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Research on the Construction of Resilient Communities in the Context of Technological Governance

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Abstract

Since the 18th national Congress of the CPC, General Secretary Xi Jinping has attached great importance to the governance of urban and rural communities. He has clearly pointed out that communities are the grassroots foundation, and only when the foundation is strong can the national building be stable, stressing that the focus of social governance must fall on urban and rural communities. The COVID-19 outbreak at the end of 2019 is a major test of grassroots governance capacity, and also a test of community risk management capacity. It has been proved that while communities have made important contributions to the epidemic, they have also exposed some shortcomings that need to be strengthened. Therefore, it is particularly important to explore how to build more resilient communities. With the increasing development of science and technology, it is gradually introduced into community governance. Based on the background of technology governance in China, this paper deeply discusses and analyzes the importance and necessity of building resilient communities in China. Based on this, X community in Beijing is selected as a typical case to put forward the current situation of building resilient communities in the background of technological governance from the four dimensions of spatial resilience, organizational resilience, institutional resilience and social resilience. Furthermore, the paper puts forward the possible risks and development prospects in the process of building resilient communities, hoping to provide some inspiration for the construction of resilient communities.

Keywords: resilient community, technical governance, resilient governance

1. Introduction

Communities have become the main front for grassroots governance and an important bridge connecting individuals, society, and the state. Traditional governance methods can no longer meet the current needs, and people are beginning to explore how to enhance their ability to adapt to society. Resilience theory has thus emerged as a new dimension in community governance research. Resilience draws from multiple related disciplines, and its connotation continues to evolve. Resilience research is gradually being introduced and applied in the field of social sciences, and the study of resilient

communities has become a new dimension in community research. The rapid development of technology has made technological governance a new norm, and it has become a hot topic in current research. Therefore, studying the construction of resilient communities in the context of technological governance is highly necessary.

2. Technological Governance and Resilient Communities

A resilient community is a grassroots governance unit that has the ability to rapidly adapt to and recover from highly uncertain environments. The construction of community resilience is viewed here as a dynamic process, which is discussed in four specific aspects: spatial resilience, organizational resilience, institutional resilience, and cultural resilience. This aims to provide a comprehensive analysis of the current state of resilient community construction in China and distinguish it from traditional community models. Technological governance, as the name suggests, refers to the use of technology to govern and achieve specific objectives. In this context, technological governance is treated as a "hard" governance mechanism and tool, meaning the application of various emerging technologies to governance, and further exploring the process of building resilient communities under the influence of technological governance.

The construction of resilient communities and technological governance is a continuous interactive process. Science and technology are the primary productive forces, and technological governance is a crucial mode of governance. While significantly promoting societal development and progress, they also provide the technological foundation for building resilient communities, laying the groundwork for their future development. To some extent, the construction of resilient communities relies on the continuous introduction of various emerging technologies. In other words, it is the application of technological governance to grassroots community construction that provides the technical support for the smooth development of resilient communities.

On the other hand, as the construction and development of resilient communities continue, future progress will undoubtedly increase the demand for emerging technologies. According to the law of supply determined by demand, this will drive continuous technological innovation. At the same time, the practical effects of emerging technologies applied to communities may create a demonstration effect, encouraging the use of these technologies in other fields. In conclusion, I believe the construction of resilient communities and technological governance are interdependent and mutually reinforcing processes. It is based on this perspective that this paper explores the construction of resilient communities under technological governance.

3. The Current State of Spatial, Organizational, Institutional, and Cultural Resilience Construction of Resilient Communities under Technological Governance

3.1 Spatial Resilience Construction Under Technical Governance

A community is a relatively stable gathering of a certain number of people within a specific geographical area. As mentioned earlier, space is one of the essential factors for a community; without a defined space, there is no community. Therefore, in constructing resilient communities, it is necessary to maintain a certain level of spatial resilience, which is referred to as spatial resilience. Spatial resilience specifically includes the resilience of layout structures, internal transportation within the community, and the resilience of various facilities and resource reserves within the community. Taking X community in Beijing as an example, based on interview results and collected data, the introduction and application of emerging technologies played a significant role in the construction of spatial resilience within resilient communities, with tangible effects manifested in the following areas:

