Strategic Research on Information Technology Promoting the Modernization of National Governance: Postprint of the Academic Review from the S70th Xiangshan Science Conference

Authors: Zhang Chao, Duan Weiyu, Kaihua Chen, Yang Xiaoguang, Long Yuntao

Date: 2024-03-27T00:00:00+00:00

Abstract

The article provides a systematic summary of the reports and speeches presented at the S70th Xiangshan Science Conference, which focused on the theme of "Strategic Research on Information Technology Advancing the Modernization of National Governance." The conference consensus is organized into three aspects: (1) Information technology advancing the modernization of national governance has achieved significant progress and accomplishments in four representative domains: smart rule of law, cyberspace governance, data governance, and emergency management; (2) Information technology advancing the modernization of national governance confronts unprecedented opportunities and challenges; and (3) It is imperative to implement a series of effective measures through top-level design to further facilitate information technology in advancing the modernization of the national governance system and governance capacity.

Full Text

Strategic Research on Information Technology Promoting National Governance Modernization—Review on the S70th Xiangshan Science Conferences

Citation Format: Zhang C, Duan W Y, Chen K H, et al. Strategic research on information technology promoting national governance modernization—Review on the S70th Xiangshan Science Conferences. *Bulletin of Chinese Academy of Sciences*, 2024, 39(1): 143-151, doi: 10.16418/j.issn.1000-3045.20231219003.

Authors: ZHANG Chao[1], DUAN Weiyu[2]*, CHEN Kaihua[2], YANG Xiaoguang[3], LONG Yuntao[1],[2]

[1]Institutes of Science and Development, Chinese Academy of Sciences, Beijing 100190, China
[2]School of Public Policy and Management, University of Chinese Academy of Sciences, Beijing 100049, China
[3]Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing 100190, China

---

Abstract

This article systematically summarizes the reports and discussions from the S70th Xiangshan Science Conference on the theme of "Strategic Research on Information Technology Promoting National Governance Modernization," distilling three key areas of consensus. First, significant progress and achievements have been made in four typical domains: smart justice, internet governance, data governance, and emergency management. Second, the application of information technology to advance national governance modernization faces unprecedented opportunities and challenges. Third, a series of effective measures must be implemented through top-level design to further promote the modernization of national governance systems and capabilities through information technology.

Keywords: information technology, modernization of state governance, smart justice, internet governance, data governance, emergency management

---

1. Main Progress and Achievements in Typical Domains of Information Technology Promoting National Governance Modernization

1.1 Smart Justice Smart justice represents an essential requirement for achieving national governance modernization and comprehensive rule of law [1]. By integrating information technology throughout judicial activities and optimizing processes, both case handling quality and efficiency have significantly improved [2].

Information technology enhances judicial process control and improves case quality. China's procuratorial organs currently adhere to a "single network" informatization development model, enabling all four levels of procuratorial organs and 3,662 procuratorates nationwide to handle all prosecutorial cases within the same application system according to unified standards, processes, and data structures. This approach effectively embeds case handling rules into judicial workflows, ensuring strict compliance with laws and regulations and promoting procedural justice.

Information technology also facilitates smart court construction and improves

case handling efficiency. Judicial organs across regions have applied big data and artificial intelligence (AI) technologies to scenarios such as similar case retrieval, recommendation, knowledge graph construction, and deviation measurement, resulting in significant efficiency gains. Judges' administrative workloads have been reduced by over 30%, while trial efficiency has increased by more than 20% [3,4].

Furthermore, information technology enables integrated aerial-space-ground clue discovery models that enhance case resolution capabilities. For instance, during the 2020 ecological environment public interest litigation case in the Nansi Lake basin, the Supreme People' s Procuratorate utilized satellite remote sensing technology from the Aerospace Information Research Institute of the Chinese Academy of Sciences to identify 237 case clues, successfully supporting field investigation and evidence collection tasks [5].

1.2 Internet Governance As the internet and physical worlds continue to merge, strengthening cyberspace governance has become increasingly critical for national and social security [6,7]. Information technology has achieved notable successes in enhancing precise detection and traceability capabilities for network security governance, improving public opinion management, and driving growth in China' s cybersecurity industry.

