WEP Warwick Evans Publishing

Academic Journal of Management Science and Engineering

ISSN: 3080-9827 (Print), ISSN: 3080-9835 (Online)
Volume 1, Number 5, Year 2026
DOI: https://doi.org/10.62051/ajmse.v1n5.07



Digitalized Disaster Prevention, Mitigation and Relief Empowering Resilient City Development: A Case Study of Chongqing Heatwave Emergency Management

Yue Li

School of National Governance, Southwest University, Chongqing, China

ABSTRACT

Disaster prevention, mitigation and relief remain long-term challenges for urban governance. Accelerating the development of digital capabilities in disaster risk management is essential for building resilient cities. Taking Chongqing's heatwave emergency management as a case study, this paper examines how digitalized disaster prevention, mitigation and relief empower resilient city development. The study finds that digital empowerment can effectively enhance urban emergency management capacity through three dimensions: strengthening digital organizational systems, constructing integrated digital platforms, and promoting deep integration of digital technologies. The practice of Chongqing demonstrates that digital transformation enables precise early warning, rapid emergency response, and coordinated disaster management under extreme weather conditions such as heatwaves. This research provides a practical pathway for improving urban resilience through digital governance and offers theoretical implications for the modernization of urban emergency management systems.

KEYWORDS

Resilient City; Disaster Prevention, Mitigation and Relief; Digital Governance Capability; Emergency Management; Digital Technology.

1. THE LOGICAL MEANING OF DIGITALIZED DISASTER PREVENTION, MITIGATION AND RELIEF EMPOWERING RESILIENT CITY DEVELOPMENT

1.1. Theoretical Connotation of Digitalized Disaster Prevention, Mitigation and Relief Empowering Resilient Cities

Digitalized disaster prevention, mitigation and relief refers to a key infrastructure project for resilient city development that utilizes digital technologies to enhance urban capacity for disaster response, aims to safeguard people's lives and property, and promotes sustainable urban development.

First, the digital organizational system constitutes the theoretical foundation of digitalized disaster prevention, mitigation and relief(Zhu et al., 2021)[1].Through organizational structure design, urban emergency management departments clarify governance responsibilities and allocate tasks among different departments(Huang & Fan, 2024) [2].Relying on digital government development, emergency management functions and tasks are transformed into independent and composable digital modules. Through the coordination and interaction among these modules, the flexibility, efficiency, and responsiveness of emergency management organizations are significantly improved, establishing the organizational foundation for digital empowerment.

Content from this work may be used under the terms of CC BY-NC 4.0 licence (https://creativecommons.org/licenses/by-nc/4.0/).
Published by Warwick Evans Publishing.

Second, the digital platform serves as the essential support for digitalized disaster prevention, mitigation and relief. Based on the governance process of "prevention–mitigation–response–recovery", digital platforms analyze urban governance issues throughout the entire disaster management process. By integrating multi-dimensional urban information, including spatial, environmental, and operational data, digital platforms construct a digitalized emergency governance environment and promote platform-based government governance.

Finally, the **integration of digital technologies** represents the core driving force of digitalized disaster prevention, mitigation and relief. The integration of various digital technologies enables emergency management departments to comprehensively acquire dynamic urban risk information and make timely decisions through data analysis, unified command, resource coordination, and rapid emergency response. Digital technologies provide intelligent support for modern urban emergency governance.

The digital organizational system provides the institutional foundation for digital disaster governance; digital platforms connect different stages of disaster prevention, mitigation and relief; and the integration of digital technologies enhances the operational capability and decision-making efficiency of these platforms. Through their interaction, these three dimensions jointly promote the modernization of digital disaster management capacity, strengthen urban safety resilience, and facilitate resilient city development.