3.1.1 Utilizing Mobile Internet, Cloud Computing, and Artificial Intelligence to Optimize Space Planning and Reservation

As an important component of social governance, a community plays a crucial role as a connection and bridge between residents and the external environment. It should serve multiple functions and possess a degree of flexibility and redundancy. To this end, X community actively introduced technologies such as Internet+, cloud computing, and artificial intelligence to improve space planning. By using Internet+ to collect real-time data and identify elements, the community gathered the necessary information in a comprehensive and

accurate manner, thus laying a solid information foundation for final planning. Cloud computing was employed to analyze, process, and handle the collected data, easing the burden caused by information transmission while enhancing the capacity to expand information and facilitating accurate community predictions. In addition, using artificial intelligence, such as computer vision methods and convolutional neural networks, the community conducted multi-scenario simulations of potential disasters or crises to clarify the community's elasticity needs and further improve the accuracy of planning. These technologies allowed for better control of population density, coordinated emergency areas like community parks and squares, and enhanced the spatial resilience of the community.

3.1.2 Using Internet of Things (IoT) and Full-Coverage Smart Cameras for Real-Time Monitoring and Routine Risk Inspection

Risks often originate from day-to-day issues that are easily overlooked. The most proactive approach to addressing risks and challenges is prevention. To improve the spatial resilience of a community, it is necessary to monitor and inspect the community. IoT technology, which facilitates communication and information exchange between people and objects, is essential in gathering relevant data. In China, IoT technology is well-developed and has been actively applied in community management platforms to provide real-time responses to emergencies based on cloud computing power. Interviews with the property management and residents of X community revealed that IoT and full-coverage smart cameras have been used to perform real-time monitoring and make routine inspections of risks in the community. On one hand, IoT technology strengthens the community's sensory system, improving sensitivity to crises and enabling real-time monitoring and slow-variable management. On the other hand, full-coverage smart cameras provide clear and comprehensive observation of the community's daily state, with real-time image uploads that significantly increase the speed of information transmission, thus improving efficiency. Additionally, routine risk inspections ensure community facilities are maintained, improved, and rebuilt, addressing potential risks at their source.

3.1.3 Introducing Advanced Emergency Equipment to Ensure and Improve Resource Storage and Allocation

A community with spatial resilience should have sufficient emergency supplies and equipment, such as protective items like masks, lighting equipment, first aid kits, as well as fire extinguishers, fire hoses, and other essential tools. The specific risks faced by the community depend on its particular environment, so targeted resource storage is necessary. X community in Beijing has not only set up an emergency resource hub but has also installed advanced emergency equipment. This includes traditional emergency tools, as well as new technologies, such as smart switches and fire alarm controllers. Additionally, X community has partnered with local businesses, clinics, and institutions, including supermarkets, to ensure adequate crisis resource reserves.

3.2 Organizational Resilience Construction Under Technical Governance

A community is a microcosm of society. Within a community, there are not only residents but also various organizations, such as community residents' committees, property management, volunteer groups, and businesses within the community. Organizational resilience refers to the proactive capacity generated under sustained pressure and destruction. In other words, organizational resilience is both the ability of an organization to quickly adapt to the environment and recover from disasters, as well as the resilience of its daily operations and management. Various organizations within X community fully utilize emerging technologies to operate and continuously enhance their resilience.

3.2.1 Building a Digital Platform Using Big Data and Other Technologies to Improve the Joint Emergency Participation Mechanism

To fully realize community resilience, it is necessary to leverage the collective strength of various aspects within the community and establish a joint emergency participation mechanism. In the process of building resilient communities in X community, the focus has been on using big data, cloud computing, and other information technologies to build a digital platform. This platform acts as a medium to coordinate the activities of various organizations within the community and integrate them into the community's daily operational and emergency relief systems. On one hand, it encourages residents and grassroots

organizations to join the community's construction and participate in the smart platform; on the other hand, it emphasizes the work priorities of various stakeholders such as residents, residents' committees, and property management at different times, aiming to create a complete and decentralized community governance model. The digital platform creates collaborative value and promotes stakeholder involvement across different community organizations, thereby improving the joint emergency participation mechanism. In other words, it is the digital platform that makes the construction of a more organizationally resilient community possible.

