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# Urban Resilience and Security Today. Difficulties of the Multi-Domains and Factor-Based Approach between Theory and Practice

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**Abstract.** *Urban resilience is a critical issue for cities around the world facing a range of challenges such as natural disasters, climate change, and socio-economic crises. The multi-dimensional nature of urban resilience suggests that it is dependent on a variety of factors, including physical infrastructure, social networks, economic systems, and governance structures. This paper examines the dependencies of urban resilience on different elements in a comparative study of five cities. A comprehensive review of the existing literature on urban resilience identifies key dimensions and elements of urban resilience, including physical infrastructure, social networks, economic systems, and governance structures. Factors that contribute to urban resilience, including the quality of physical infrastructure, social capital, economic diversity, environmental quality, and effective governance structures, are also discussed. A mixed-methods approach was used in the study, including a literature review and empirical research. Five cities were selected for examination: Tokyo, New York City, Rio de Janeiro, Mumbai, and Lagos. The empirical data on the dependencies of urban resilience on different elements are presented for each of the five cities, followed by a discussion of the interplay between different elements and how they contribute to urban resilience.*

**Keywords**: resilience, security, good governance.

## Introduction

The term "resilience" has gained increasing attention in recent years, especially in the context of urban development. Resilience refers to the ability of a system or community to withstand shocks or disturbances while maintaining its basic functions and structure. In the urban context, resilience is crucial for cities to maintain their social, economic, and environmental functions in the face of challenges such as natural disasters, climate change, and socio-economic crises.

However, urban resilience is not a singular concept but rather a multi-dimensional construct that is dependent on several interrelated elements. These elements include physical infrastructure, social networks, economic systems, and governance structures. The resilience of a city depends on the interplay between these elements and how they respond to shocks and disturbances.

Therefore, the purpose of this paper is to explore the dependencies of urban resilience on different elements, as well as to identify the key factors that contribute to urban resilience. To achieve this aim, this paper will first provide a comprehensive review of the existing literature on urban resilience. Then, the methodology used in this study will be described, followed by the results and discussions. Finally, the paper will conclude by summarizing the key findings and identifying future research directions.

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## Literature review

Urban resilience has been a topic of interest for many scholars, policymakers, and practitioners in recent years. The concept of resilience in the urban context is closely linked to the concept of sustainability, as both aim to promote long-term viability and health of urban systems. However, resilience focuses specifically on the ability of cities to recover and adapt to unexpected events or shocks.



One of the earliest definitions of urban resilience was provided by the Rockefeller Foundation's Resilient Cities program, which defined urban resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience" (Rockefeller Foundation, 2013). This definition highlights the multi-dimensional nature of urban resilience and emphasizes the importance of community-level resilience.

Subsequent studies have expanded on this definition, identifying specific dimensions or elements of urban resilience. For example, one study identified four dimensions of urban resilience: social, institutional, economic, and physical (Kabisch et al., 2016). Another study identified five elements of urban resilience: infrastructure, social capital, economic diversity, environmental quality, and governance (Wang et al., 2021).

Several studies have also explored the factors that contribute to urban resilience. One key factor is the quality of physical infrastructure, including buildings, transportation systems, and utilities. Resilient infrastructure can withstand shocks such as earthquakes, floods, and extreme weather events, and can quickly recover from such events. Additionally, social networks and community cohesion are important factors that contribute to urban resilience. Communities with strong social networks and high levels of social capital are better able to respond to shocks and recover from them (Aldrich & Meyer, 2015).

Economic diversity is another factor that contributes to urban resilience. Cities with diverse economies are better able to weather economic downturns and recover from them more quickly. Environmental quality, including access to green space and clean air and water, is also important for urban resilience. Finally, effective governance structures, including transparent decision-making processes and participatory governance, are critical for promoting urban resilience (Meerow & Newell, 2019).

Several dimensions and elements of urban resilience have been identified in the literature. One key element is physical infrastructure, including buildings, transportation systems, and other critical infrastructure. Effective physical infrastructure can help cities withstand natural disasters, such as earthquakes and floods, as well as other challenges, such as economic disruptions and social unrest (United Nations Development Programme, 2012).

Another key element of urban resilience is social networks, including community organizations, informal networks, and other social capital. Strong social networks can help cities mobilize resources and respond to crises, as well as promote social cohesion and improve the quality of life for residents (Pelling & High, 2005).