First, information technology improves precise detection and traceability in network security governance. With advances in cross-modal multi-dimensional semantic analysis and multi-modal event knowledge graph construction, relevant technologies can now retrieve and trace security events and monitor specific incidents, thereby enhancing network security governance effectiveness. For example, Alibaba' s "AI Rumor Crusher," powered by neural networks and recognition technology, can determine news authenticity within one second, significantly improving the ability to stop rumor dissemination at its source [8].

Second, information technology enhances public opinion governance capabilities. AI and big data technologies enable deep natural language processing of textual information, while increasingly efficient tools and platforms for data visualization and analysis help users understand public opinion data more intuitively. This has led to more comprehensive, automated, scientific, precise, and personalized network public opinion governance [9,10].

Third, information technology development has driven rapid growth in China' s cybersecurity industry. According to Ministry of Industry and Information Technology data, China's cybersecurity industry scale exceeded 200 billion yuan in 2021, with an average annual growth rate of 15% during the 13th Five-Year Plan period [11].

1.3 Data Governance Data has become a core production factor and fundamental strategic resource for China' s economic development. Fully exploiting data value and accelerating data governance development have become essen-

tial choices and important tasks for advancing national governance system and capability modernization [12]. With the maturation of new data infrastructure and continuous improvement in data element market construction, information technology has played a crucial role in promoting compliant and efficient data circulation.

First, technologically advanced new data infrastructure is maturing, further enhancing data resource supply capabilities. China continues advancing network infrastructure construction represented by 5G and 6G mobile communication technologies, accelerating the deployment of all-optical networks and Internet Protocol version 6 (IPv6). By the end of September 2023, China had built 3.189 million 5G base stations, with IPv6 traffic accounting for 58.4% of mobile network traffic [13]. Information technology development has significantly increased the number of government data openness platforms and improved data supply capacity. For instance, between 2012 and 2022, 208 provincial and municipal local governments launched government data openness platforms [14].

Second, information technology drives continuous improvement in data element market construction. Information technology continuously empowers high-quality services and efficiency improvements in data trading platforms. For example, the IDex data trading system of the Beijing International Big Data Exchange utilizes privacy computing and blockchain technology to encrypt data content, effectively releasing and enabling the flow of data' s computational value [15]. This development has expanded the data trading market scale. As of August 2023, China had established 48 data trading institutions [16], whose transaction volume in 2022 accounted for 71.7% of cumulative trading volume [17].

1.4 Emergency Management The application and development of new-generation information technology have transformed emergency resource layout management thinking and decision-making models [18], finding applications in diverse emergency scenarios such as natural disaster emergency management. Meanwhile, China' s emergency management informatization and big data platform construction continue to improve, significantly enhancing emergency management effectiveness.

First, information technology empowers diverse emergency management scenario applications, with remarkable results from emergency management informatization projects. In natural disaster emergency management, early warning networks have achieved extensive coverage in key areas, with earthquake early warning systems capable of disseminating alerts through mobile applications. New-generation information technologies such as satellite communication have demonstrated crucial support roles in natural disaster emergency governance [19]. For example, during the "7 • 20" extreme rainstorm disaster in Zhengzhou, Henan in 2021, the Beidou satellite system provided over 870,000 data points to rescue personnel, greatly supporting disaster relief operations [20]. In actual rescue operations, information technology has enabled drones

to solve communication interruption problems in real scenarios [19]. In social mobilization, information technology facilitates precise delivery of disaster warning information. The National Early Warning Information Release Center has applied AI technology to approximately 3,000 accounts, successfully producing and distributing early warning short videos [21].

Second, emergency management informatization big data platform construction continues to improve, achieving cross-level, cross-regional, cross-industry, and cross-scenario collaborative sharing of multi-source heterogeneous massive data. China has essentially completed a national natural disaster comprehensive risk survey database system that integrates one national comprehensive database, ten national industry databases, and 32 provincial databases. This system has overcome key technical challenges in multi-modal data access, massive data spatial quality inspection, big data storage and management, spatial data sharing and services, and rapid massive data visualization. It can support rapid visualization of 20 TB of data volume and nearly one billion data records, and has facilitated the collection and sharing of survey, assessment, and coordination data across national, provincial, municipal, and county levels, as well as ten industry sectors.

