

# Urban Resilience Assessment

Subjects: Others | Engineering, Civil

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This paper aims to provide a better understanding of the state of knowledge on urban resilience assessment through mapping the knowledge domain and highlighting emerging trends during different periods. The objects of study were 420 papers published in the Web of Science from 1998 to 2020. Science mapping was done using VOSviewer and CiteSpace, two widely known software tools for bibliometrics analysis and scientometric visualization. The results show that research published on urban resilience assessment was very limited and fragmented until 2009, and the focus has mainly been on risk mitigation and vulnerability assessment. The intellectual base grew between 2010 and 2014, when a paradigm shift from approaches based on robustness and reliability toward more adaptation-oriented approaches occurred. Finally, the annual publication trends have grown rapidly over the past five years and there has been more emphasis on climate change adaptation and flood resilience.

Keywords: urban resilience assessment ; science mapping ; bibliometrics analysis ; flooding ; earthquake ; critical infrastructure

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## 1. Introduction

The ever-growing concentration of humans and economic activities in urban areas requires taking actions to reduce vulnerabilities to a multitude of climatic and non-climatic risks that threaten proper functioning of cities. This need is well-recognized in science and policy circles and there are now numerous publications and policy frameworks aimed at providing solutions on how to enhance urban resilience. There have also been many efforts to guide resilience planning through development and implementations of indicators and assessment tools. The main objective of this study was to provide a better understanding of the knowledge structure and trends in “urban resilience assessment” studies and to identify journals, documents, and authors that have played more influential roles in the development of the field. Two bibliometrics analysis and science mapping applications, namely VOSviewer and CiteSpace, were used for this purpose. These applications allow performance analysis, as well as knowledge domain visualization.

## 2. Trends in recent years

The results show that until 2010 the knowledge base of the field was very limited, but the number of publications has progressively increased ever since. The growth rate has been particularly high over the past five years, which could be explained by the increasing emphasis on the significance of urban resilience in major policy documents such as the UN SDGs, the Sendai Framework for Disaster Risk Reduction, and the New Urban Agenda. Dividing the analysis period into three sub-periods (1998–2009, 2010–2014, and 2015–2020), it was found that, during the first period, the intellectual base was limited and fragmented, and the few papers published were mainly focused on engineering-based resilience characteristics such as robustness and stability. However, during the second period, the knowledge base started to grow and a paradigm shift toward more adaptation-based approaches that promote characteristics such as diversity, modularity, self-organization, connectivity, and adaptive capacity occurred. Major progress in the development of indicators for assessing urban resilience was achieved during this period. Finally, within the past five years, the intellectual base has further expanded and more knowledge about indicators, tools, and methods for assessing urban resilience has been produced. In particular, more attention has been paid to assessing resilience to climatic impacts.

In terms of thematic focus, overall, several major clusters were found. The dominant one is focused on resilience to climate change impacts, with a clear emphasis on urban flooding. However, assessing resilience to other important stressors such as extreme heat has, comparatively, received limited attention. It was argued that, given the projections about the increase in frequency and intensity of climatic impacts, further research on climatic stressors is expected to be published in the coming years. Another major cluster is mainly focused on resilience of critical infrastructure systems to natural hazards such as earthquakes and tsunamis. This has been a persistent focus area throughout the analysis period. Finally, there are, comparatively, less developed clusters on institutional aspects of urban resilience, and planning- and

design-related measures such as land use planning and green infrastructure development. Overall, these clusters cover issues related to three major dimensions of urban resilience: environment/ecology, infrastructure, and governance/institutions. However, economy and society/well-being are two important dimensions that are comparatively understudied. Further research on assessing social and economic dimension of resilience should, therefore, be conducted. Since the recent COVID-19 pandemic has instigated new discussions on the significance of urban resilience, more research on health-related indicators is expected to be conducted in the coming years.

In addition to identifying major thematic focus areas, this paper highlights key sources, authors, and publications that lay the foundation of the field of urban resilience assessment. Network analyses of these components resulted in clusters that are in line with the thematic clusters discussed above. Furthermore, the CiteSpace application allowed progressive visualization of the knowledge domain and influential authors/publications over the analysis period. This information can be used by interested groups as a point of reference to gain better knowledge about the structure and thematic evolution of urban resilience assessment. Overall, this study has gone some way toward providing a better understanding of the current status of research on urban resilience assessment that is a rapidly growing field of research. Further work is, however, needed to gain more detailed information about the different thematic clusters and research hotspots identified in this study. In addition, further manual analysis is needed to gain more details about the geographic focus of the literature and the socioeconomic and climatic conditions that have received more attention. This can be done using systematic review approaches. Such approaches are likely to provide more qualitative information to better interpret the quantitative details identified by bibliometrics analysis. In addition, further research is needed to fill the knowledge gaps related to economic and social dimensions of urban resilience assessment and resilience to climatic stressors other than flooding. Finally, future research should also make efforts to fill the knowledge gap related to the implementation of urban resilience assessment tools and methods.

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