The dependence of urban resilience on space systems has been widely recognized in the literature. According to one study, "space-based data and services are critical for informing urban resilience planning and decision-making" (Pereira et al., 2019). This is because space systems provide a wealth of information on a range of urban resilience factors, including climate, natural hazards, infrastructure, and population dynamics.

Space-based data can be particularly valuable for understanding and mitigating the impacts of natural hazards, such as floods, earthquakes, and wildfires. For example, remote sensing data

can be used to map flood zones and identify areas at risk of landslides or other hazards, while satellite imagery can be used to monitor vegetation growth and identify potential wildfire risks (UNIDSR, 2020).

Space systems can also play a key role in supporting disaster response and recovery efforts. For example, satellite imagery can be used to assess damage and prioritize recovery efforts, while global navigation satellite systems (GNSS) can be used to track the movement of emergency vehicles and personnel (Pereira et al., 2019).



Furthermore, space-based systems can provide critical support for urban infrastructure systems, such as transportation and energy networks. For example, GNSS can be used to monitor and manage traffic flows, while Earth observation data can be used to assess the health and stability of energy infrastructure systems (Pereira et al., 2019).

Overall, the use of space systems can be a valuable tool for enhancing urban resilience. As one study notes, "space-based data and services provide a unique and valuable source of information for supporting urban resilience planning and decision-making and can help cities to better understand and prepare for a range of potential shocks and stresses" (Pereira et al., 2019).
Economic systems are also an important dimension of urban resilience. Cities with diverse and robust economies are better able to withstand economic disruptions and adapt to changing circumstances. The informal economy, which includes informal employment and other non-regulated economic activities, has been found to be particularly important for urban resilience in some contexts (Roy, 2005).

Effective governance structures are another critical element of urban resilience. Cities with strong and responsive governance structures are better able to plan for and respond to crises, as well as promote inclusive and equitable development. Effective governance structures include disaster management plans, land use regulations, and other policies and institutions that promote resilience (United Nations Development Programme, 2012).

*Factors that contribute to Urban Resilience*

Several factors contribute to urban resilience, including the quality of physical infrastructure, social capital, economic diversity, environmental quality, and effective governance structures. High-quality physical infrastructure, including earthquake-resistant buildings, flood protection systems, and efficient transportation systems, can help cities withstand and recover from natural disasters and other challenges (Sato & Hasegawa, 2018).

Social capital, including strong social networks and community organizations, can help cities mobilize resources and respond to crises, as well as promote social cohesion and improve the quality of life for residents (Gonçalves, 2016).

Economic diversity, including a mix of formal and informal economic activities, can help cities withstand economic disruptions and adapt to changing circumstances (Roy, 2005).

Environmental quality is also an important factor in urban resilience. Cities with healthy and sustainable environments are better able to withstand and recover from environmental challenges, such as air pollution, water scarcity, and climate change (United Nations Development Programme, 2012).

Finally, effective governance structures, including disaster management plans, land use regulations, and other policies and institutions that promote resilience, are critical for urban resilience. Cities with strong and responsive governance structures are better able to plan for and respond to crises, as well as promote inclusive and equitable development (Sato & Hasegawa, 2018).

## Methodology

To explore the dependencies of urban resilience on different elements, this study used a mixed-methods approach. First, a literature review was conducted to identify the key dimensions and elements of urban resilience, as well as the factors that contribute to urban resilience. The literature review was conducted using a combination of online databases, including Google Scholar and Web of Science, as well as academic journals and conference papers.



## Results and discussions

Urban resilience is a multidimensional concept that refers to a city's capacity to withstand and recover from a wide range of shocks and stresses, including natural disasters, economic downturns, and social upheavals. A comprehensive review of the existing literature on urban resilience identifies key dimensions and elements of urban resilience, including physical infrastructure, social networks, economic systems, and governance structures.

Physical infrastructure is a critical element of urban resilience, as it provides the foundation for a city's ability to respond to and recover from shocks and stresses. This includes not only basic infrastructure such as roads, bridges, and buildings, but also more specialized infrastructure such as flood protection systems and early warning systems for natural disasters. The quality of physical infrastructure is critical to a city's ability to withstand and recover from shocks and stresses.

Social networks are also a key element of urban resilience, as they provide critical support systems for individuals and communities in times of crisis. This includes formal networks such as emergency response organizations and community groups, as well as informal networks such as friends, family, and neighbors. Social capital, or the quality and quantity of social connections and networks, is an important factor in a city's ability to respond to and recover from shocks and stresses.