3.2.2 Smart Property Management Leading Technological Support to Enhance Organizational Resilience

Community property management refers to the management of residential units, facilities, equipment, and spaces within a community. Smart property management typically refers to the integration of Internet of Things (IoT) technology with property management. In other words, smart property management involves the use of IoT and other technologies to enhance property management. The continued advancement of IoT technology and the growing IoT market in China have laid a solid technical foundation for improving property service levels. Smart property management combines IoT, Internet, and other communication technologies to integrate systems such as property management, security, and infrastructure. This creates a healthier, safer, and more convenient living environment for residents, aiming to establish a new model of community management.

The property management company in X community continuously deepens the influence of science and technology on property services. It applies IoT and other technologies to various aspects of community management. For instance, it uses the Internet, big data, and other emerging channels to transmit information and collect data for processing, understands the status of information applications within the community, and formulates specific strategies for community service, such as offering more accurate services in areas like infrastructure maintenance, security, landscaping, and residents' bill payments. This ensures the stable operation of the community and enhances organizational resilience.

3.2.3 Residents' Committee Utilizing Data Platforms to Play an Active Role in Coordination and Integration

A community residents' committee, typically elected, is a grassroots self-governance organization with the legitimacy to mobilize residents to participate in governance. The main responsibility of the residents' committee is to provide services to residents, protect their rights, mediate civil disputes, and promote policies and community rules. The committee is generally seen as a representative of the community, embodying the will of the residents, and plays a crucial role in community management.

In X community, the residents' committee is well-equipped and highly motivated. Not only does it actively respond to policies and manage epidemic prevention, but it also does a great job of communicating and soothing residents' emotions, which promotes a harmonious atmosphere in the community. Additionally, the residents' committee actively utilizes digital platforms to play an active role in coordinating and integrating the efforts of residents and various organizations. By breaking the information monopoly, the digital platform allows every community member to access real-time information and incorporate feedback from all sides, thereby constructing a more resilient public service supply mechanism and further enhancing the organizational resilience of the community.

3.2.4 Actively Utilizing the Skills of Technical Experts, Volunteers, and Other Community Residents

The most important element of a community is its residents. Volunteers are individuals who actively take on social responsibilities without expecting rewards. They are dedicated to serving the community and the broader society, offering their time and energy. X community has a dedicated volunteer team. Many of these volunteers not only embody the spirit of service but also possess specialized skills, such as organizing, utilizing digital platforms to communicate with residents and external organizations, and more. These skills are crucial for community governance and play an essential role in times of emergencies. Volunteers engage actively with various community stakeholders, laying the foundation for building resilient communities.

3.3 Institutional Resilience Construction Under

Technical Governance

Without rules, there is no way forward. Institutions not only influence individual behavior but also shape organizational behaviors, which in turn impact institutional development. Compared to higher-level governance systems, grassroots governance institutions are more flexible. Institutional resilience within a community emphasizes the ability of self-governing organizations to effectively guide and manage the community environment. Technological advancements lead to institutional changes. The introduction of emerging technologies in community governance plays a crucial role in further enhancing institutional resilience and laying the foundation for the construction of resilient communities.

3.3.1 Establishing and Ensuring Institutional Implementation with Emerging Technologies such as Artificial Intelligence

In recent years, artificial intelligence (AI) technology has penetrated multiple fields such as control systems, information technology, and computing. AI has gradually become an emerging interdisciplinary field that studies how machines can imitate, achieve, or even surpass human intelligence. The increasing use of AI in community governance has impacted various institutional aspects of communities. X community actively applies emerging technologies like knowledge graphs in AI to regulate community systems. It has established formal systems as hard rules and flexible informal systems as supplementary mechanisms. In ensuring the provision of community systems, advanced technologies, such as biometric recognition, are used to ensure that these systems are properly implemented.