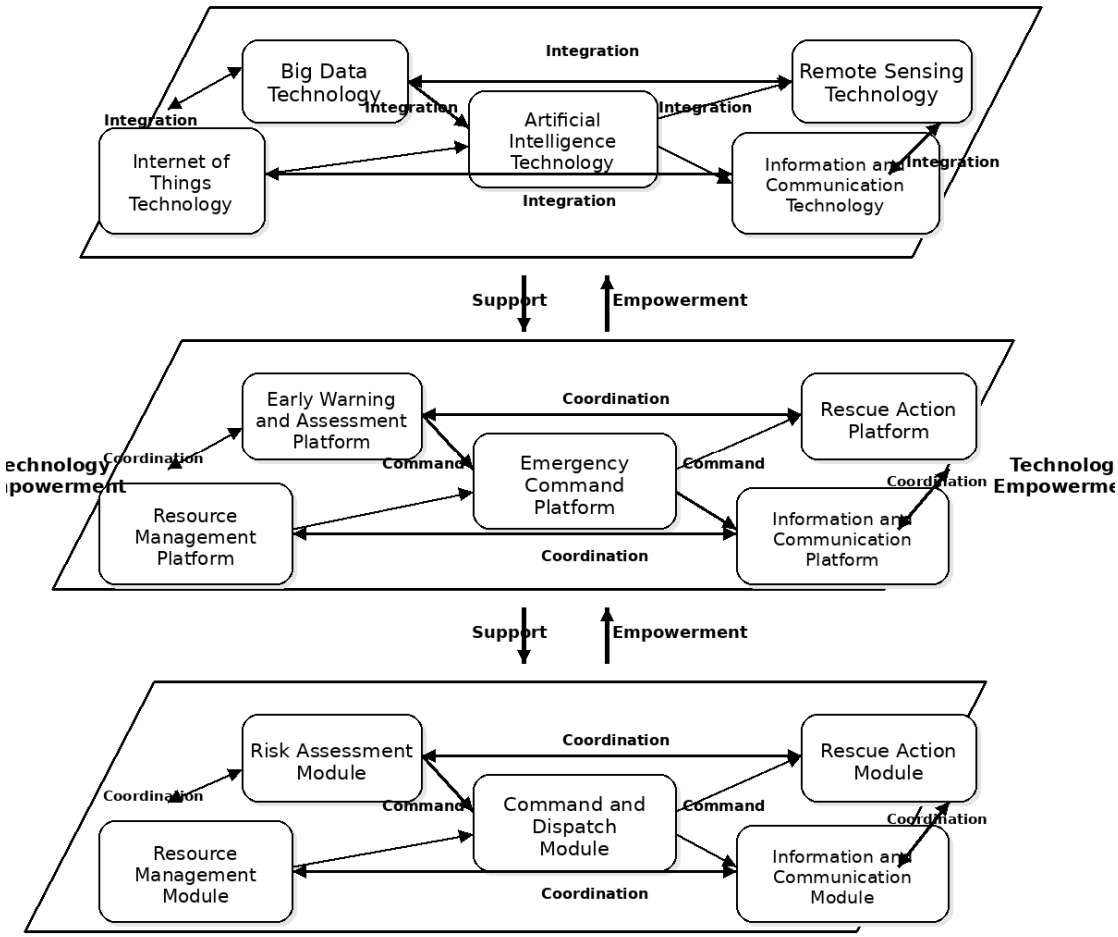


Fig 1. Digitalized disaster prevention, mitigation and relief empowerment pathway

1.2. Mechanism of Digitalized Disaster Prevention, Mitigation and Relief Empowering Resilient Cities

(1) Foundation Layer: Development of Digital Organizational Systems

The foundation of digitalized disaster prevention, mitigation and relief lies in establishing digital organizational systems. Government serves as the primary actor in social governance and plays a leading role in designing governance rules and coordinating public resources. Therefore, effective digital disaster governance requires a scientific and rational organizational structure.

