transformation. Intelligent customer service can quickly solve customer problems, grasp customer needs through real-time voice recognition and semantic understanding, provide customers with accurate services, and automatically store customer characteristics. The financial industry empowered by AI can also provide customers with personalized financial management methods, predict and analyze market conditions, provide investors with references, and allow customers to enjoy better services through digital product presentations.

In addition, given that the information systems of various cities are not interoperable and the data formats are not uniform, China is vigorously strengthening the application of big data and AI technology. Moreover, AI technology must be promoted to protect people's livelihood. Considering the issues of time and space comprehensively, a refined zoning material guarantee service plan against the influence of epidemic is designed, as shown in Fig. 5, to strengthen the governance capability of cities and regions, formulate a refined zoning material guarantee service plan, and use spatial intelligence to enhance the city's digital governance capability. Furthermore, AI and big data technology are applied to improve people's livelihood and wellbeing by solving the problems of essential material supply in ordinary living.

Under the guidance of the above service plan, several scientific research institutions have been combined to use AI technology to develop a residential material guarantee system. At the same time, a voice recognition follow-up system and an AI technology design are used. The map query can better help residents obtain the materials they need. This system embodies how to use AI to serve people's livelihood and reveals the future value and reform direction of AI.

4.5 Smart campus application demonstration

Driven by digital technologies, such as the IoT, cloud computing, big data, and AI, the development of education informatization has clearly demonstrated the characteristics of intelligence, openness, personalization, and socialization. Smart campuses are transforming through technological means. Under this transformation, the traditional campus is upgraded, and the deep integration of information technology and education is realized. The comprehensive use of intelligent sensing, behavior profiling, behavior trajectory analysis, and other methods helps to realize analysis and intelligent management of behavior big data and build a smart campus through the data collected, such as teaching scenes, personnel flow, and campus safety, on the campus of Hunan University of Technology and Business. The behavioral big data intelligent decision-making analysis system, as shown in Fig. 6, realizes a series of functions such as student disconnection and unusual behavior early warning, big data-assisted teaching evaluation, big data-assisted employment, campus safety early warning, library behavior analysis, teachers and students group portraits, etc.

The system further normalizes and follows up a collection of classroom teaching behavior data. It also uses AI technology to perform accurate behavior analysis on the massive video big data of classroom teaching to achieve the intelligent sensing of teaching effects, the quantitative analysis of teaching quality, and the scientific evaluation of teaching supervision. The above results provide references for the in-depth integration of digital technology and smart campuses, promote school management innovation, and ultimately realize education informatization, scientific decision-making, and standardized management.

