FUTURE CITIES AND ENVIRONMENT

# Navigating Uncertainties: A Scoping Review of Risks in Urban Planning

REVIEW

SALHAH SULAIMAN ALHASSANI
RADHI M. ALZUBAIDI
ASEEL ALI HUSSIEN
*Author affiliations can be found in the back matter of this article

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## ABSTRACT

The discipline of urban planning is an ever-evolving and essential area of study that plays a pivotal role in the formation and development of future cities. In this research, we seek to examine the varied risks inherent in urban planning projects and how these risks impact decision-making and growth. The research is a scoping review, which includes synthesis and analysis of various articles in the field. The study's findings indicate a wide range of risks, including natural risks, environmental risks, societal risks, and other complex risks that impede the process of decision-making and inhibit the progress of urban planning. The significance of multidisciplinary cooperation, risk assessment approaches, and data-driven decision-making is underscored. Moreover, it highlights the need for implementing strategies that enhance resilience and adaptability, promoting the construction of robust infrastructure, and implementing efficient financial risk mitigation strategies. This study gives useful insights into the intricate nature of urban planning and presents suggestions for academics and policymakers to foster the development of urban settings that are more sustainable, inclusive, and resilient.

**CORRESPONDING AUTHOR:**
**Salhah Sulaiman Alhassani**
University of Sharjah, College of Engineering, Industrial Engineering, UAE
u19104911@sharjah.ac.ae

**KEYWORDS:**
Risks; Urban Planning; Risk Assessment; Decision-making; Urban Planning Project

**TO CITE THIS ARTICLE:**
Alhassani, SS, Alzubaidi, RM and Hussien, AA. 2024. Navigating Uncertainties: A Scoping Review of Risks in Urban Planning. *Future Cities and Environment*, 10(1): 10, 1–14. DOI: https://doi.org/10.5334/fce.230

## 1 INTRODUCTION

The discipline of urban planning is characterized by its dynamic nature since it assumes a crucial part in the process of constructing the cities of tomorrow (Levy, 2016). Urban planning plays a crucial role in the holistic development of cities since it concurrently fosters growth and safeguards public health (Panagopoulos, González Duque, & Bostenaru Dan, 2016). The process of global urbanization has given rise to heightened recognition of the complexities and potential risks inherent in urban growth (Feng, Zhang, & Bourke, 2021). Urban planning encounters a multifaceted array of possible challenges, ranging from environmental risks to socioeconomic risks (Chaiechi, 2020). The adverse effects of climate crises, armed conflicts, pandemics, and similar environmental and anthropogenic calamities are impeding urban expansion, hence exerting a detrimental influence on economic progress and the pursuit of sustainable development.

One of the primary issues encountered by countries worldwide is the endeavor to establish cities that are both sustainable and robust in the face of various risks (Bibri & Krogstie, 2017). There is a need for novel planning solutions that may effectively optimize the functioning of multifaceted urban socio-ecological and technological systems while simultaneously mitigating risks. Moreover, it is important to note that cities in developing nations are confronted with significant challenges, such as widespread poverty, fast urbanization, and inadequate infrastructure (Awuah & Abdulai, 2022). Consequently, these cities are particularly vulnerable to the adverse impacts of climate change.

Numerous scholars have conducted extensive research and implemented various initiatives aimed at promoting the establishment of sustainable growth through improved urban planning (Ongkowijoyo, Doloi, & Gurmu, 2020; Chaiechi, 2020). However, there is a dearth of research that delves into risk-reduction techniques and planning methodologies within the decision-making framework for constructing resilient cities (Saaty & De Paola, 2017). The identification of risks inherent in urban planning is of utmost importance since these risks have the potential to give rise to infrastructure challenges and contribute to suboptimal urban growth. It is essential to develop a more comprehensive comprehension of the obstacles that hinder the implementation of risk-sensitive urban design, as well as to investigate potential strategies for surmounting these hurdles (Sharma & Miyazaki, 2019).

Hence, the objective of this research is to do a comprehensive scoping review in order to thoroughly assess the risks associated with urban planning and identify viable strategies for mitigating them. The anticipated result of this study is expected to provide a basis for commencing other research endeavors that may support the advancement of resilient urban planning. This research used a scoping review methodology to comprehensively gather, assess, and integrate the findings of many scholarly articles that examine the risks associated with urban planning and emphasize the need to address these risks to facilitate improved development. The research question selected as the foundation for performing the scoping review in this study is as follows: "What are the risks involved in the urban planning projects that hinder decision-making and growth?"