Digital organizational systems rely on digital government development. Digital government represents an important direction of governmental digital transformation, characterized by the interaction between platform-based architectures, digital interfaces, and modular organizations（Hu, 2023) [3]. Modular organizations rely on standardized interfaces to realize cross-functional coordination among different governance components (Wu & Ren, 2014) [4].

Under the framework of digital government, emergency management departments should promote modular transformation by reorganizing governance functions into interconnected modules. A modular emergency governance structure can include several functional components:

- **Command and coordination module:** responsible for overall emergency decision-making and unified coordination;
- **Risk assessment module:** providing disaster analysis and evaluation to support decision-making;
- **Resource management module:** allocating emergency resources according to command requirements;
- **Emergency response module:** implementing rescue operations and field actions;
- **Information communication module:** ensuring real-time information exchange and technical support.

Through the platform-based architecture of digital government, these modules interact with each other and form a relatively stable organizational structure, improving the effectiveness and efficiency of disaster prevention, mitigation and relief operations.

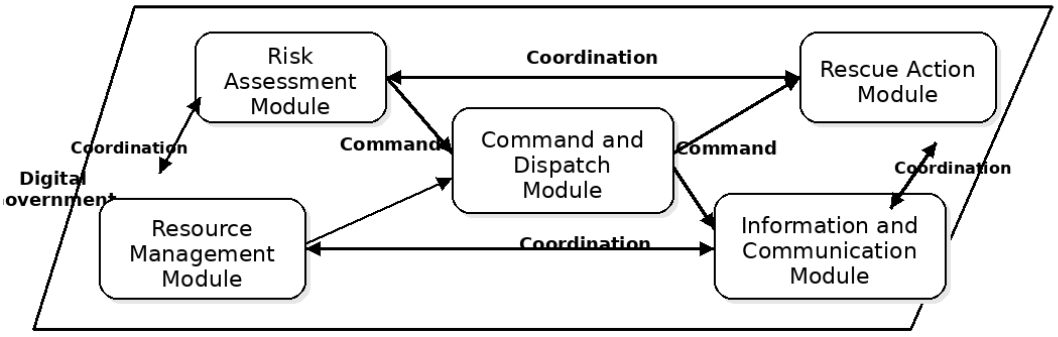


Fig 2. Digital organization system foundation layer

(2) Structural Layer: Construction and Interconnection of Digital Platforms

The structural support for digitalized disaster prevention, mitigation and relief lies in the construction and interconnection of digital platforms. Digital platforms serve as important tools for smart urban governance, core carriers of governmental governance functions, and key channels for public participation in urban management(Wen & Lin, 2021) [5].

Strengthening digital empowerment requires the scientific planning and construction of big data platforms and network systems, while improving cross-departmental coordination and joint command capabilities. The **digital emergency command platform** functions as the core component of the digital emergency management system, running through the entire emergency management process.

It is responsible for unified command, rapid decision-making, and coordination among different emergency response platforms.

The **digital risk assessment platform** collects and integrates multi-source data to conduct risk identification, analysis, evaluation, and early warning. The **digital rescue operation platform** organizes and coordinates emergency rescue forces based on platform instructions and risk information, enabling real-time monitoring, dynamic analysis, and scientific evaluation of rescue operations. The **digital resource management platform** manages and allocates emergency resources according to command requirements. Meanwhile, the **digital information communication platform** establishes and maintains emergency communication networks to ensure real-time data transmission and information sharing among different functional modules.

Through mutual coordination and multi-level linkage, these digital platforms form an integrated governance system for disaster prevention, mitigation and relief. This system enables dynamic disaster management, rapid risk response, and efficient emergency coordination.