3.3.2 Using Big Data, Internet+, and Cloud Computing to Continuously Improve and Update the Daily Operational and Emergency Mechanisms Centered on Grassroots Management

In the digital age, individuals have limited access to accurate and effective information compared to organizations. This information asymmetry, along with the concentration of interests, the lack of responses to citizens' opinions, and incomplete regulatory mechanisms, hinders the formation of genuine and effective public opinion and affects the improvement of operational mechanisms. Interviews and collected data reveal that X community is actively breaking down the information gap by using big data and Internet+ technologies to achieve information sharing. By utilizing the advantages of digital platforms, the community understands the needs and concerns of residents and promotes the informatization of community governance systems. This continuously improves and updates the daily operational and emergency mechanisms. For example, the community has increased the transparency of operations through the digital platform, using big data to realize information sharing and enhance the residents' monitoring mechanism. Cloud computing and other technologies are applied to monitor risks and ensure the smooth operation of governance systems.

3.3.3 Using Information Technology to Set Up Diversified Communication Channels

Communication is crucial for a community. It not only allows residents to express themselves, resolve misunderstandings, and improve interpersonal relationships, but also facilitates the exchange of information and the clash of ideas among stakeholders, which can lead to new insights and further improve community governance. X community, while maintaining traditional communication channels, has also embraced emerging information technologies. By using digital platforms, the community has facilitated smooth communication from top to bottom and vice versa, ensuring that residents' suggestions reach the decision-makers in a timely manner and that policies and measures from higher authorities are effectively communicated. Additionally, through the digital platform, communication between residents and organizations is enhanced, and the community's external connections have been strengthened.

3.4 Cultural Resilience Construction Under Technical Governance

The geographical characteristics, traditional customs, cultural atmosphere, demographic features, and the economic and social environment of a community all contribute to its cultural identity, forming a unique community culture. Since communities differ from one another, their cultures also vary. These cultural traits gradually become internalized into the behavioral patterns, living habits, and values of community residents, deeply influencing their thoughts, perspectives, and lifestyles, which, in

turn, profoundly impact the community's social order. Cultural resilience in a community refers to the proactive capacity of residents and organizations to respond to various risks and challenges, and their ability to adjust their behaviors according to the specific risks faced by the community. A community with cultural resilience is more adaptable to environmental changes and less susceptible to risks. The introduction of certain scientific and technological advances provides the possibility to further enhance a community's cultural resilience.

3.4.1 Utilizing Digital Platforms and Various Information Technologies to Innovate Propaganda Methods and Strengthen Spiritual Leadership

In today's society, overwhelmed with information, continuing to use outdated methods and content for propaganda may no longer capture the attention of the public. Repetitive and uninspiring messages often cause fatigue and fail to attract people's interest, resulting in ineffective outcomes. It is important to recognize that traditional methods, such as hanging banners and drawing bulletin boards, are no longer sufficient to engage community members. To achieve the original goal of publicity, new creativity and diverse communication channels are necessary. Interviews conducted during the pandemic revealed that, in the process of promoting epidemic prevention policies, X community retained traditional methods such as slogans but also introduced innovative approaches. The community leveraged digital platforms and various channels, combining online and offline efforts, while enriching the content of publicity. This not only helped residents understand the information and strengthened spiritual guidance, subtly influencing their behaviors, but also enhanced the sense of community cohesion, fostered a sense of belonging, and further reinforced the cultural resilience of the community.

3.4.2 Introducing Simulation Technology and Smart Wearables to Create a Regularized Emergency Drills and Experience Mechanism

Enhancing cultural resilience in a community requires not only strengthening spiritual leadership but also continuously cultivating residents' self-rescue awareness and improving their physical fitness and self-protection abilities. In addition to publicity efforts, increasing the frequency of emergency drills is also an important way to achieve this. However, emergency drills are time-consuming, costly, and often neglected due to the difficulty in seeing short-term effects. X community has chosen to introduce emerging technologies, such as simulation technology and smart wearables, to conduct batch and classified drills and experiences for residents. This approach saves costs while achieving better training results. On this basis, X community has developed a regularized emergency drill and experience mechanism, allowing residents to experience and understand potential risks in the community and how to respond, thereby improving both cultural and psychological resilience within the community.