2. Challenges in Information Technology Promoting National Governance Modernization

2.1 IT Supply Lags Far Behind Application Scenario Demands The scenarios for information technology to empower national governance urgently need expansion, while scenario-driven IT supply remains insufficient. Digital scenarios serve as the link connecting information technology with digital social development, but their application in empowering national governance modernization requires further deepening and expansion [17]. China possesses advantages in massive data and rich application scenarios [18], yet there is an urgent need to systematically identify demands across judicial, data, network society, and emergency management domains to drive corresponding IT development and further advance national governance modernization. Due to information asymmetry between the current research system and governance entities, combined with the significant externalities and non-economic nature of IT research for governance modernization, China' s IT supply across various national governance domains lags behind and cannot match the practical demands of national governance modernization [19,20]. There is an urgent need to increase policy support based on addressing real demands, strengthen demand-oriented and scenario-driven IT supply, and promote relevant IT research and development.

2.2 Persistent Data Security Issues The modernization of national governance systems and capabilities requires encouraging data openness and flow to break data silos and enable IT empowerment in governance processes, which inevitably brings data leakage, cross-border transmission threats, and other data security issues [20,21]. Facing this conflict between development and security,

there is an urgent need to build a data governance system that balances fairness and efficiency to collect, integrate, mine, share, and manage exponentially growing data flows, while ensuring data security and appropriately exploiting data element value. Meanwhile, as information technology empowers modernization in domains such as smart justice and emergency management that involve data from numerous departments, digital security issues acquire dynamic complexity and deep coupling characteristics [17], posing significant challenges for IT-enabled national governance modernization.

2.3 Data Element Value Remains Underexploited Data elements constitute the core strategic resource for IT to promote national governance modernization. While massive data injects new vitality into economic development, it also presents new challenges for data governance, particularly that data element value remains insufficiently exploited. As a production factor, data possesses commodity attributes, while its transaction and circulation endow it with financial attributes beyond its commodity value, creating value premiums [22]. Under market economy forces, data is no longer merely a "relic" of online behavior but a resource closely connected to personal and property rights. However, data value in pricing, usage, and circulation remains underexploited [23]. Specifically, imperfect market pricing mechanisms, slow marketization processes, and the incomplete applicability of traditional accounting valuation methods have resulted in inadequate data asset valuation and pricing systems, limiting data asset transaction system development. Incomplete data ownership and allocation rules have become obstacles to high-quality data market development. Data diversity and heterogeneity, along with inadequate cross-regional and cross-level data coordination mechanisms, constrain the comprehensive activation and full utilization of data element value.

2.4 Incomplete Legal Guarantee System Information technology serves both as a tool for and an object of rule of law. It can improve or provide new governance technologies, means, and models [17], while simultaneously generating new governance issues and reshaping governance order, necessitating improved institutions to resolve this order dilemma [19]. Facing rapidly evolving new technologies and complex, diverse national governance modernization application scenarios, the establishment of corresponding laws and institutional rules for IT-enabled national governance modernization exhibits obvious lag. There is an urgent need to enhance institutional timeliness, establish and improve a systematic institutional framework for IT-enabled national governance modernization, and elevate policies to legal status. Legislation should delineate boundaries between public and private data and clearly define privacy rights attributes, accelerate standard system construction, unify technical and business standards across various scenarios, and leverage law' s rigid constraints.

3. Policy Recommendations

3.1 Strengthen Digital Technology as the Foundation for IT-Enabled National Governance Modernization First, strengthen scenario-driven digital technology research and scenario adaptation. Collect and analyze multi-scenario data on digital technology promoting national governance modernization, comprehensively review current development status, identify digital technology demands in key domains, and strengthen critical core technology breakthroughs. Establish pilot mechanisms to improve digital technology scenario adaptation, optimize scenario empowerment effects based on pilot experience, and summarize replicable and promotable digital technology experiences for national governance modernization.

Second, improve software and hardware carrier development to solidify the foundational environment for digital technology promoting national governance modernization. Strengthen development and utilization of operating systems, software, chips, platforms, and other hardware/software carriers that advance digital technology development. Benchmark against platforms like GitHub and Hugging Face to improve open-source platforms conducive to model development, testing, and training, keeping various model training environments and application scenarios domestic to reduce costs for enterprise technology development.

Third, strengthen digital technology talent cultivation and development systems. Cultivate compound R&D talent possessing both digital technology capabilities and domain expertise to meet national governance modernization demands in smart justice, internet governance, data governance, emergency management, and other key areas.