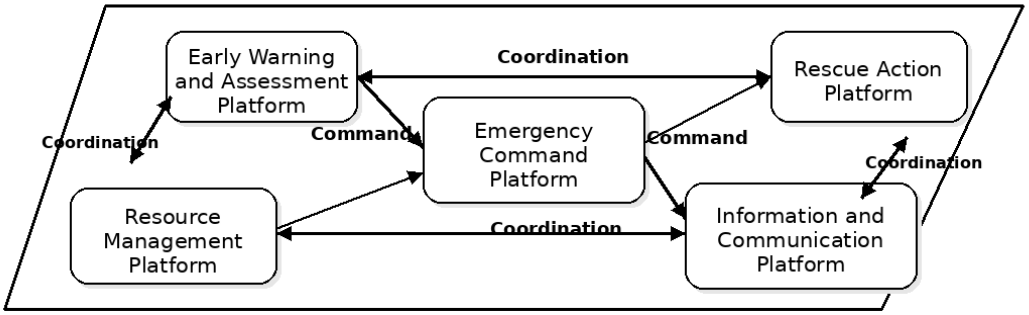


Fig 3. Digital platform structural layer

(3) Brain Layer: Integration of Digital Technologies

The core of digitalized disaster prevention, mitigation and relief lies in the integration of digital technologies. Digital technologies are not only important tools for promoting organizational transformation and improving governance effectiveness, but also essential drivers for modernizing national governance systems and governance capacity.

Enhancing disaster prevention and emergency response capabilities requires the deep integration of multiple digital technologies. **Internet of Things (IoT)** technology enables real-time monitoring of disaster risks through urban sensor networks and provides continuous data streams for emergency management platforms. The combination of **big data analytics and artificial intelligence (AI)** allows governments to identify disaster trends, analyze potential risks, and provide scientific support for emergency decisions.

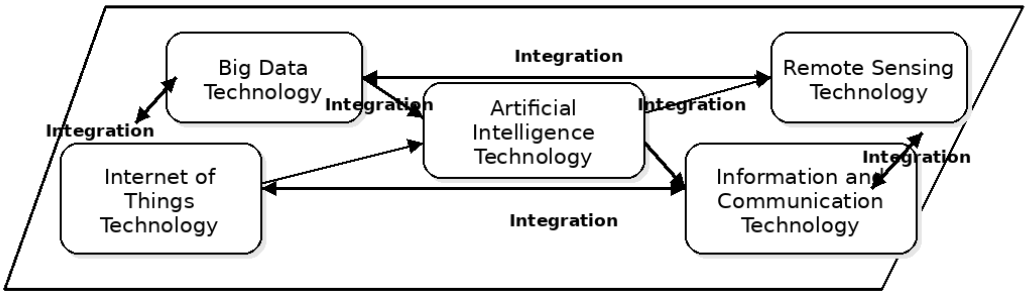


Fig 4. Digital technology integration brain layer

Remote sensing technology and Geographic Information Systems (GIS) provide accurate spatial information for disaster management, allowing decision-makers to visualize disaster distribution and affected areas. **Digital twin technology** creates virtual disaster scenarios, providing simulation environments for emergency planning and strategy optimization. Meanwhile, **mobile communication technologies** deliver warning information directly to citizens and collect public feedback, improving interaction and real-time responsiveness.

The integration of these technologies creates a comprehensive digital disaster governance ecosystem, significantly improving cities' capabilities in disaster perception, emergency response, and risk management.

2. PRACTICAL EXPERIENCE OF CHONGQING HEATWAVE EMERGENCY MANAGEMENT

In August 2022, Chongqing experienced one of the longest and most extensive heatwave events since meteorological records began. The extreme heat tested not only the city's environmental resilience but also the practical effectiveness of its disaster prevention, mitigation and relief system.

Facing severe heatwave challenges, Chongqing actively promoted digital empowerment in emergency management and developed a comprehensive governance approach based on digital organizational systems, integrated platforms, and technological integration.

2.1. Strengthening Digital Foundations: Building a Smart Urban Safety Infrastructure

Chongqing accelerated digital government development and promoted the modular transformation of emergency organizations, gradually establishing a "smart foundation" for urban safety(He & Yin, 2024) [6].

