

Advances in Urban Community Resilience Research

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Abstract

Global warming has led to frequent extreme natural disasters around the world, making urban disaster prevention a new hotspot for research. As a major constituent unit in urban systems, communities play a very important role in enhancing urban resilience. Therefore, this study aims to analyse and summarise the relevant literature on urban community resilience to explore the concept, influencing factors, assessment methods and enhancement strategies of urban community resilience, and to provide theoretical support for the sustainable development of urban communities.

Keywords

Urban communities, community resilience, assessment methods, disaster prevention and mitigation.

1. Introduction

City is a complex and interdependent social-ecological system, since its formation it has been subjected to various impacts from the outside world and its own vulnerability, how to create a safe, suitable and sustainable urban environment is the focus of the current construction [1]. As the basic unit of the city, the resilience of the urban community is crucial to the sustainable development of the city. With the acceleration of urbanisation, urban communities are facing more and more challenges and risks, such as natural disasters, public health events, and social security events. Urban community resilience refers to the ability of urban communities to maintain or rapidly restore their basic functions and structures in the face of various disasters and pressures. Therefore, it is of great theoretical and practical significance to strengthen the research on urban community resilience and improve the coping and recovery capacity of urban communities.

2. The concept and meaning of urban community resilience

2.1. Definition of urban community resilience

Overall, the research paradigm of resilient communities basically follows the evolutionary logic of "engineering resilience-ecological resilience-evolutionary resilience" [2]. In the 1870s, foreign scholars have begun to study the relevant issues of resilience theory, and in the 1990s, the theory of building resilient communities to achieve community disaster mitigation and community risk management has received widespread attention, but no uniform definition of this concept has been formed yet [3]. In the 1990s, the theoretical research of building resilient communities to achieve community disaster reduction and community risk management has received widespread attention, but a unified definition of this concept has not yet been formed [3]. Due to the different perspectives of interpretation of resilient communities in the academic community, there are differences in the key words of its conceptual definition. LIU J Y et al [4] believe that the community in the different stages of the existence of risk shows different adaptive and resistance capacity, focusing on the process of "resistance and learning"; Khew Y T J et al [5] pointed out that the community should have the ability to continue to prevent,

withstand and mitigate the external risk, with the restoration of the community's functions, and can sum up the experience of enhancing the ability to resist the recurrence of risk, focusing on the concept of resilient community. Resilience to renewed risk, focusing on the ability of communities to resist shocks to their infrastructure when they are resilient to risk.

In the context of the new era, foreign scholars have reached a basic consensus on community resilience in the following aspects: community resilience should focus on Resilience as Persistence, Adaptability and Transformation [6], or should strengthen the research on community capacity, resilience, adaptability, coping capacity, learning capacity, and comprehensive debugging and survival capacity. Although different scholars in China understand this concept with different focuses, the basic consensus on several points includes the following: First, community resilience is the ability to maintain the basic functions of the community under pressure. Second, it is the ability to recover quickly after a catastrophic event. And third, it is the process of self-organisation, self-adaptation, and self-recovery of the community after a crisis occurs [7]. In this paper, urban community resilience is defined as the ability of an urban community to maintain or rapidly recover its basic functions, structures and services in the face of various natural and man-made disasters, social pressures and changes. It includes multiple aspects of community resilience, such as physical, social, economic and environmental aspects, and emphasises community adaptability, flexibility and sustainability.

2.2. Characteristics of urban community resilience

Urban community resilience has a multifaceted character. It emphasises the ability of communities to adapt and recover in the face of various pressures and shocks. It is specifically expressed in the stability, flexibility and sustainability of communities. Stability enables communities to maintain basic functions in difficult circumstances, flexibility allows communities to adjust quickly to changes, and sustainability ensures long-term community development. These characteristics are interrelated and together constitute an important connotation of urban community resilience.