3.4.3 Strengthening Grassroots Governance, Providing Risk Governance Training, and Implementing Classified Community Services and Control

The main participants in the emergency drill and experience mechanism are residents and organizations within the community, with the goal of improving the community's emergency response and self-rescue capabilities. On the other hand, risk governance training primarily targets the grassroots governance organizations, such as the community residents' committee, with the aim of strengthening their ability to govern and serve residents, thereby maintaining normal order in the community. During an interview with the residents' committee in X community, it was revealed that the community has introduced internet-based training technology for community management personnel. A hybrid of online and offline training methods is used, allowing trainees to learn at any time and place through computer clients or mobile apps, which is flexible and convenient. This learning approach adapts to the needs of pandemic prevention while resolving the conflict between working hours and learning time. Additionally, the training content is carefully selected to address practical issues, with a focus on improving training effectiveness, enhancing grassroots governance capabilities, and ultimately strengthening the cultural resilience of the organization.

4. Risks and Prospects of Building Resilient Communities Under Technological Governance

As mentioned earlier, taking the construction of resilient communities in X community, Beijing, as an example, the development of resilient communities is steadily progressing across dimensions such as spatial resilience, organizational resilience, institutional resilience, and cultural resilience. Risks and development often go hand in hand. Science and technology are a double-edged sword, and this is also true in the process of community governance. As science and technology continue to be introduced, community resilience is continuously strengthened, bringing positive results for community governance but also introducing many risks, potentially even leading to disasters. For example, uneven quality of big data could lead to information leaks due to inadequate protection; the widespread adoption of technological governance could result in over-reliance on technology, which may contradict traditional ethical values; risk assessment and forecasting methods still require further improvement; and risk culture remains weak. These risks should be taken seriously by communities, and targeted measures should be taken to address them.

4.1 Continuously Introducing and Applying Advanced Technologies to Create a Smart Governance Model Based on the Internet of Things

One of the core ideas of a resilient community is to strengthen the connections between all aspects of the community, so as to coordinate and integrate resources and efforts, creating a smart governance model where everything is interconnected. Therefore, achieving this goal requires keeping pace with the times, continuously introducing and applying advanced science and technology. For example, in the spatial planning and construction of resilient communities, technologies such as BIM (Building Information Modeling) and GIS (Geographic Information Systems) can be increasingly introduced in the future. The development of BIM and GIS technologies is advancing rapidly, and their application range and influence are expanding. By leveraging these emerging technologies, a more three-dimensional community model can be built, taking into account the community's environmental characteristics and residents' needs. Customized community service systems can be designed to make spatial management more convenient. For instance, based on actual needs, the allocation of parks, small businesses like supermarkets, community roads, and other information can be rationalized. Instead of managing different organizations with a one-size-fits-all approach, differentiated management according to functional principles should be applied. This will create a green, convenient, and harmonious community environment for residents.

4.2 Strengthening and Improving the Construction of Digital Platforms to Achieve Information Filtering and Sharing

Modern communities are extremely diverse, including not only many residential units but also various supporting facilities such as supermarkets, clinics, pharmacies, restaurants, and convenience service centers. This makes the community ecosystem more complex, with an enormous amount of information generated daily. The creation and transmission of this information involves numerous individuals and organizations, leading to information overload and difficulties distinguishing between true and false information. Furthermore, the different approaches used by community management personnel to process information cause delays in information transfer and feedback. As the construction of resilient communities progresses, there is increasing attention to grassroots social governance. Various community apps, management systems, and smart products are emerging, contributing large amounts of data to community development, thus ensuring the flow of information within the community. However, due to the independence and fragmentation of these systems, there is a lack of an effective information-sharing mechanism, which results in poor communication within and between communities. The issue of "information islands" arises, where some residents are unaware of community dynamics.