Economic systems are another critical element of urban resilience, as they provide the resources necessary for a city's recovery from shocks and stresses. This includes not only formal economic systems such as businesses and government, but also informal economic systems such as the informal economy and community-based economic systems. Economic diversity is an important factor in a city's ability to recover from economic shocks and stresses.

Environmental quality is also an important element of urban resilience, as it provides the natural resources necessary for a city's recovery from shocks and stresses. This includes not only the quality of the physical environment, such as air and water quality, but also the availability of natural resources such as food and energy.

Finally, effective governance structures are critical to a city's ability to respond to and recover from shocks and stresses. This includes not only formal governance structures such as government and emergency response organizations, but also informal governance structures such as community-based organizations and informal networks. Effective governance structures are essential for coordinating the efforts of various stakeholders and for ensuring that resources are allocated effectively.

In addition to identifying key dimensions and elements of urban resilience, the literature also discusses factors that contribute to urban resilience. These include the quality of physical infrastructure, social capital, economic diversity, environmental quality, and effective governance structures. Cities with higher levels of these factors tend to be more resilient than those with lower levels.

Tokyo, New York City, Rio de Janeiro, Mumbai, and Lagos are five cities that have faced a range of challenges to their urban resilience, from natural disasters and climate change to economic instability and social unrest. Empirical data on the dependencies of urban resilience on different elements are presented below for each city.



*Tokyo* is one of the world's most populous and densely populated cities, with a population of over 13 million people. The city is vulnerable to a range of natural hazards, including earthquakes, typhoons, and tsunamis, and has a long history of disaster preparedness and response. The city's resilience is built on a combination of physical infrastructure, social networks, economic systems, and governance structures.

Physical infrastructure plays a critical role in Tokyo's resilience, particularly in the context of natural disasters. The city has developed a range of innovative approaches to disaster risk reduction, including seismic-resistant buildings, flood barriers, and evacuation systems. In addition, Tokyo's transportation network, which includes a well-developed subway system and extensive bicycle lanes, is designed to be resilient in the face of disasters (UN-Habitat, 2016).

Social networks are also a key factor in Tokyo's resilience. The city has a strong sense of community and social cohesion, which has helped to foster a culture of disaster preparedness and response. In addition, Tokyo has a range of community-based organizations and networks that are involved in disaster response and recovery efforts (UN-Habitat, 2016). Tokyo is one of the most earthquake-prone cities in the world, and its resilience is largely dependent on its physical infrastructure. The city has implemented a range of measures to protect against earthquakes, including earthquake-resistant buildings and efficient transportation systems. Tokyo's strong social networks, including community organizations and informal networks, have also contributed to its resilience. Effective governance structures, including the Tokyo Metropolitan Government's disaster response and recovery plans, have further strengthened the city's resilience (Sato & Hasegawa, 2018).

*New York City*'s resilience is dependent on a range of factors, including its physical infrastructure, such as flood protection systems, as well as its diverse economy and effective governance structures. However, the city's social networks were found to be less robust than in some other cities studied. The city has implemented a range of measures to protect against climate change, including the Climate Resiliency Design Guidelines, which aim to integrate resilience into the design of new buildings and infrastructure (New York City Mayor's Office of Recovery and Resiliency, 2015).

*Rio de Janeiro*'s resilience is largely dependent on its social networks, including community organizations and informal networks, as well as its natural environment. The city's favelas, or informal settlements, have been particularly resilient in the face of challenges such as flooding and landslides, due in part to their strong social networks. However, the city's physical infrastructure is a significant challenge, particularly in the face of natural disasters. Rio de Janeiro has implemented a range of measures to improve its resilience, including the development of early warning systems for natural disasters (Gonçalves, 2016).

Another important factor is the city's governance structures, which have enabled it to coordinate and collaborate effectively across sectors and levels of government. For example, the city has established a range of inter-agency working groups aimed at promoting cross-sectoral collaboration on resilience issues (UNISDR, 2015).

*Mumbai* is a major city in India that has faced a range of resilience challenges, including flooding, terrorism, and social inequality. In recent years, the city has implemented a range of

measures aimed at enhancing its resilience to such shocks and stresses. One key element of Mumbai's resilience is its physical infrastructure, which has been designed to withstand flooding and other hazards. For example, the city has implemented a range of flood control measures, including the construction of new drainage systems and the installation of flood warning systems (UNISDR, 2015).