2.3. Components of urban community resilience

The components of urban community resilience include the physical and social dimensions. The physical dimension involves the degree of improvement of infrastructure and public service facilities. The social dimension covers the organisational capacity of community residents, social networks, community culture, etc. In addition, when community resilience is deconstructed from another different dimension, the social, economic, natural, environmental, and ecological are its most prevalent constituents, while the infrastructure, physical, institutional, and human dimensions are the second most prevalent [8]. The interaction of these elements, which together affect the ability of urban communities to cope with external shocks and changes, is an important foundation for achieving urban community resilience.

3. Methods for assessing the resilience of urban communities

3.1. Integrated approach to evaluation

Considering the evaluation of urban community resilience as a multi-indicator comprehensive assessment problem, the comprehensive score of resilience is calculated by comprehensively considering the performance of multiple indicators. Commonly used comprehensive evaluation methods include hierarchical analysis method (AHP), entropy weighting method, and fuzzy comprehensive evaluation. These methods can help determine the weights of indicators and integrate the performance of different indicators into a comprehensive score.

Among them, the hierarchical analysis method, as a kind of subjective assignment method, is one of the most commonly used methods for determining the weights of evaluation indicators due to its combination of qualitative and quantitative analyses, as well as the advantages of

strong logic and high credibility. Inviting a number of experts in the relevant key industry fields to score the importance of each indicator, and then determining the weights of each indicator by calculating the hierarchical analysis method in order to establish the hierarchical structure of order, and comparing the results of the measurement indicators [9].

3.2. Weighting scheme for indicators

Based on expert opinion or stakeholder engagement, a score for urban community resilience is calculated by weighting the indicators. The weights can be determined through expert questionnaires, expert interviews or stakeholder meetings. The methodology emphasises the importance and relative weights of the different indicators and can be flexibly adapted to specific situations.

3.3. Gray correlation analysis

Based on the concept of grey correlation, the performance of urban community resilience is assessed through correlation analysis of changes in different indicators over time or space. Grey correlation analysis can help to reveal the correlation and trend of change among indicators, so as to assess the overall performance of urban communities in terms of resilience, recovery and adaptation.

3.4. Scenario analysis methods

The resilience performance of urban communities under different scenarios is assessed by constructing different disaster scenarios. The scenario analysis method can help to understand the vulnerability and coping capacity of urban communities under different types and intensities of disasters, and suggest corresponding improvements according to different scenarios.

3.5. System dynamics approach

A system dynamics model is used to simulate the dynamic evolution process of urban resilience. By establishing a system dynamics model of urban community resilience, it is possible to simulate the recovery and adaptation process of urban communities after disasters, and to reveal the long-term trends and influencing factors of urban community resilience.

4. Factors influencing the resilience of urban communities

4.1. Natural factors

Natural factors include geographic location, climatic conditions and topography. For example, urban communities located in seismic zones or coastal areas face a higher risk of natural disasters and need to be more resilient to cope with them. In addition, climatic conditions, such as the frequency of extreme weather events, can have an impact on the infrastructure, ecosystems and lives of residents in urban communities. Therefore, natural factors should be fully considered in urban planning and community building, and measures should be taken to enhance the resilience of urban communities.

4.2. Social factors

Social factors include the social networks of community residents, social capital and community cohesion. A good social network can facilitate information sharing and mutual assistance in resources, and enhance the community's ability to cope with disasters. Rich social capital helps to improve the organisational and collaborative capacity of the community. Strong community cohesion enables residents to work together to meet challenges in difficult times.

4.3. Economic factors

A stable economic base can provide resources and support for a community's development and ability to cope. Economic factors include employment opportunities, income levels, and industrial structure. Higher employment opportunities and income levels can enhance the economic stability of residents and improve the community's resource reserves and ability to cope with risks. A reasonable industrial structure helps the community diversify, reduces dependence on a single industry, and enhances economic resilience. At the same time, economic factors are also closely related to the community's infrastructure development and public service provision, which play an important role in supporting the overall resilience of urban communities.