## 2 METHOD FOR SCOPING REVIEW

In order to examine the breadth and diversity of methodologies and interdisciplinary approaches used in the field of urban planning, this study adopts the technique of Arksey and O'Malley (2005) by formulating a comprehensive research question to inform the development of the search strategy. In order to establish the goals, procedures, and reporting techniques in advance, a protocol was prepared prior to the study. The protocol included a comprehensive outline of the guiding question, identifying and selecting the relevant studies, data charting, and presenting the results. Figure 1 presented below depicts the scoping review methodology used in the research, which encompasses five distinct steps.

The first stage of the framework is identifying the research question, which was "What are the risks involved in the urban planning projects that hinder decision-making and growth?"

Subsequently, the next phase included the identification of pertinent research. During this phase, it is crucial to conduct an initial search that thoroughly investigates the existing and relevant literature pertaining to the research issue. This particular stage is crucial in order to guarantee the selection of relevant and sufficient literature for the purpose of performing the scoping review analysis. Electronic databases such as Web of Science, Scopus, Science Direct, and SAGE

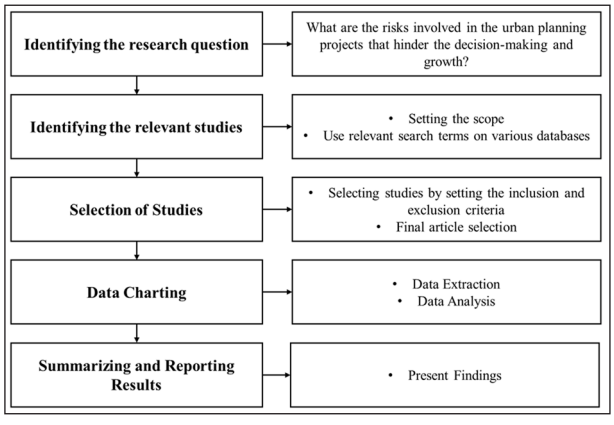


**Figure 1** Scoping Review Methodology for Identifying Risks in Urban Planning.

Journals were used to conduct a literature search. These are databases that store and publish a large extent of research papers across various fields of study and, hence, were deemed appropriate to be included in the review.

The study employed a comprehensive search strategy to gather relevant literature on risks in urban planning. The primary search terms included combinations of keywords related to urban planning (such as "urban planning," "city planning," "infrastructure planning") and risk-related terms ("risks," "risk reduction," "disaster risk reduction," "risk assessment," "risk management"). These terms were used in various combinations to ensure thorough coverage.

It is worth mentioning the use of quotation marks around certain search terms was to ensure that the search engines treated those terms as exact phrases rather than individual words. For example, searching for "risk reduction" ensures that the results include the exact phrase "risk reduction" rather than documents that contain the words "risk" and "reduction" separately. This approach is particularly useful for terms that are commonly used together in specific contexts, thereby increasing the relevance and precision of the search results. In contrast, the search terms related to urban management were not enclosed in quotation marks because these terms are more flexible and can appear in various forms across the literature. For example, the terms "urban planning," "urban plan," and "city planning" are likely to yield relevant results whether they appear as exact phrases or as part of broader discussions on the topic. By not using quotation marks, the search captures a wider range of articles that may use these terms in different but still relevant contexts, thus broadening the scope of the literature review. In summary, the quotation marks around risk-related terms ensure precision by targeting specific phrases, while the absence of quotation marks around urban management terms allows for a broader and more inclusive search of the relevant literature.

Searches were conducted across several electronic databases known for their extensive collections of academic papers, including Web of Science, Scopus, Science Direct, and SAGE Journals. To refine the selection, specific inclusion and exclusion criteria were applied. Inclusion criteria encompassed articles published between 2012 and 2023, written in English, and covering a variety of publication types (journal articles, conference papers, book chapters, review articles) with any methodological approach (qualitative, quantitative, or mixed methods). Exclusion criteria ruled out non-scholarly literature (such as government and organizational reports, editorial papers, newsletters), non-English articles, and articles not focusing specifically on risks in urban planning. This rigorous selection process ensured that the final set of 18 academic articles was highly relevant and provided a robust basis for the scoping review.