First, Chongqing developed an urban emergency management system based on the "1361" digital Chongqing platform architecture. Through institutional restructuring, the city optimized emergency governance responsibilities, integrated functions from multiple departments, and established a comprehensive emergency management system covering both municipal and grassroots levels.

Second, Chongqing promoted the modular transformation of emergency organizations through digital technologies. Based on the digital emergency command center, the city established:

- a digital decision-making module;
- emergency execution modules;
- professional technical support modules.

The digital emergency command center serves as the core of emergency governance, responsible for unified coordination and rapid deployment. Emergency response departments execute specific tasks through resource integration and coordinated action, while professional departments provide technical assistance and information support.

Finally, Chongqing promoted the transformation from modular organizations toward scenario-based governance. Through integrated intelligent public data platforms, urban governance elements were reorganized, and different governance scenarios were matched with corresponding organizational modules. This governance model, characterized by platform integration, modular coordination, and scenario adaptation, enabled Chongqing to respond effectively to prolonged heatwave conditions and related risks such as forest fires and droughts.

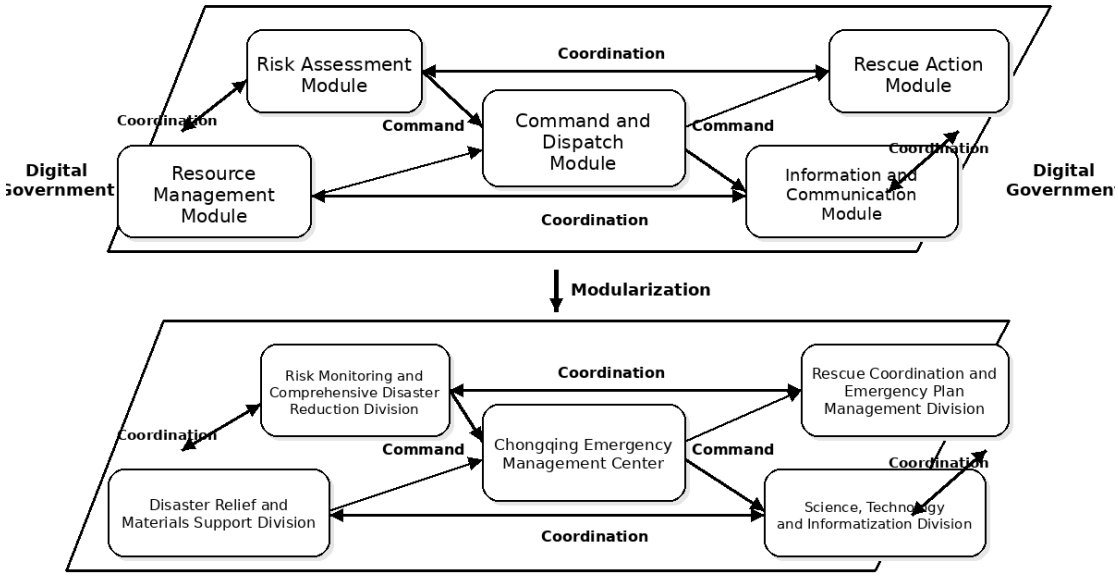


Fig 5. Chongqing Urban safety smart foundation

2.2. Building a Digital Collaborative Platform: Creating an Urban Resilience Coordination Network

Chongqing has promoted platform-based governance for disaster prevention, mitigation and relief by constructing digital platforms that establish a collaborative emergency response network for heatwave management.

First, the **urban heatwave emergency disaster prevention digital platform** strengthens the foundation of disaster prevention. Relying on the integrated meteorological digital platform, Chongqing combines meteorological, geological, hydrological and other multi-source data to conduct comprehensive analysis. Through temperature risk assessment and classification, the city applies Geographic Information System (GIS) technology to create a "one map" visualization system for heatwave risks, enabling real-time monitoring of temperature changes and accurate prediction of potential heatwave hazards.