4.4. Institutional factors

Reasonable institutional design can provide clear rules and guidance and facilitate the effective allocation and management of community resources. For example, a sound emergency management system can improve the community's ability to cope with disasters, and a sound community governance mechanism can help to enhance community organisation and coordination and resident participation. In addition, policy support and the safeguard of laws and regulations are key factors in enhancing the resilience of urban communities. By formulating relevant policies and regulations, communities can be provided with the necessary resources and support to promote community resilience.

5. Strategies for increasing resilience in urban communities

5.1. Planning and design strategies

This section focuses on how to enhance the resilience of urban communities through planning and design strategies. Specific contents include: First, optimising community layout and improving the efficiency of space utilisation. Second, strengthening infrastructure construction to enhance the community's disaster resilience. Third, focusing on ecological environmental protection to enhance the community's natural adaptive capacity. In addition, it also includes the promotion of participatory planning in the community and the enhancement of the residents' sense of identity and belonging, among other aspects. The implementation of these strategies can provide strong support for the sustainable development of urban communities.

5.2. Community governance strategies

By strengthening community governance, the organisational, co-ordination and coping capacities of the community can be improved, thereby enhancing the resilience of the community. Specifically, the objectives of the community governance strategy can be achieved by improving community governance mechanisms, strengthening community organisations and increasing the participation of community residents.

5.3. Emergency management strategies

Through the formulation of scientific and reasonable emergency plans, community residents' awareness of and skills training in emergency response have been strengthened, so as to improve the community's ability to respond to emergencies. At the same time, a sound mechanism for the stockpiling and deployment of emergency supplies has been established to ensure that the necessary material support can be provided in a timely manner during emergencies. In addition, strengthen collaboration and communication with relevant departments to form an emergency response linkage mechanism to improve the efficiency and synergy of emergency response, thereby effectively enhancing the resilience of urban communities.

5.4. Public engagement strategies

Community cohesion and the ability to cope with crises can be enhanced by encouraging residents to actively participate in community affairs and improving their awareness and capacity for self-governance. Specific measures include the establishment of mechanisms for the participation of community residents, the development of community education and training activities, and the strengthening of cooperation between communities and social organisations in order to promote public participation in urban community resilience building.

6. Conclusion and outlook

The unique advantages of resilience thinking in disaster governance have been fully recognised by various international organisations and scholars, and have also gradually gained the attention of domestic scholars, generating a large number of community resilience-related studies. Currently, the assessment of urban community resilience faces challenges such as incomplete and reliable data, interrelationships among indicators and comprehensive evaluation, issues of time and spatial scales, as well as social participation and public perception. Addressing these issues requires interdisciplinary research and an integrated approach to improve the science and practicality of urban resilience assessment. In the future, community resilience related research can focus on the following four areas.

Innovations in research methods: In the future, urban community resilience research can introduce more interdisciplinary approaches, such as complex systems theory and social network analysis, to gain a deeper understanding of the intrinsic mechanisms of community resilience. At the same time, real-time monitoring and assessment of community resilience can be achieved with the help of big data and artificial intelligence technologies. In addition, field experiments and case studies are conducted to verify the validity of theoretical models and provide a scientific basis for policy formulation. Through these innovative approaches, it is expected to promote new breakthroughs in urban community resilience research.

Expansion of research: Urban community resilience research can further expand its content in the future by focusing not only on the resilience of the physical environment and infrastructure, but also by exploring in depth the impact of social, economic, cultural and other factors on community resilience. For example, the role and needs of different social groups in community resilience should be studied, the relationship between economic development and community resilience should be analysed, and the impact of cultural traditions on the community's response to disasters and crises should be examined. Through comprehensive and in-depth research, more targeted and comprehensive recommendations will be provided to enhance urban community resilience.

Advancement of practical applications: In the future, the application of urban community resilience in practical scenarios, such as responding to natural disasters and public health events, should be strengthened. Through practice, the relevant theories and methods should be constantly tested and improved, so as to enhance the coping capacity and resilience of urban communities. At the same time, it is also necessary to pay attention to the characteristics of different types of urban communities and formulate targeted resilience enhancement strategies, so as to achieve the sustainable development of urban communities.

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