4.6 Smart society public resources and data governance application demonstration

The rapid development of information technology has

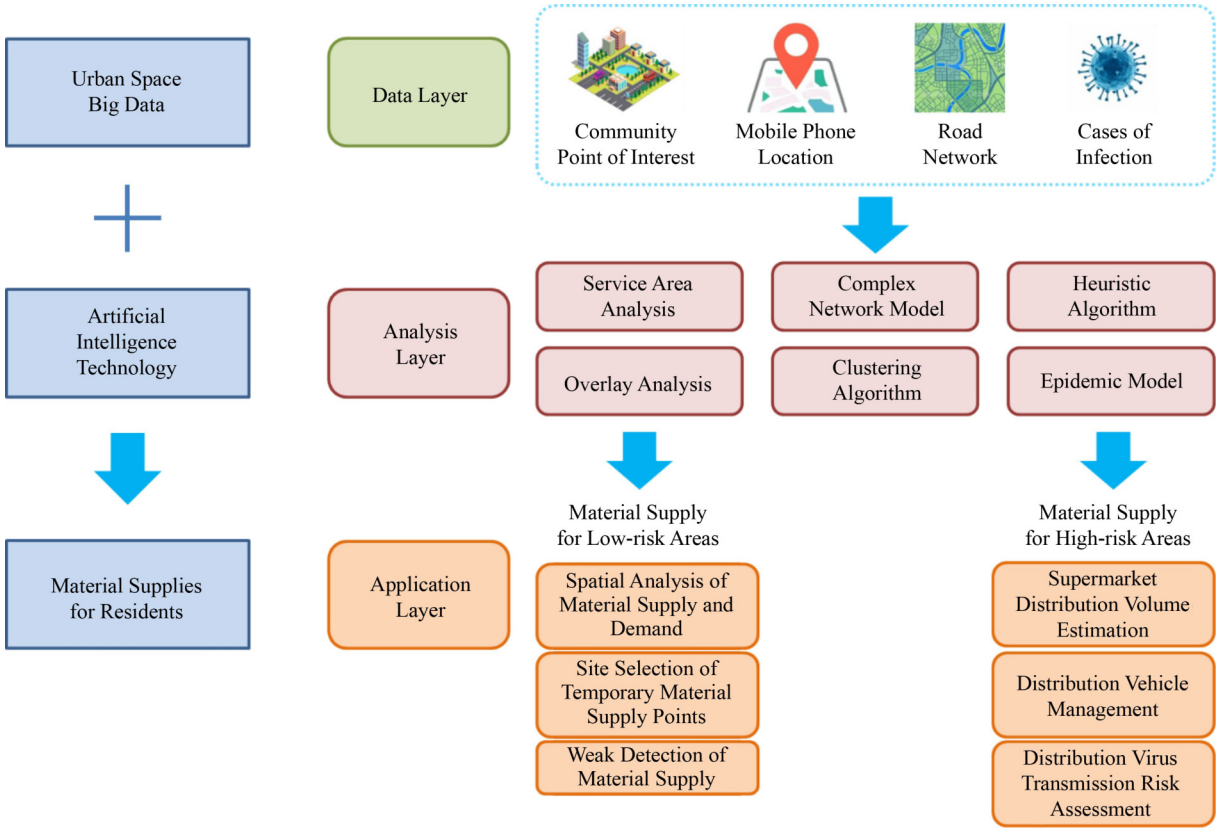

Fig. 5 Refined zoning material supply service plan.

brought about exponential growth in the amount of data. Explosive data have gradually become one of the important potential resources of society. They are gradually embedded in the structure of daily life and even promote social changes. However, massive data also bring unprecedented issues to data governance. Some other challenges included data sharing, reliable data storage, and fast access. In response to these challenges, the innovative research on the integration of blockchain, AI, big data, and multi-party secure computing technology has been carried out. Furthermore, a blockchain technology system with independent property rights has been constructed, as shown in Fig. 7. A private chain is built based on Ethereum technology. In addition, a high-performance blockchain hybrid consensus algorithm and a management system are built to support the basic application and security protection of the blockchain. To break through the data sharing problem between different government agencies and business entities, a blockchain-based data-sharing security platform was developed. The architecture is shown in Fig. 8. The blockchain and trusted computing environment are used to complete the data sharing that is invisible to users and to obtain the data calculation and analysis results.

To solve problems of data processing and data storage in the construction of smart cities, microservice governance and distributed database clusters are used, and a blockchain information browser is developed. The architecture is shown in Fig. 9, which meets the horizontal expansion of queries and the small size of functional modules granularity. Thus, it meets the needs of a stable system operation and a gray upgrade, and provides reliable storage and fast access to the database. It provides a scientific basis for innovative application of blockchain technology in smart government affairs, digital credit investigation, e-commerce, education, and other fields.

As mentioned above, the modernization of smart society governance has plenty of practical application and exploration: The establishment of a basic information platform can lay a solid foundation for smart society governance, build a smart society governance technology and capability modernization evaluation system, and provide decision-making suggestions from the overall planning, coordination and linkage, etc. Practical explorations in epidemic prevention and control provide a decision-making basis for COVID-19 epidemic development trend prediction, epidemic risk measurement, prevention and control measures optimization, etc. In terms of people's livelihood protection, spatial intelligence is used to formulate refined zoning material supply service plans to enhance urban digital governance capabilities. In terms of public security governance, the awareness and early warning system of public security situation and a smart society emergency handling system are established to improve

Fig. 6 Smart campus behavior big data intelligent decision analysis system.

the public security governance capabilities of the smart society. In terms of public resource and data governance applications, a blockchain technology system with independent property rights is built. This system is conducive to the promotion and application of blockchain technology in multiple fields. The rich results obtained from the exploration and practice of the modernization of smart society governance have laid a good foundation for the further development of the modernization of smart society governance.