Second, the **urban heatwave emergency mitigation platform** strengthens process-based risk management. By utilizing the digital emergency command platform, Chongqing enhances joint consultation and risk assessment among professional departments. Through unified command and coordinated decision-making, the city conducts targeted regulation of high-risk areas, achieving both precise intervention and comprehensive coverage in heatwave emergency management.

Third, the **intelligent emergency rescue platform** improves operational response capacity. Through the integration of city, district/county, township and community-level rescue systems, Chongqing has established a multi-level emergency response network. This platform enables rapid mobilization of rescue forces, coordinated emergency actions, and efficient implementation of disaster response measures.

Fourth, the **digital heatwave resource management platform** strengthens disaster relief capacity. Through the integrated public data platform, Chongqing digitizes emergency supplies and monitors the entire process of resource allocation. The platform enables dynamic management of emergency materials and heatwave-related financial resources, ensuring timely resource deployment, accurate allocation, and clear responsibility during emergency operations.

Finally, the **integrated video communication system** supports secure digital emergency information transmission. By providing efficient video communication services, the system enables real-time data

exchange between fixed monitoring points and mobile emergency units, effectively supporting public safety management and emergency response operations.

Through the construction of a digital collaborative platform, Chongqing has transformed fragmented emergency resources into an integrated governance network, improving the coordination efficiency and adaptive capacity of urban disaster management.

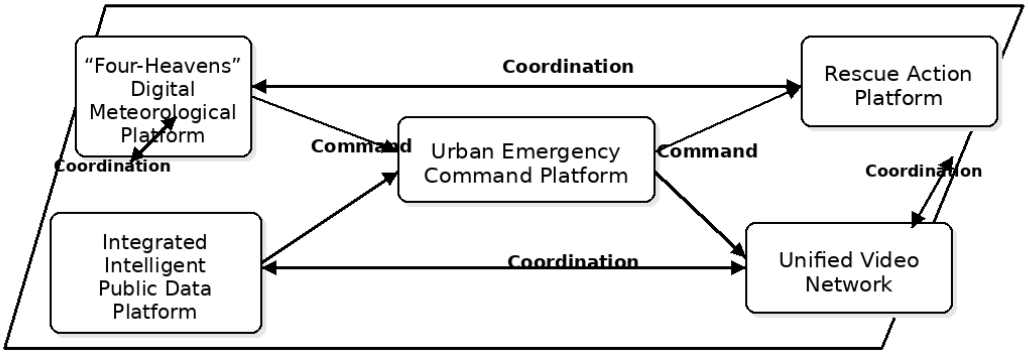


Fig 6. Chongqing Urban resilience Collaborative platform

2.3. Activating Digital Intelligence: Strengthening the Smart Emergency Management Hub

Chongqing has accelerated the innovation and integrated application of digital technologies, activating an intelligent emergency management hub for heatwave response.

First, Chongqing has strengthened the digital foundation of heatwave emergency protection. The emergency management department utilizes sensor networks to monitor temperature changes in real time, identifies early warning signals of extreme heat events, and applies big data analysis to predict heatwave development trends. Combined with GIS technology, the system evaluates potential impacts on urban ecosystems and public health, identifies key protection areas, and provides early warnings and emergency response plans in advance.

