



# A Preliminary Study on the Methods of Improving Emergency Management Capability by Frontier Information Technology

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**Abstract.** My country is one of the countries with the most serious natural disasters in the world. The characteristics of the disaster chain are increasingly prominent, and the rescue of all disasters is facing unprecedented challenges. Emergency management is an important part of the national governance system and governance capacity. It undertakes the important responsibility of preventing and resolving major security risks, responding to various disasters and accidents in a timely manner, and undertaking the important mission of protecting the safety of people's lives and property and maintaining social stability. This paper briefly analyzes the shortcomings of emergency management capabilities in our country, and proposes ways to rapidly improve emergency management capabilities in terms of technical factors, as well as technical means to comprehensively improve emergency management capabilities, providing a useful reference for the construction of emergency management in our country.

**Keywords:** emergency management · information technology · system · perception · communication technology · big data · blockchain · artificial intelligence

## 1 Introduction

The term “natural disasters and man-made disasters” is a visual summary of “public emergencies”. The term “natural disasters” refers to natural disasters such as earthquakes, hurricanes, floods, mudslides, forest and grassland fires, etc.; “man-made disasters” includes accidents and disasters, public health incidents, social security incidents, etc. “Natural and man-made disasters are characterized by the fact that individuals are almost powerless and require the mobilization of national forces, social resources and, in some cases, the joint efforts of the whole world. Throughout human history, we can say that it is a history of multiple disasters, each of which has left a painful mark. Responding to public emergencies is an important task that can hardly be avoided in any country or dynasty. Therefore, emergency management capability is considered by countries around the world as a key element reflecting the comprehensive governance capability of large and strong countries. China is not only one of the countries in the world with the highest

frequency of natural disasters, the widest geographical distribution, the most types of disasters and the most serious losses each year, but also one of the countries where traffic accident hazards and other safety risks are intertwined and overlapping, prone to occur and multiply. In the 14th Five-Year Plan and the 2035 Vision, the country issued a mobilization order to optimize the national emergency management capacity system construction [1–3]. It has become a major practical issue for modern city construction emergency management.

## 2 China's Emergency Management Effectiveness Is Obvious, but There Are Still Capacity Shortcomings

Since the founding of New China, the Party and State leaders have attached great importance to it. After the gradual accumulation from 1949 to 2003, the construction of the second generation emergency management system with “one case and three systems” from 2003 to 2012, and the comprehensive construction of the emergency management system led by the overall national security concept after 2012, especially the establishment of the Ministry of Emergency Management in 2018, the initial formation of The emergency management system with Chinese characteristics, which is unified command, specialized and permanent, responsive, and linked from top to bottom, has been effective in China's emergency management, but there are still shortcomings. **The construction of emergency management system has been effective.** At the early stage of the founding of the country, China's emergency management work was mainly divided into departments to respond to various natural disasters. Since the reform and opening up, with the rapid development of the economy, production safety accidents gradually entered a high period, and the work of production safety was highly valued. The Ministry of Emergency Management was formally established in 2018 to steadily promote the development of emergency management at the national level. The Ministry of Emergency Management was formally established in 2018, and at the national level, the Ministry of Emergency Management is steadily promoting the conversion of public security fire forces and armed police forestry units, forming national comprehensive fire rescue teams, and forming various professional rescue teams at the provincial (municipal) level to speed up the construction of an emergency rescue force system with Chinese characteristics. At the same time, focusing on “all-hazard, big emergency” rescue tasks, emphasizing all-hazard management, the whole process management, from process re-engineering and preparation, prevention, mitigation, response and recovery of the five links, comprehensive optimization of emergency management operation mechanism. Through a series of capacity measures, China's ability to prevent and resolve major security risks has improved significantly, and the cause of emergency management in China has entered a new stage of historical development. **There are still shortcomings in disaster prevention and mitigation capabilities.** With the continuous improvement of the emergency management system, China's emergency management capacity has made great progress, but in response to extreme weather conditions in the face of epidemics, floods, typhoons and other disasters, the overall level of science and technology information technology is low, early perception of risks and hazards, early identification, early warning, early release capacity is lacking, there are still some shortcomings and short

boards. 2019 Wuhan's new crown epidemic outbreak exposed the center problems of the emergency management system in cities; the extraordinary rainstorm in Zhengzhou in 2020 once again sounded the alarm of the vulnerability and specificity of urban rainfall and flood management. In terms of the mechanism of emergency management capacity formation, the main technical factors are: first, the information base is weak; second, the phenomenon of information silos is serious; third, the degree of intelligence of information systems is low; fourth, the overall level of science and technology information is low; the ability of early perception, early identification, early warning and early release of risks and hazards is lacking; and the security of emergency communications and command platforms is not yet perfect.