The search process for this study involved a systematic application of specific inclusion and exclusion criteria during the full-text screening to ensure transparency and replicability. The inclusion criteria were as follows: Articles published between 2012 and 2023 to ensure the relevance and currency of the findings; articles published in English for consistency and ease of comprehension; various types of scholarly publications, including journal articles, conference papers, book chapters, and review articles; explicit focus on risks in urban planning, encompassing studies on urban planning processes, strategies, and outcomes related to risk management; and articles employing any methodology, including qualitative, quantitative, or mixed methods. The exclusion criteria ruled out non-scholarly literature, such as government reports, organizational reports, editorial papers, newsletters, and other non-peer-reviewed sources; articles in languages other than English due to potential language barriers; articles that did not specifically focus on risks in urban planning but were solely about urban planning or related disciplines without addressing risk factors; and articles that mentioned risks in urban planning only superficially, without detailed analysis or discussion. During the full-text screening, each article was meticulously evaluated against these criteria, ensuring that only the most relevant and rigorous articles were included in the final assessment. This careful selection process provided a robust basis for the scoping review and ensured the transparency and replicability of the search process.

A substantial body of research exists pertaining to urban planning; yet there is a shortage of studies specifically addressing the risks associated with urban planning and the strategies to mitigate the same. Consequently, the inclusion and exclusion criteria were developed to focus on the topic specifically. In the third step, the process of selecting studies included the application of inclusion and exclusion criteria, as shown in the Table 1 provided below.

| INCLUSION CRITERIA | EXCLUSION CRITERIA |
|---|---|
| (1) Articles published between 2012 and 2023 | (1) Literature: such as government reports, organizational reports, editorial papers, and newsletters. |
| (2) Articles published in English language. | (2) Articles in any language other than English. |
| (3) Articles can be of various types, such as journal articles, conference papers, book chapters, review articles. | (3) Articles that did not focus on any risk at all and were only about urban planning or related discipline. |
| (4) Articles that have adopted any methodology, such as qualitative, quantitative, or mixed. | |