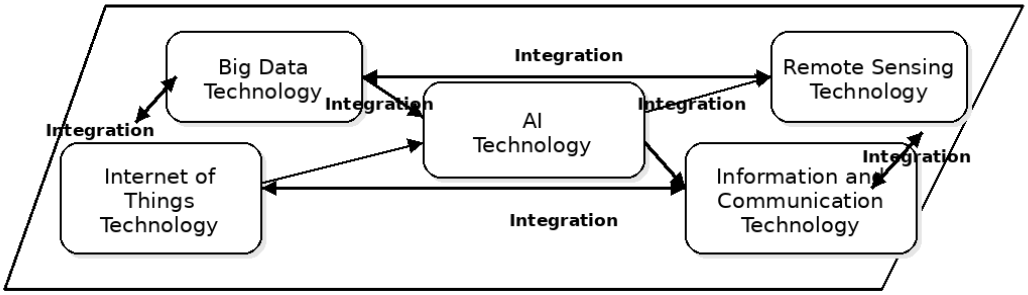


Fig 7. Chongqing intelligent emergency management Hub

Second, Chongqing has enhanced digital coordination and promoted precision governance in heatwave emergency management. When extreme heat events occur, the emergency management system immediately activates emergency plans. Through the digital command center, energy resources, water resources and rescue forces are scientifically coordinated and dispatched to achieve rapid response and effective control. Meanwhile, digital communication networks transmit safety information and emergency guidance to residents, reducing potential casualties and property losses.

Third, Chongqing has promoted the application of emerging digital technologies to enhance the sustainability of emergency governance. Artificial intelligence technologies are applied for disaster

situation analysis, supporting forest fire prevention and drought management in high-risk areas. Digital technologies are also used to optimize urban energy systems and water resource management, reducing pressure on electricity networks and water supply systems during extreme heat events.

Through the integration of sensing, analysis, decision-making and response capabilities, Chongqing has developed an intelligent emergency management hub that improves urban resilience against extreme weather risks.

3. PRACTICAL PATHS FOR DIGITALIZED DISASTER PREVENTION, MITIGATION AND RELIEF EMPOWERING RESILIENT CITIES

3.1. Strengthening Digital Organizational Systems as the Foundation of Digital Emergency Governance

Building resilient cities requires people-centered governance, safety-oriented development, and technology-enabled transformation. Enhancing urban security capacity requires strengthening the organizational foundation of emergency governance.

First, governments should strengthen digital government development under effective organizational leadership. By constructing a platform-based digital government architecture, emergency management systems can achieve digital transformation and establish new operational mechanisms and organizational frameworks.

Second, governmental departments should promote modular transformation. A “1+N” modular organizational model can be established, with the digital emergency command center serving as the core module and multiple specialized modules supporting different emergency governance tasks. This structure improves organizational coordination and enhances practical emergency response capabilities.

Third, modular organizations should be deeply integrated with governance scenarios. By adopting a problem-oriented approach, governments should redesign organizational structures according to complex urban governance challenges and extend governance capabilities to different urban spaces and service points. This approach strengthens organizational foundations and improves the precision and efficiency of urban risk management.

3.2. Enhancing Digital Emergency Management Capacity through Integrated Digital Platforms

Urban governance involves multiple dimensions of social and public affairs. Facing increasingly complex urban risks, it is necessary to strengthen digital empowerment and enhance emergency management capabilities through integrated digital platforms.

First, governments should establish **precision early-warning platforms** and develop a comprehensive risk monitoring system. Through integrated and standardized monitoring platforms, governments can accurately identify risks, analyze real-time data, assess disaster levels across different regions, and visualize risk information through digital maps, thereby improving decision-making efficiency.

Second, governments should establish **risk assessment and management platforms** to integrate disaster-related information. By collecting and analyzing multi-source disaster data, these platforms can evaluate disaster severity, affected areas, and emergency demands, forming a comprehensive disaster information database to support scientific decision-making.

Third, governments should construct **intelligent collaborative command platforms** to achieve precise emergency response. A centralized digital command platform should integrate

communication systems, monitoring technologies, and decision-support functions. Through visualized management and intelligent analysis, decision-makers can conduct effective field command, optimize resource allocation, and coordinate emergency response operations.

Fourth, governments should establish **emergency resource management platforms** to create a comprehensive digital resource database. Through platform-based resource management, emergency materials and response resources can be monitored dynamically and allocated rapidly according to disaster conditions, improving resource utilization efficiency and supporting effective rescue operations.