5 Conclusions

The development of emerging information technologies, such as big data, cloud computing, and the IoT, has accelerated the arrival of a new round of technological revolution. Human society is gradually moving toward a higher form of “intelligence”. China’s urban construction, services, and management capabilities have been significantly improved to a certain extent. However, in the face

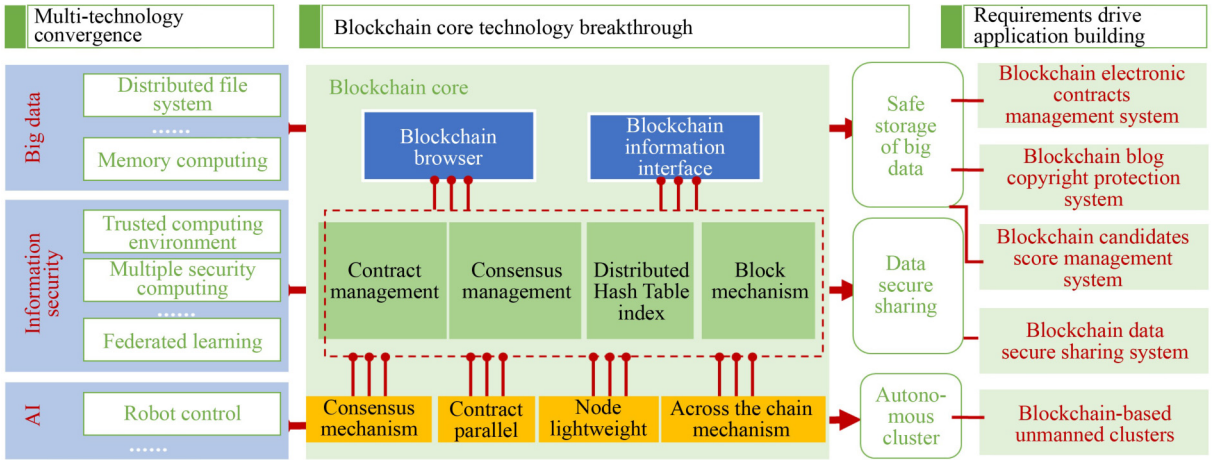

Fig. 7 Blockchain technology system framework.

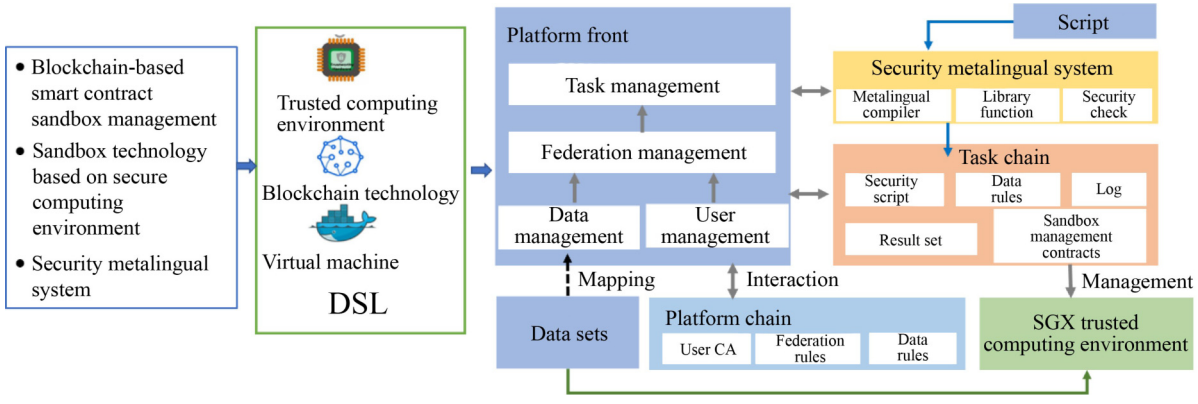

Fig. 8 HOPE data sharing security platform based on blockchain technology (notes: DSL: Domain specific language; CA: Certificate authority; SGX: Software guard extensions).