**Table 1** Eligibility Criteria.

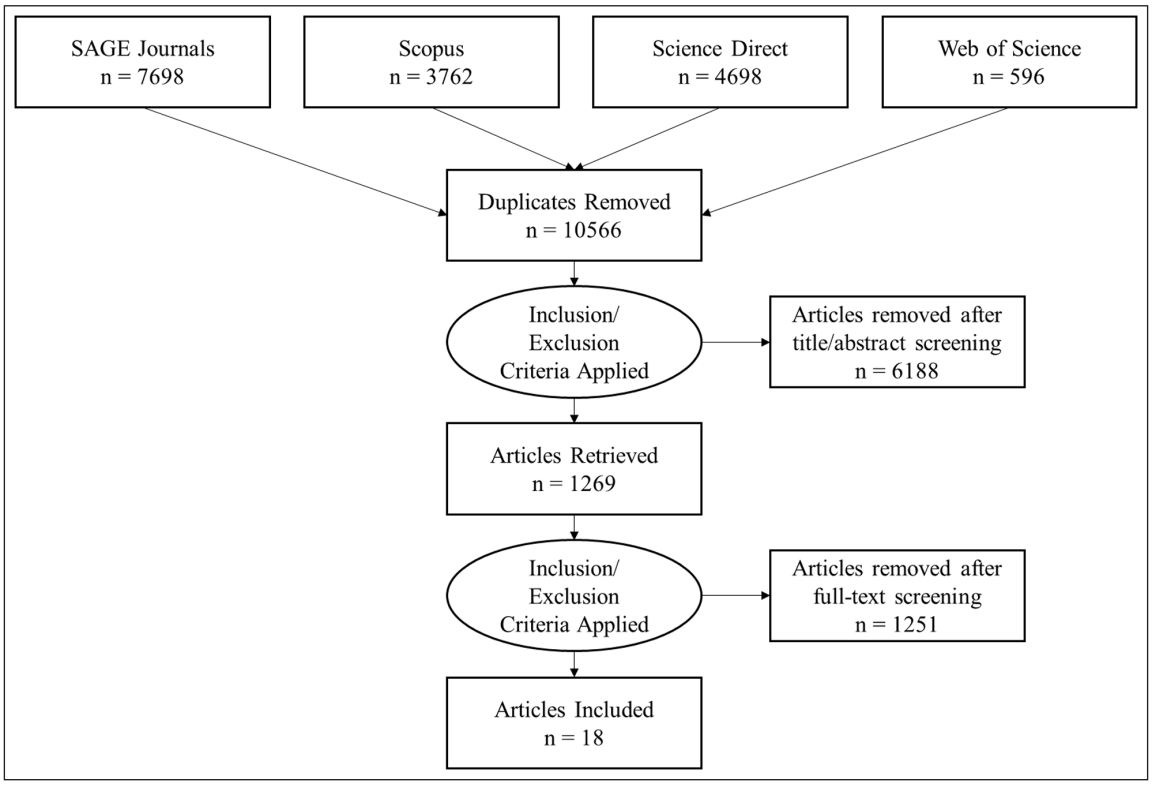


**Figure 2** Comprehensive Literature Search Strategy for urban Planning Risks.

By using the search mentioned above method, a comprehensive collection of 16,754 articles was acquired. Following the elimination of 10,566 duplicate entries, the titles and abstracts of the remaining articles were subjected to screening. After conducting title and abstract screening, a total of 1268 articles were identified. Subsequently, the inclusion and exclusion criteria were applied, taking into consideration specific criteria that comprised three components throughout the full-text screening process: 1) The main focus of this study pertains to the field of urban planning. 2) The incorporation of research encompasses both concise and comprehensive examinations of specific risks that may impede the urban planning process. 3) The incorporation of diverse research methodologies, including descriptive articles, simulation-based theoretical frameworks, qualitative and quantitative research, as well as mixed-methods studies, also offers strategies for mitigating risks associated with urban planning. After applying the established criteria for inclusion and exclusion, a total of 18 academic articles were considered appropriate for inclusion in the final assessment. The comprehensive search approach is shown in Figure 2. The open-source reference management software Zotero's desktop version was used to manage all the cited papers.

In the last two stages of the research, data charting was conducted as a means of visually representing the collected data. The outcomes of this process are then reported in the subsequent section.

## 3 RESULTS

During the data charting phase, a structured Excel spreadsheet was used to collect and organize pertinent information for evaluation purposes. The evaluation criteria used in this study included many key factors, including the research setting, year of publication, research purpose, research technique, risks (related to urban planning) focused upon, and research results. The results are presented in the form of descriptive analysis, which indicates data charting and analysis and identifying of common themes, which indicate types of risks outlined. They are outlined in the following sub-sections.

### 3.1 DATA CHARTING AND ANALYSIS

The following Figure 3 illustrates the categorization of articles pertaining to risks in urban planning according to the year of their publication. The figure illustrates a consistent upward trend in the number of articles published over time, which is consistent with the escalation of crises that impede urban planning and development. As reported in statistics compiled by Statista in 2022, the global urbanization rate stood at 57%. This may imply that research in urban planning ought to adjust to the evolving environment brought about by crises and global occurrences. This statement underscores the criticality of conducting research in the domain of urban planning that investigates crisis response, global perspectives, and data-driven analysis.

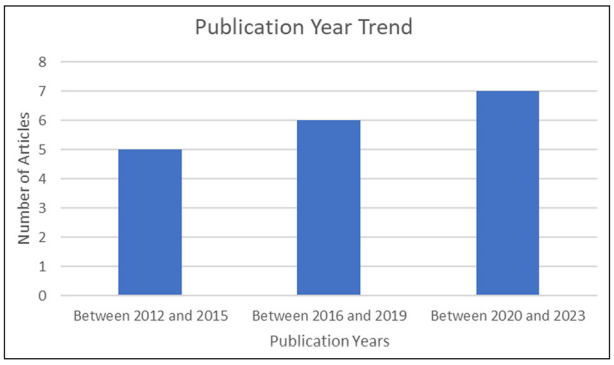


**Figure 3** The 18 Selected Articles by Publication Year.

Additional information regarding the quantity of articles published in particular research contexts (countries) is provided in the table that follows along with the represented pie chart as shown in Figure 4. The statistics provide an overview of the quantity of articles pertaining to specific nations, including Australia, Nicaragua, Papua New Guinea, Zambia, Russia, and Italy. In some cases, articles are linked to multiple contexts in the same article; for instance, "Multiple European cities" and "The Netherlands and the United Kingdom" are examples. The number of articles for each of these countries is between one and three, which signifies the degree of research or emphasis on urban planning and growth in those particular areas. For instance, China has the highest number of articles in a single context article, considering that it is highly developing and there is a significant need for urban planning. This implies the existence of research endeavors that encompass multiple cities in these regions or involve comparative analyses, which may aim to tackle shared urban planning challenges or foster collaborative efforts. The inclusion of four articles in the "General Context" category indicates an urban planning research emphasis that is potentially more comprehensive and not limited to a particular country or region.