Integrated digital platforms connect different stages of disaster prevention, mitigation and relief. By promoting data sharing, cross-departmental coordination, and intelligent decision-making, these platforms strengthen the overall resilience of urban emergency governance systems.

3.3. Enhancing Intelligent Emergency Governance through Deep Integration of Digital Technologies

Accurate and effective disaster prevention, mitigation and relief constitute essential components of resilient city development. To modernize urban governance systems and improve emergency management capabilities, governments must promote the deep integration of digital technologies and enhance intelligent emergency governance.

First, governments should strengthen digital technology applications and establish an integrated disaster data ecosystem. Through advanced data collection and integration technologies, information from meteorology, geology, hydrology, transportation, and other fields can be aggregated into a unified disaster information pool. Big data analytics and artificial intelligence technologies can then be applied to identify patterns, predict risks, and improve the efficiency of disaster information utilization.

Second, governments should promote technological innovation and develop integrated digital solutions. Emerging technologies, particularly artificial intelligence, can be applied to simulate disaster scenarios and improve the accuracy of risk prediction. Machine learning and deep learning algorithms can enhance the intelligence level of monitoring and early-warning systems, while supporting regulatory decision-making and emergency response.

Third, governments should strengthen digital technology infrastructure and ensure reliable emergency communication. By integrating satellite communication, mobile communication, wireless networks, and other communication technologies, cities can establish dedicated emergency communication systems to ensure stable and reliable information transmission during disasters.

Through the integration of digital technologies, cities can transform traditional reactive emergency management into proactive risk governance. Digital intelligence not only improves disaster perception and response capabilities but also provides continuous technological support for resilient city development.

4. CONCLUSION

Digital transformation provides a new pathway for strengthening urban resilience and improving disaster prevention, mitigation and relief capabilities. Taking Chongqing’s heatwave emergency management as an example, this study demonstrates that digital empowerment enhances resilient city development through three interconnected dimensions: digital organizational systems, integrated digital platforms, and deep digital technology integration.

The Chongqing case shows that digital organizational transformation provides the institutional foundation for emergency governance, integrated digital platforms enhance coordination and

response efficiency, and advanced digital technologies improve risk perception, prediction, and decision-making capabilities. Through the combination of organizational restructuring, platform integration, and technological innovation, digital governance contributes to more adaptive and intelligent urban emergency management.

However, digital transformation should not be understood merely as technological upgrading. Its effectiveness depends on the integration of technology, organizational capacity, and governance mechanisms. Future resilient city development should further strengthen cross-sectoral coordination, improve data-sharing mechanisms, and promote the sustainable integration of digital technologies into disaster governance systems.

Digitalized disaster prevention, mitigation and relief represents not only a technological pathway but also an institutional innovation for enhancing urban resilience. By continuously improving digital governance capabilities, cities can better respond to increasingly complex climate risks and build safer, more adaptive, and sustainable urban environments.

REFERENCES

[1] Zhu, Z. W., Liu, Y. Y., & Yang, Y. (2021). Resilient governance: Practice and exploration of resilient city construction in China. Public Administration and Policy Review, 10(03), 22-31.

[2] Huang, H., & Fan, W. C. (2024). Constructing “safety-resilient cities”: Conception, theory and implementation path. Journal of Beijing Administrative College, (02), 1-9.

[3] Hu, C. M. (2023). Three-dimensional framework for modular organization and digital government. Administrative Tribune, 30(03), 82-93.

[4] Wu, Y. Q., & Ren, H. (2014). Research on the operating mechanism of modular organization. China Science and Technology Forum, (01), 47-51+56.

[5] Wen, H., & Lin, B. (2021). Emergency demands, technology empowerment and innovation of government services. E-Government, (01), 12-20.

[6] He, B. J., & Yin, M. Q. (2024). Global actions, strategies and guidelines for beating urban heat. Urban Planning International, 39(03), 132-140.