3.2 Break Data Barriers and Promote Data Element Development, Utilization, and Openness as Core Elements of IT-Enabled National Governance Modernization First, establish a unified spatiotemporal framework as a baseline foundation. Coordinate technology integration, business integration, and data integration across key domains of IT-enabled national governance modernization. Use big data, AI, cloud computing, and other technical means to construct a unified spatiotemporal framework baseline that carries multi-modal data and multi-domain business models, completely mapping multi-source data with real-world spatiotemporal logical associations into the data carrying space and model operation computing space of this unified framework.

Second, promote multi-source data fusion and high-quality cross-level data sharing. Improve collaborative management and service levels for data elements across levels, regions, systems, departments, and businesses. Develop shared service interfaces for frequently demanded data and build a big data platform serving the entire society for IT-enabled national governance modernization. Simultaneously, establish and improve data updating, content verification, and

sharing exchange mechanisms during data sharing to strengthen data quality management.

Third, fully embed advanced information technology into data element governance theory research. Promote the full utilization of advanced information technology in future data element governance theoretical research, embedding machine learning and large model technologies into data element pricing models to establish more realistic theoretical models and develop multi-simulation technical methods applicable to different spatiotemporal scales.

Fourth, establish a multi-level data trading market that considers both commodity and financial attributes of data elements. From the dual-attribute perspective of data elements, promote the marketization process, fully consider data elements' financial attributes, and improve the construction of data trading systems.

3.3 Further Align China' s Large Model Development with National Governance Modernization Demands First, coordinate the layout of large model development in key directions. Conduct strategic planning for large model development and application in critical fields, industries, and sectors. Formulate large model development guidelines for vertical domains, industries, and sectors to accelerate implementation and effectiveness in specific application scenarios for national governance modernization.

Second, strengthen basic research on intelligent algorithm models. Promote theoretical and applied research on mathematical tools such as large-dimensional random matrix theory, infinite-dimensional Bayesian theory, and infinite-dimensional statistical learning theory to address shortcomings in algorithm models for large model development and enhance foundational capabilities for large model applications in national governance modernization.

Third, use government-industry-academia-research collaboration to break barriers in matching real scenario demands. Support collaborative large model R&D models between academia and industry, guiding academic breakthroughs in information barriers through joint research projects or innovation competitions. Actively promote integration of innovation chains and industrial chains, encourage key technology industries such as chip technology and cloud computing to form industrial innovation consortia, solve current mismatches between large models and real scenario demands, and foster a new government-industry-academia-research-application ecosystem for national governance.

3.4 Accelerate Establishment of Data Security Laws and Regulations to Support Basic Research and Core Technology Breakthroughs in Data Security First, promote data security standard formulation and legal establishment. Facing massive, heterogeneous, and diversified data collections, establish a classified and graded data security governance system, clarify rights and responsibilities for data supply, use, and management, and imple-

ment data security principal responsibilities. Promote differentiated control requirements and technical protection strategies for different data categories and levels. Strengthen data usage norms and standard establishment to ensure privacy and security throughout data collection, storage, circulation, and application. Legally issue local regulations and government rules on data security to more specifically address local needs.

Second, support basic research and core technology breakthroughs in data security. Establish data security special projects and utilize relevant national major science and technology programs to strengthen data security theoretical research and frontier technology exploration, supporting basic research and core technology breakthroughs in privacy computing, blockchain, data watermarking, and other data security areas.

4. Conclusion

While information technology brings new tools to national governance, it also introduces new concepts and models. IT-enabled national governance has become a crucial strategic focus in major power competition. We must deeply understand the opportunities brought by rapid IT development to national governance, grasp the main aspects of IT-enabled national governance, innovate governance concepts and methods, promote governance process reengineering and model optimization, and continuously improve national governance effectiveness.

Acknowledgments

We thank the over 40 experts and scholars who participated in the S70th Xiangshan Science Conference on "Strategic Research on Information Technology Promoting National Governance Modernization" for their profound insights, professional perspectives, and the consensus reached through this conference.