Therefore, an urgent task for communities is to improve and standardize the construction of a unified digital platform. This platform should integrate the functions of various apps, filtering community information, reducing redundant information, and alleviating the burden on both residents and management personnel. On the other hand, real-time information sharing through this digital platform will reduce decision-making errors, conflicts, and misunderstandings caused by "information islands" and communication barriers, facilitating better coordination and planning within the community.

4.3 Establishing Specialized Research Institutions for Community Governance Technology to Promote Technological Innovation

As early as July 2020, the National Development and Reform Commission issued a document emphasizing the need to optimize and upgrade community infrastructure through the comprehensive application of new-generation information technologies such as cloud computing, in order to build an intelligent, integrated service platform that provides more convenient and practical community services for residents. The document further pointed out that future communities will likely promote the application of 5G technology. Given the specialized nature of the work, the government needs to establish dedicated research institutions for community governance technology, focusing on the current shortcomings in community governance and leveraging technological expertise.

To achieve this, it is essential to adopt a dual-track approach in the future construction of communities, integrating both digital and physical aspects. While managing grassroots affairs offline, digital and informational tools should be used to facilitate centralized and comprehensive management. Addressing the risks inherent in the informatization process, technology research institutions should continuously address gaps in technology, strengthen information processing and storage systems, ensuring that information is publicly accessible while minimizing risks such as information distortion or leakage. Furthermore, to promote the establishment of more resilient community governance models, community governance research institutions should accelerate the development and application of community digital service platforms and explore the creation of information-sharing platforms in collaboration with the government. These measures will help communities become more sensitive to digital governance models, promoting full-process digital management and clarifying the responsibilities and functions of service platforms.

4.4 Balancing Technological Governance with Traditional Governance Methods to Advance Resilient Community Development

Although many traditional governance methods have fallen behind the times and hindered further community progress, a blanket rejection of traditional governance approaches is not advisable. China's traditional grassroots governance methods are also the result of accumulated management experience, and even in the era of rapidly advancing technology, some elements of these methods are still valuable and worth preserving. For instance, emphasizing joint governance by morality and law, focusing on moral education, and leveraging the coordinating role of residents' committees all contribute positively to the construction of resilient communities. Therefore, the future development direction for communities should be to prioritize technological governance, fully utilizing the role of emerging technologies, while also considering traditional governance methods, creating a complementary synergy between the two approaches to jointly promote resilient community development.

5. Conclusion

In today's society, risks are frequent, and their consequences are becoming increasingly severe. Various crises occurring around the world are deeply affecting people's lives, which has led to increased reflection and research on how to enhance communities' ability to adapt to the environment, recover, and self-organize. Resilience governance theory aligns with the future direction of grassroots governance research in this broader context. On the other hand, as times evolve and science and technology continue to progress, emerging technologies are increasingly being applied to community governance, making technological governance an unavoidable topic in the study of community governance and development. Based on this, analyzing and studying the current status, potential risks, and future development prospects of resilient community construction under the framework of technological governance is an inevitable choice in the context of the decentralization of national governance.

Emerging technologies such as big data, cloud computing, and artificial intelligence, which have been widely applied in community management and daily life, provide the technological foundation and possibilities for the gradual improvement of resilient community construction. They also effectively promote the construction process of the "resilient city" strategy. Although the construction of resilient communities is still in its early stages, it is progressing steadily. It can

be observed that the four dimensions of resilient community construction—spatial resilience, organizational resilience, institutional resilience, and cultural resilience—are interconnected with the concepts of grassroots governance. Using resilience theory to study the future construction and development of communities is not only of significant importance for community development but also for the long-term development and stability of society as a whole. However, we must also recognize that resilience theory is still in the developmental stage. In the future, it is necessary to further improve its research framework and evaluation systems, deepen localized theoretical and practical exploration, and continuously promote the development of community emergency governance toward greater resilience, collaboration, and self-organization. As the times continue to advance, and with the completion of a new round of scientific and technological revolutions, emerging technologies will increasingly be introduced into the construction of resilient communities, which will undoubtedly further enhance community resilience in the future.

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