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Risk management in the era of big data

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***Abstract*—As the reform enters the deep water zone, various contradictions are increasingly revealed, various risk events continue to appear, and risk governance faces new challenges. As the product of informationization development, big data has a series of new characteristics and provides a new idea and technical support for risk management. To promote the innovative path of risk management in the era of big data, we should cultivate big data technology thinking and change traditional thinking of risk management, apply big data platforms systems to realize networked governance, strengthen the construction of governance systems to ensure governance effectiveness.**

Keywords— Big data; Risk management; Risk society

I. Introduction

With the acceleration of industrialization, marketization and globalization, the modernization of China's society is developing rapidly, and the society is undergoing changes and transformations, at the same time, the occurrence of various risk events is showing a trend of expanding. Whether it is the SARS event in 2003, the Wenchuan Earthquake in 2008, or the COVID-19 in 2020 that continues to this day, the seemingly unrelated risk events are all intrinsically related, indicating that China has entered a high-risk society stage. As the rise and development of big data technology, risk management has ushered in a new stage. Big data is the product of the development of informationization, and its wide application provides new ideas for risk management, and will bring innovation and development of the governance system.

II. Risk management in the era of big data

The application of big data technology to deal with risk events has a long history. In traditional industrial society, we have already started preliminary data collection and response mechanism work. Risk governance in the pre-data age has the characteristics of singleness, fragmentation and stylization. First of all, on the subject of governance, emphasis is placed on the government-led governance model. The government-led governance system emphasizes the subject status of the government, rather than implementing multi-center collaborative governance, and elevates risk governance to a political height, which is a political responsibility and obligation. This governance model can concentrate all the power to solve the risk problem, but the governance body and governance means are single and unable to mobilize other governance bodies to coordinate which is lack of flexibility and diversity. Secondly, in terms of governance models, most of them focus on response, and pay less attention to forecasting and pre-judgment links. In the pre-data era, when a risk event broke out, the main body of government governance responded to the crisis as quickly as possible. The governance model that emphasizes response and neglect prediction makes the governance subject in a passive state when a risk event occurs, and stakeholders and organizations cannot directly participate in the risk governance process. Thirdly, in the process of governance, data sharing and circulation cannot be effectively realized, giving rise to the phenomenon of "information islands". As the first subject of governance, the government has a large amount of data and information, which makes risk governance policies more scientific and accurate. However, in the actual governance process, the information collection, storage and analysis of various departments are relatively independent, which makes the effective circulation and sharing of data information impossible. The disclosure and sharing of data is an effective way to improve governance effectiveness and increase the trust and support of people. When a major risk event breaks out, only the disclosure, sharing and circulation of information, and the break of the phenomenon of data monopoly can improve the response efficiency of various governance entities and minimize the impact of risks. German sociologist Ulrich·Beck believes: "As a social theory and cultural diagnosis, the concept of risk society refers to a stage of modernity, at which the threats generated on the road to industrialized society begin to dominate. "[1] Three sections of risk assessment conclusions are shown in table 1.

TABLE I. Three sections of risk assessment conclusions

Risk description	Risk categories	Risk plan
Risk element Risk map	High risk	The first level plan: the risk of imminent
	Intermediate risk	The second level plan: Risks that need to be closely watched and highly valued, and should be dealt with at any time
	Low risk	The third level plan: the risks that need regular attention and continuous follow-up, or turn into the second or even the first level of risk

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Since the 18th CPC National Congress, socialism with Chinese characteristics has entered a new era. President Xi pointed out: “The next five years may be a period when various risks facing our country's development will continue to accumulate or even become concentrated.”[2] In the new historical situation of the new era, in the process of building a modern and powerful socialist country in China, risks in various fields have been accumulating and even appearing intensively, including the domestic economic, political, social and natural risks, as well as international economic, political and military risks, etc. Multiple risks affect the safety and happiness of people's lives, and affect the country's economic development and social stability. With the deepening of reform and the transformation of social structure, all kinds of risks nowadays are more complex and disorderly than those in the traditional industrial society, which own stronger destructiveness and destruction, and such risk prevention and governance needs to be placed on a more prominent position.

In 2012, the United Nations issued the white paper “Big Data for Development: Opportunities and Challenges”, which clearly states that the era of big data has arrived. In 2013, big data began to be applied in the fields of biology, medicine and other disciplines, bringing conveniences to people's lives. That's what Alvin Toffler said, “If IBM's mainframe pulls open the letter Information revolution, then big data is the third wave of colorful movement.”[3] The continuous development and application of big data technology have brought a new perspective for risk management, and provided a more scientific technical path. Victor Meyer-Schoenberger once clearly pointed out that “big data refer to the method of using all data instead of the shortcut of random analysis.”[4] Through the analysis and sorting of data, a more accurate, scientific and intelligent modern risk management model can be realized. It is of great significance to carry out data association, data analysis and data interpretation for all kinds of risk phenomena, so that the theory of big data can be applied to the modern risk management system, and constantly promote the development of modern risk management with the help of scientific and intelligent big data technology.