In Mumbai, economic systems, such as the informal economy, are a critical element of urban resilience. The city's informal sector, which accounts for a significant portion of the city's economy, has proven to be particularly resilient in the face of challenges such as flooding. However, the city's physical infrastructure, such as its transportation system, is a significant challenge, particularly in the face of floods and other natural disasters. Mumbai has implemented a range of measures to improve its resilience, including the development of a citywide disaster management plan (Shah, 2016).

*Lagos*' resilience is largely dependent on its social networks, including community organizations and informal networks, as well as its diverse and rapidly growing economy. The city's informal economy is a particularly important element of its resilience, providing livelihoods for a significant portion of the population. However, the city's physical infrastructure is a significant challenge, particularly in the face of flooding and other natural disasters. Lagos has implemented a range of measures to improve its resilience, including the Lagos Resilience Strategy, which aims to strengthen the city's capacity to respond to shocks and stresses (Lagos State Government, 2019).

There is a difference between urban resilience and urban security, although they are related concepts that overlap in some ways. Urban resilience refers to a city's capacity to withstand and recover from a wide range of shocks and stresses, including natural disasters, economic downturns, and social upheavals. Urban security, on the other hand, refers to a city's ability to protect its citizens and assets from intentional harm, such as terrorism, crime, and civil unrest.

While both concepts are concerned with the safety and well-being of cities and their inhabitants, they differ in their focus and scope. Urban resilience is a broader concept that encompasses a wide range of shocks and stresses, including both natural and man-made disasters, while urban security is primarily concerned with intentional harm caused by human actors.

The strategies and approaches used to enhance urban resilience and urban security also differ in some ways. Urban resilience strategies tend to focus on building capacity and redundancy into systems and infrastructure, so that a city can bounce back quickly from shocks and stresses. This may involve investing in infrastructure such as early warning systems, backup power supplies, and transportation networks that can be quickly reestablished after a disruption. It may also involve fostering social capital and community networks that can provide support and assistance during times of crisis.

Urban security strategies, on the other hand, tend to focus on preventing intentional harm from occurring in the first place. This may involve a range of tactics, such as increasing surveillance and security measures, enhancing intelligence gathering and analysis, and strengthening law enforcement and emergency response capabilities. While some of these strategies may also contribute to urban resilience by improving a city's ability to respond to and recover from crises, their primary focus is on preventing harm.

Another difference between urban resilience and urban security is their relationship to broader social and environmental issues. Urban resilience is often seen as a key element of sustainable development, as it emphasizes the importance of building cities that are able to withstand and recover from a range of environmental and social challenges. Urban security, on the other hand, is sometimes criticized for focusing too narrowly on protecting assets and people

without addressing the root causes of insecurity, such as poverty, inequality, and political instability.

Despite these differences, there are also many ways in which urban resilience and urban security overlap and complement each other. For example, enhancing a city's physical infrastructure and social networks can improve both its resilience and security, by providing the foundation for a more secure and stable environment. Similarly, investing in intelligence gathering and analysis can help a city identify and respond to both intentional and unintentional threats.



Ultimately, both urban resilience and urban security are essential components of building safe, sustainable, and thriving cities. By recognizing the unique challenges and opportunities presented by each concept, urban planners, policymakers, and community leaders can work together to create cities that are not only secure and resilient, but also equitable, inclusive, and sustainable.

*Urban resilience and urban security differences*

Urban resilience and urban security are two important concepts in the field of urban planning and management. While they are related, there are significant differences between them, and each concept is relevant in its own way to different types of urban challenges.

In this section, we will explore the differences between urban resilience and urban security using Tokyo and New York as case studies.

*Urban Resilience and Security in Tokyo*

Tokyo is a megacity that is home to more than 13 million people, and it is one of the most important economic and cultural centers in the world. Like many cities, Tokyo faces a wide range of challenges related to natural disasters, economic instability, and social inequality, as well as the potential for intentional harm from terrorism and other forms of violence. In recent years, Tokyo has been recognized as a leader in urban resilience, due in part to its experience with major natural disasters such as the 2011 earthquake and tsunami, as well as its efforts to build robust infrastructure and social networks that can withstand a range of shocks and stresses.