### **3 The Initial Formation of China's Emergency Management System, Enhance the Ability to Focus on Technical Factors**

**China's emergency management system has taken initial shape.** After the establishment of the State Ministry of Emergency Management in 2018, its responsibilities are positioned as follows: organizing the preparation of the overall national emergency plan and planning, guiding the work of various regions and departments in responding to emergencies, promoting the construction of emergency plan systems and plan exercises; establishing a disaster reporting system and unifying the release of disaster situations, coordinating the construction of emergency forces and material reserves and unifying their dispatch in disaster relief, organizing disaster The Ministry of Emergency Management is responsible for the construction of disaster relief system, guiding the emergency rescue of production safety and natural disasters, undertaking the work of the National Command for Special Disasters, guiding the prevention and control of fires, floods and droughts, and geological disasters, etc. It is also responsible for the comprehensive supervision and management of production safety and the supervision and management of production safety in industrial, mining and trade industries. At the same time, the Ministry of National Emergency Management and related departments and local respective division of responsibilities, the establishment of coordination and cooperation mechanism. This has resulted in the construction of a unified command, special and permanent, responsive, up and down linkage of emergency management system and emergency response capabilities. It is mainly reflected in the following five aspects: First, the national emergency management system has been initially built. Second, the emergency plan has been gradually improved. Third, the basic establishment of the legal system of emergency management. Fourth, the linkage disposal mechanism, and fifth, the consistency of responsibility and authority has been established. **Improve the ability to focus on the technical factors.** The biggest feature of emergency management is the suddenness of the event, uncertainty, the danger of a large and large range of hazards, and the complexity of the relevant factors, the corresponding key to enhance the ability of emergency management is the issue of means of support. To improve the control capability, it involves four stages of public emergencies: before, during, and after. The prevention stage includes risk perception, risk assessment and control, safety hazard investigation, and other emergency management links; the monitoring and warning stage involves collecting information, scientific research and judgment, early warning and

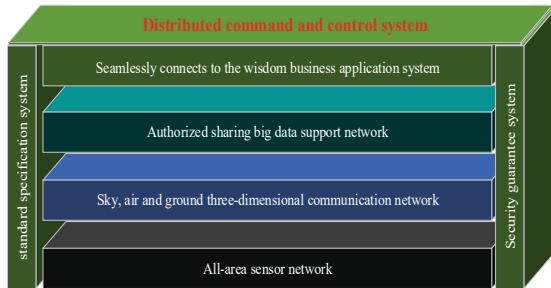
decision-making, and other emergency management links; the disposal stage involves emergency response, including rapid response, rapid reporting, rapid disposal, and rapid recovery. The post-event stage involves information statistics, post-disaster evaluation, emergency learning and other emergency management links. To achieve the goal of “two hundred years” and the Chinese dream of great rejuvenation of the Chinese nation, it is necessary to fully and reasonably apply cutting-edge information technology, to realize the sensing network in prediction and monitoring, to realize the toughness, high speed, intelligence and integration of sky, air and ground in three-dimensional communication, and to realize intelligent early warning, coordination, command and control. To achieve intelligent early warning, flat distributed command, rapid disposal, accurate supervision, in order to meet the prevention and resolution of major risks, effective response to the many challenges facing major emergencies.

#### **4 Build a Comprehensive Emergency Management Capacity to Enhance the Technical Means to Support the System**

At present, the fourth industrial revolution and digital transformation have a huge impact on China's economy and society, and also provide significant opportunities for modernization of emergency management work and emergency management tools. Focusing on the “five main directions” of emergency management informatization, such as integrated command, emergency communication, short-range early warning, domain-wide perception and data intelligence, we will vigorously develop smart security and smart emergency, use modern information technologies such as big data, block chain, Internet of Things and artificial intelligence to effectively integrate various departments and realize data sharing, and break through inter-departmental We can use modern information technology such as big data, blockchain, Internet of Things and artificial intelligence to effectively integrate various departments and realize data sharing, break through the “information silo” of emergency management between departments, improve the efficiency and flexibility of government emergency response and provide all-round support for emergency management. The all-round technical means support system is shown in Fig. 1. The system starts from the perception level of data acquisition to realize the whole area coverage; considers the communication as the neural network to realize the seamless connection of sky, air and ground; takes the data as the bloodline to share the authorization on demand; takes the application as the grip to realize the service support on demand.

**All-area sensor network:** Through the IOT network, satellite network, aviation or tethered network, video network, and universal perception, collect and converge data information from various places, departments, systems, and regions to build an intelligent perception network with territorial coverage to realize continuous real-time monitoring of natural disaster-prone, prone, and frequent areas and high-risk industries and fields in a comprehensive three-dimensional manner without blind spots, and to provide real and reliable data sources for multi-dimensional, comprehensive, predictive, and alarm risks.