III. New features of risk management in the era of big data

A. Diversity and unity of risk management subjects

At present, all kinds of risk events are prone to occur frequently, risk governance subjects have gradually broken through the past government-led single mode and developed to diversify governance subjects. Various risks often do not exist alone, and in the face of multiple risks intertwined with each other, it’s impossible for anyone to take care of themselves alone, so a comprehensive management body is needed to prevent the risk complex. In the face of current risks and challenges, we have placed greater emphasis on multi-party participation and risk sharing among risk governance bodies, so that different governance bodies can effectively prevent, defuse and control risks within their responsibilities, and constantly improve their governance capacity and level.

With the continuous development of emerging technologies such as the Internet of Things and cloud computing, enterprises, media and the public can become the main force of risk management with the technical support of big data platforms. When risks and crises erupt, government governance entities participate in the handling of risk events as soon as possible. Companies, media and other governance entities obtain key information such as time-sensitive risk development processes and trends through the collection and analysis of big data information, providing more scientific and detailed risk information for government governance subjects. In the era of big data, the circulation of information resources is accelerating, and network resources are abundant and extensive, so people express their wishes and needs through Internet, which affects the government's decision-making on risk management and provides a new supplementary means for risk management. It can be seen that “big data is the 'free' resource of the industrial society, and no matter who has the data, he or she has the initiative.”[5]

B. Scientific and accurate process of risk management

In the era of big data, the acquisition and analysis of a large amount of data information has revolutionized the way of risk management, promoting the modernization of governance systems and capabilities, and making the governance process more scientific and accurate. In the pre-data era, the information collection channels are limited, and the acquisition of data to information is relatively inconvenient. When dealing with risk events, decision makers mostly rely on long-term experience accumulation and use previous experience to deal with current risks. Without flexibility and pertinence, risks may further erupt and bring greater disasters. Risk management in the era of big data is based on a large number of sample data; big data brings great value and can undoubtedly avoid risks more effectively.

Big data technology uses comprehensive analysis methods to predict risks in a targeted manner, and provides scientific and precise decision-making information for governance entities. In the application of risk management, by collecting a large amount of data, mathematics, statistics, computer and other tools are used comprehensively to analyze the big data, so as to complete the transformation of data to information and then to decision-making. The decision-making of governance subjects is from cognition of the current situation, prediction of the future to strategy selection, corresponding to the descriptive analysis application of big data, predictive analysis application and guiding analysis application of three levels, decision-making is no longer based on experience but with the help of data analysis to form a scientific and accurate judgment. The big data technology in the new era has changed the pattern of risk management. The precise governance model reduces the cost of the governance process to a lower level, governance methods are more professional, and the governance effect is more ideal. A scientific governance model, differentiated and targeted governance strategies for different types of risks, has gradually formed a new governance situation that uses data to speak. At present, domestic and foreign risk events such as natural disasters, epidemic viruses, and terrorist attacks occur frequently, so the requirements for scientific and precise governance are becoming more and more urgent. It is urgent to allocate information resources rationally and give full play to the role of big data in social governance.

C. Institutionalization and Legalization of Risk Management System

In the practice of applying big data technology to the risk management system, realizing the institutionalization and legalization of risk management is the key dimension. "It's necessary to make full use of big data platforms, comprehensively analyze risk factors, and improve the ability to perceive, predict, and prevent risk factors."[6] Realizing the institutionalization and legalization of the risk management system and promoting the transformation of the risk management system from fragmentation and division to integration are very necessary.

The so-called institutionalization has two basic connotations. One is to realize the construction of the fundamental, basic and important systems of socialism with Chinese characteristics, which is the major prerequisite for risk management. The second is to realize the systematic, scientific and legalization of the governance system of various risk events, which are the proper meaning of risk governance. A healthy institutional system is a prerequisite for stable risk management; otherwise，social order may be disrupted during the governance process, causing greater risks. The so-called rule of law is a vivid embodiment of the concept of rule of law in the field of risk management. Only by strengthening the rule of law can be the governance of various risks have laws to follow, so that the division of powers and responsibilities can be clarified, and the various governance processes can be carried out in accordance with reasonable process steps. At the same time, it is also conducive to the implementation of all kinds of risk governance, making governance really put into practice, and enhancing people's sense of trust and identity in different governance subjects. New features of risk governance in the era of big data are shown in chart 1.

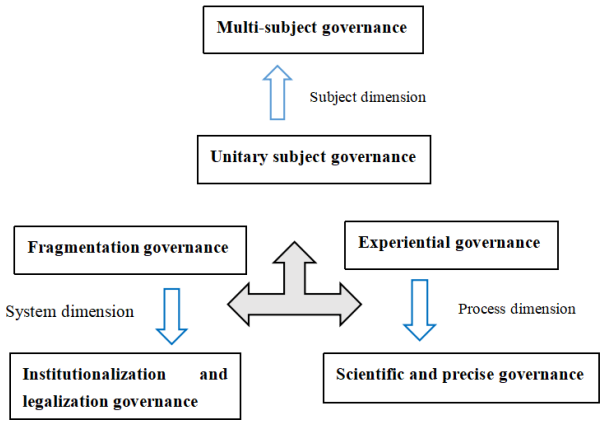

Chart 1 New features of risk governance in the era of big data

IV. Path innovation of risk management in the era of big data

A. Cultivate big data technology thinking and change traditional governance thinking

Big data has been widely used in many areas of daily life, and it is changing people's thinking, production, life and other aspects. Cultivating big data technology thinking and changing traditional governance thinking are the inevitable requirements of risk governance in the new era. As Victor Meyer Schönberg said, "Big data is a source of people gaining new cognition and creating new value, or a way to change markets, organizations, and the relationship between government and citizens."