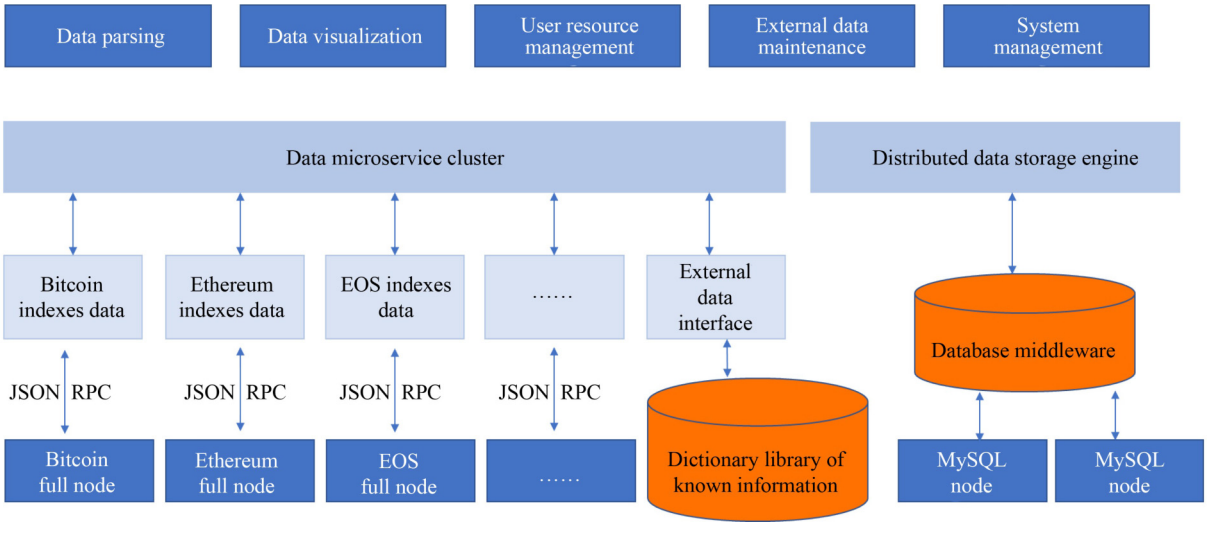

Fig. 9 Blockchain information browser technical framework (notes: EOS: Enterprise operation system; JSON RPC: JavaScript object notation remote procedure call).

of the increasingly complex social governance systems and ever-changing social needs, especially the huge disasters caused by the COVID-19 pandemic to human society, problems such as mismatched demands, poor information sharing, and severe fragmentation are becoming increasingly evident. The construction of smart cities no longer meets the development demands of modern society. The governance of smart society driven by digital technology has ushered in an unprecedented period of opportunity. Under the background of smart society construction, this article puts forward a modern strategy for smart society governance integrated with digital technology innovation after an in-depth analysis of the opportunities and challenges in a smart society. A more comprehensive and systematic practical exploration has been carried out in governance modernization, and great contributions have been made to the modernization of China's smart society governance driven by digital technology from both theoretical and practical aspects. First, this article further enriches the research on the theory of smart society governance by placing the development of digital technology, achieving smart society governance at the height of the national strategy and proposing a modern governance strategy for smart society. Second, with the support and guidance of the modernization strategy for smart society governance, this article proposes to focus on emerging information technology fields, such as digital twin, IoT, blockchain, and AI. Achieving human empowerment, city empowerment, and society empowerment provides theoretical guidance for digital technology in the process of innovative and smart society governance. Finally, this study conducts many practical explorations in key areas of the modernization of smart society governance. While providing data support, scientific methods, and decision-making recommendations for China's smart society governance technology and capability assessment, it also contributes to China's epidemic prevention and control and related policy formulation. In addition, centering on social public security, government affairs, digital credit investigation, e-commerce, education, and other fields, the article provides valuable experience and reference for the further improvement of urban digital governance capabilities through the construction of a public security early warning system, an emergency handling system, and other systems, including blockchain technology with independent intellectual property.

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