**Sky, air and ground three-dimensional communication network:** communication system is the pillar of information exchange. Using software-defined network (SDN),



**Fig. 1.** Schematic diagram of the all-round technical means support system

5G, LoRa, IPv6, digital trunking (PDT), wireless digital subcarrier and other technologies, integrated drones, man-portable equipment, private networks, the Internet, wireless communication networks, Beidou satellites, communication satellites and other means to build a sky, air and ground three-dimensional all-area coverage, the entire penetration, toughness and resistance to destruction of reliable emergency communications network.

**Authorized sharing big data support network:** Establish distributed emergency management data centers and emergency management business service clouds across the country to provide elastic computing, edge computing, powerful performance, and cloud resource service capability with on-demand access; build a massive data resource support system with all-round data acquisition, all-network data convergence, and all-dimensional data fusion to meet the needs of emergency management in terms of classification organization, precise service, authorized sharing, and safe It can meet the requirements of classification organization, precise service, authorized sharing and secure and controlled data resource management for emergency management.

**Seamlessly connects to the wisdom business application system:** based on the authorization sharing big data support network, it constructs five business domain soft application sub-systems for emergency management: monitoring and early warning, command and rescue, decision support, government management, supervision and management, and provides high-quality application service capability to provide tools to carry out the whole process of business under normal and extraordinary conditions in advance, in the event, in the middle of the event, and afterwards; by accessing single sign-on as it happens. Provide integrated application service entrance for users at all levels.

**Security guarantee system:** Establish a comprehensive three-dimensional security protection system and a scientific and intelligent integrated management system of development, operation and maintenance. It realizes all-dimensional and multi-level security prevention and control of emergency management information system, deploys intelligent development, operation and maintenance integrated management system, establishes perfect operation and maintenance management system and operation and maintenance response mechanism, and ensures safe, stable, efficient and reliable operation of information network and application system of the Ministry of Emergency Management.

**Standard specification system:** Establish and improve the standard specification of emergency management information system including overall, infrastructure, data

resources, application support, business application, operation guarantee, information management, etc., to provide a basis for the whole process of emergency management information construction.

## 5 Conclusion

With global warming [4–6], the risk of natural disasters in China has further intensified. At the same time, China's weak production safety base is difficult to fundamentally change the status quo in the short term, dangerous chemicals, mining, transportation, construction and other traditional high-risk industries and fire safety risks and hazards are still prominent, all kinds of safety risks and hazards intertwined and overlapping, production safety accidents are still prone to occur. Therefore, with the introduction of the “14th Five-Year Plan” for the national emergency response system, we will speed up the modernization of emergency management system and capability, make full use of modern high technology such as Internet of Things, industrial Internet, remote sensing, etc., and focus on four stages: before, after, during and after, as well as the whole process management, normal operation, extraordinary operation and comprehensive protection. In the four aspects of business, we apply cutting-edge information technology in an integrated, comprehensive and scientific manner to quickly and effectively improve emergency management capabilities. Only under the framework of “comprehensive emergency management”, we can realize the change from emphasizing all-disaster management to whole-process management, from achieving “comprehensive coverage” to pursuing “deep and effective”, from emphasizing comprehensive to emphasizing professional. Only by changing from emphasizing all-hazard management to emphasizing the whole process management, from achieving “comprehensive coverage” to pursuing “in-depth and effective”, and from emphasizing comprehensive to emphasizing specialization, can we meet people's growing security needs.

## References

1. People's Network. Promoting the modernization of the national emergency management system and capacity, <http://theory.people.com.cn/n1/2020/0224/c40531-31601677.html>
2. Central People's Government of the People's Republic of China. General Office of the State Council on the Issuance of National Emergencies, [http://www.gov.cn/zhengce/content/2017-07/19/content\\_5211752.htm](http://www.gov.cn/zhengce/content/2017-07/19/content_5211752.htm)
3. Ministry of Emergency Management of the People's Republic of China. Adhering to the Chinese Way, Advancing the Modernization of Emergency Management System and Capability, [https://www.mem.gov.cn/xw/ztzl/2021/xxgclzqh/zjjd/202112/t20211218\\_405215.shtml](https://www.mem.gov.cn/xw/ztzl/2021/xxgclzqh/zjjd/202112/t20211218_405215.shtml)
4. Cline W R. The economics of global warming[J]. Institute for International Economics, Washington, DC, 1992: 399.
5. Masson-Delmotte V, Zhai P, Pörtner H O, et al. Global warming of 1.5 C[J]. An IPCC Special Report on the impacts of global warming of, 2018, 1(5).
6. Song F, Zhang G J, Ramanathan V, et al. Trends in surface equivalent potential temperature: A more comprehensive metric for global warming and weather extremes[J]. Proceedings of the National Academy of Sciences, 2022, 119(6): e2117832119.

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