In the era of big data, data supply is realized through the collection of massive data, and basic algorithms of big data are used for data analysis, and big data is visualized to realize the big final data application. A series of technical data processing provides a new perspective on risk management. "Many contradictions are superimposed and the challenge of increasing hidden risks is still serious and complex." [7]Grasping the occurrence rules of risks from big data analysis, scientifically predicting the occurrence of risks, grasping the harbingers of risks and formulating targeted plans, have broken through the passive response and stylized treatment methods of traditional governance. Various big data platforms provide convenience for governance entities to conduct governance, and also provide a wide range of ways for people to participate in governance, gradually, big data thinking is taking shape. These risk governance methods are new changes in the era of big data. They break through the limitations of traditional governance ideas and provide a new path for current risk governance.

B. Apply big data platforms system to realize networked governance

The construction of the big data platforms system is based on the current development of big data and basic algorithms. The formation of a unified information platform enables accurate collection of various information resources, realizes networked governance of information resources, and provides efficient and targeted services for preventing risks. It's very necessary to apply big data platforms in related fields to realize networked governance. For example, the active application of big data technology in government governance and people's livelihood services can prevent social conflicts from the source and improve the effectiveness of social governance; the application of big data technology in education, medical care, transportation and other specific areas can understand the real needs of people, promote the transformation of related fields, and enhance people's sense of happiness in life. President Xi has repeatedly emphasized that the new era must "always treat the maintenance of national security and social stability as a basic work of the party and the country."[8] Integrating dispersed data resources, realizing networked governance and paying attention to the dynamics of each grid, can realize the passive wait of risk management for the transition to active decision-making, reducing the cost of risk management. After the establishment of unified big data platforms, the information resources of the whole society can achieve unified classified management and standardized operation. A large number of data resources flow in the information platform, which can achieve maximum information sharing. The time spent on data acquisition, analysis, and processing is greatly reduced, which greatly improves work efficiency of each governance bodies. The platform and dynamic governance mode is realized with the help of network technology, providing a complete set of

accurate comprehensive management service system for risk governance, which is an innovative development of risk governance mode in the new era. Under normal circumstances, the four risk strategy measures are shown in table 2.

TABLE II. Four measures of risk strategy

Strategy item	Responses
Predict risk	For the potential risks that have not yet occurred and are destructive, conduct predictive analysis and eliminate the risks in advance
reduce risk	For the risks that will occur and cannot be avoided, targeted measures should be taken to reduce the catastrophic consequences of the risks
Shared risk	Promote the diversified development of governance entities, enable all entities to actively participate in the risk governance process, jointly respond to risks, and achieve risk sharing
Accept the risk	Establish a sound risk management mechanism, conduct reasonable analysis of low-risk, medium-risk, and high-risk events, predict, avoid and respond to risks, and form a scientific risk management model

C. Strengthen the construction of governance system and ensure its effectiveness

In the era of big data, risks and challenges of various aspects are increasingly comprehensive and complex, bringing great challenges to risk governance mechanisms, which require that various risk prevention and control mechanisms must be constantly improved to ensure effective governance measures. The first is to strengthen the construction of data information linkage sharing mechanism to realize the information flow of multiple governance entities. The risks in the new era are comprehensive and diverse. In the face of these complex risks, multiple governance entities are required to cope with them. Whether government departments, enterprises, institutions, or people should all share the risks and realize the sharing of data resources, promoting the refinement and accuracy of risk prevention and control and governance. The second is to accelerate the construction of a big data talent team to provide intellectual support for the governance system by encouraging talents in the fields of mathematics and computer to enter the field of big data, actively introducing high-end talents at home and abroad, establishing a multi-level big data talent training system, cultivating big data technology and application-oriented talents, and supplying high-quality talents for the governance system. Through relying on the various educational resources of the society, it can be realized to carry out knowledge popularization and education training for big data, and improve the society's level of awareness and application of big data. The final point is to strengthen the legal system related to big data to provide institutional guarantees for the governance system. The mass information of big data is a double-edged sword, which can provide convenience but also cause a series of security problems. Information leakage threatens people's lives, and information abuse leads to a crisis of trust. Improving legal construction and ensuring information security has become a legal guarantee that is currently urgently needed.

V. Conclusions

In the process of promoting the construction of socialism with Chinese characteristics, we will inevitably face various major challenges, major risks and major obstacles. Big data technology is just an effective means to prevent and resolve various risks. In the future, risk management will be a collaborative governance model featuring multiple subjects, accurate prediction and scientific innovation.

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