References

1. Fan M Z. The basic logic of smart justice—How digital technology and justice correspond. *Legal Forum*, 2023, 38(3): 27-37. (in Chinese)
2. Ji J H. Technological dynamics, value basis and value mechanism of judicial development in the era of wisdom. *Chinese Journal of Maritime Law*, 2022, 33(3): 65-76. (in Chinese)
3. Sun Y. Human-machine collaboration and its improvement in intelligent adjudication of class cases. *Academic Exchange*, 2023, (7): 73-87. (in Chinese)
4. Guo C, Lyu J Q. Exploring the new mode of handling public interest litigation+technology integration cases—Taking the handling of the Nansihu special case as an example. *People' s Procuratorial Semimonthly*, 2022, (12): 31-33. (in Chinese)

5. Xu H, Li J Q. Possibilities and boundary limits of generative artificial intelligence assisting judicial adjudication. *Journal of Taiyuan University of Technology (Social Science Edition)*, 2023, 41(6): 24-32. (in Chinese)
6. Ren B Q. Research topics on network governance. *Journal of Beijing University of Aeronautics and Astronautics (Social Science Edition)*, 2023, 36(4): 54. (in Chinese)
7. The Research Group of "Strategic Research on Information Technology Supporting the Modernization of Internet Governance" under the Subtheme of Major Consulting Project of Chinese Academy of Sciences, Guan X H, Fang C, et al. Challenges and responses of digital government enabling cyber governance. *Governance*, 2023, (16): 51-55. (in Chinese)
8. Yuan S. Research on disinformation under the threshold of overall national security concept. *Journal of International Security Studies*, 2022, 40(3): 32-56. (in Chinese)
9. Li B, Gao L X. The intelligent turn of public opinion governance in the context of big data: Current situation, risks and countermeasures. *Chinese Editors Journal*, 2023, (5): 4-10. (in Chinese)
10. Li M D, Kuang Y. Network public opinion management in the context of big data and artificial intelligence: Value, risk and path exploration. *Journal of Beijing University of Technology (Social Sciences Edition)*, 2021, 21(6): 1-10. (in Chinese)
11. The Research Group of "Strategic Research on Information Technology Supporting the Modernization of Data Governance" under the Sub-theme of Major Consulting Project of Chinese Academy of Sciences, Wu D S, Feng Y Y, et al. Key support for data governance modernization. *Governance*, 2023, (13): 34-38. (in Chinese)
12. Zhang L. Driving Chinese modernization with digitalization. *Red Flag Manuscript*, 2023, (21): 29-33. (in Chinese)
13. Tang J G. Practice of and thinking on the system of data ownership under the new data view. *Law Science Magazine*, 2022, 43(5): 49-63. (in Chinese)
14. Yuan Y, Fan B. Research on emergency resource layout from the perspective of big data driving. *Journal of Information Resources Management*, 2022, 12(3): 35-43. (in Chinese)
15. Zhang H B, Dai X Y, Qian D P, et al. Strategic perspective of leveraging new generation information technology to enable modernization of emergency management. *Bulletin of Chinese Academy of Sciences*, 2022, 37(12): 1727-1737. (in Chinese)
16. Wei X W. Water conservancy business card for deeper application of Beidou. *China Water Resources News*, 2022-05-26(08). (in Chinese)
17. Hao Y, Chen K H, Kang J, et al. Digital technology enables construction of national governance modernization. *Bulletin of Chinese Academy of Sciences*, 2022, 37(12): 1675-1685. (in Chinese)
18. Xi J P. Continuously strengthening and optimizing China' s digital economy. *Qiu Shi*, 2022, (2): 4-8. (in Chinese)
19. Chen K H, Zhang C. Accelerating the modernization of national gover-

nance empowered by digital technology. *Wisdom China*, 2023, (5): 32-34. (in Chinese)
20. Yang X G, Chen K H, Zheng X L, et al. Digital technology enables the modernization of national governance: Challenges and responses. *Governance*, 2023, (5): 52-55. (in Chinese)
21. Li J, Shen S H, Sun X L, et al. Identification and classification for risk paths in the context of cross-border important data flow. *Chinese Journal of Management Science*, 2021, 29(3): 90-99. (in Chinese)
22. Jin C L, Chen R D. Data valuations and its derived financial attributes: Formation logic and future challenges. *The Journal of Quantitative & Technical Economics*, 2022, 39(7): 69-89. (in Chinese)
23. Zhang Y J. China program and system development of data resource ownership: State ownership. *Political Science and Law*, 2020, (8): 15-26. (in Chinese)
24. Song F Q, Qiu Z J. The rule of law in the data element market governance: Subject, ownership and path. *Shanghai Economic Review*, 2022, (4): 13-22. (in Chinese)

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