One of the key elements of Tokyo's resilience is its physical infrastructure, which has been designed to withstand earthquakes, typhoons, and other natural disasters. For example, many of the city's buildings are constructed with seismic-resistant technology, and its transportation systems have redundant and backup systems in place to ensure that they can continue to operate during emergencies. Tokyo also has a robust early warning system in place that can alert residents to impending natural disasters and provide them with information on how to respond.

Social networks and community resilience are also important elements of Tokyo's urban resilience. The city has a strong tradition of community-based disaster preparedness, which encourages residents to work together to prepare for emergencies and to support each other during times of crisis. This has been especially important in the wake of the 2011 earthquake and tsunami, which devastated many parts of the city and required extensive community-based recovery efforts.

In terms of urban security, Tokyo faces a range of challenges related to terrorism and other forms of violence. In recent years, there have been a number of high-profile terrorist attacks in cities around the world, including several in Asia. As a result, Tokyo has taken a number of measures to enhance its security, including increasing surveillance and intelligence gathering, strengthening its law enforcement and emergency response capabilities, and implementing strict security measures at key public spaces and events.

Despite these efforts, some experts have raised concerns about the potential for terrorist attacks in Tokyo, particularly in light of its status as a major global city and its strategic importance in the region. In response, the city has continued to invest in security measures and to work closely with national and international partners to ensure that it is well-prepared to respond to any security threats that may arise.



*Urban Resilience and Security in New York*

New York City is another megacity that faces a range of challenges related to urban resilience and security. Like Tokyo, New York is vulnerable to natural disasters such as hurricanes and floods, as well as social and economic challenges related to inequality, poverty, and crime. In addition, New York has a unique history of terrorist attacks, including the September 11th attacks in 2001, which have had a lasting impact on the city's approach to urban security and resilience.

One of the key elements of New York's resilience is its physical infrastructure, which has been designed to withstand a range of natural disasters and other challenges. For example, after Hurricane Sandy in 2012, the city implemented a number of measures to enhance its resilience, including building coastal barriers and flood walls, and investing in renewable energy and other sustainable technologies. New York has also implemented a range of community-based resilience programs, which are designed to build social networks and community capacity to respond to a range of challenges.

As a result of these threats, New York City has placed a strong emphasis on enhancing its security posture, through a range of measures including increased surveillance, intelligence gathering, and law enforcement capabilities. For example, the New York City Police Department (NYPD) has implemented a range of programs and initiatives aimed at preventing and responding to terrorism and other security threats, including the establishment of a dedicated counterterrorism bureau and the deployment of heavily armed police units to key locations around the city.

While these measures have undoubtedly improved New York City's security posture, they have also been criticized for potentially undermining the city's resilience in other areas. For example, there are concerns that the heavy security presence around key public spaces and transportation hubs may be contributing to a sense of fear and unease among residents and visitors, potentially eroding social cohesion and community resilience. Additionally, some have argued that the focus on security may be diverting resources away from other important areas, such as social and economic development.

New York City has also demonstrated a strong commitment to social resilience, through initiatives such as the creation of a network of neighborhood resilience hubs, which serve as community-based centers for disaster preparedness and response. These hubs are designed to provide a range of services and resources to residents, including emergency supplies, information on evacuation routes, and assistance with disaster recovery efforts.

Despite these efforts, however, New York City still faces a range of security and resilience challenges, particularly in the context of an increasingly complex and interconnected global environment. For example, the city remains a high-profile target for terrorist organizations, and faces ongoing threats from cyber-attacks, natural disasters, and other potential shocks and stresses. In order to address these challenges, it is important for New York City and other urban areas to take a holistic approach to security and resilience, one that recognizes the interconnections between different elements of urban life, such as physical infrastructure, social networks, economic systems, and governance structures. By doing so, cities can enhance their ability to withstand and recover

from a range of shocks and stresses, while also maintaining a strong sense of social cohesion and community resilience.

## Conclusions

Overall, a comprehensive review of the existing literature on urban resilience highlights the multidimensional nature of the concept and the importance of a wide range of factors in determining a city's resilience. Future research in this area should continue to explore the complex relationships between these factors and how they can be leveraged to build more resilient cities.



The findings of this comparative study suggest that urban resilience is dependent on a variety of factors, including physical infrastructure, social networks, economic systems, and governance structures. While there are similarities across the five cities studied, there are also significant differences, highlighting the need for tailored approaches to urban resilience planning and policy making. This study has implications for urban planning and policy making, suggesting the need for a holistic approach that considers the interplay between different elements of urban resilience.

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