An additional trend that was discerned pertained to the methodology employed by the papers. The research methods utilized are detailed in the subsequent table, which is crucial for comprehending the research environment, identifying gaps, and staying in line with the developing methodologies in this specific discipline. Urban planning research utilizes a diverse range of methodologies, as indicated in the Table 2. These include quantitative surveys, case studies, theoretical investigations, review articles, simulation-based model development, and multi-criteria decision-making approaches such as AHP and ANP. The wide range of methodologies employed enables scholars to tackle the intricate and multifaceted risks inherent in the field of urban planning. Additionally, the case study research methodology was the most widely utilized. This may be due to the multidisciplinary and intricate nature of the urban planning field and the fact that case studies provide researchers with a practical examination of how urban planning concepts, associated risks, and their tangible effects on communities, in addition to the corresponding strategies, operate.

Thematic analysis was conducted to analyze the data to answer the primary research question. Thematic analysis is a method used by researchers to discern repeating patterns and themes in relation to the study issue. Following the thematic analysis explained by Braun and Clarke (2012), the study identified main themes: Natural risks, Environmental risks, Social risks, and other risks. The thematic analysis in this study aimed to identify recurring patterns and themes related to risks in urban

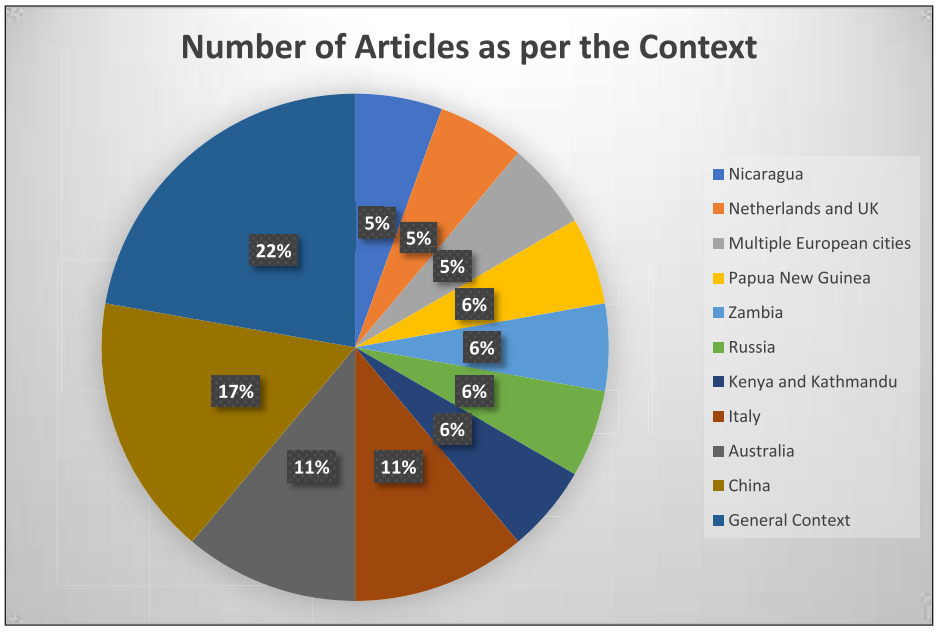


**Figure 4** Geographical Distribution and Context of the 18 Selected Studies on Urban Planning.

| METHOD USED | SOURCES |
|---|---|
| Case Study | (Zhou & Liu, 2012), |
| | (Rivera & Wamsler, 2014), |
| | (Valtonen et al., 2015), |
| | (Löwe et al., 2017), |
| | (Rosa, Santangelo, & Tondelli, 2021), |
| | (Cremen, Galasso, & McCloskey, 2022), |
| | (Menteşe et al., 2023) |
| Theoretical Study | (Renn & Klinke, 2013), |
| | (Xue, 2014), |
| | (Taylor, Siame, & Mwalukanga, 2021) |
| Multi-criteria Decision Making (AHP and ANP) | (De Lotto et al., 2016), |
| | (Saaty & De Paola, 2017), |
| | (Sharma & Miyazaki, 2019) |
| Simulation-based model development | (Zhao & Liu, 2016), |
| | (Ongkowijoyo, Doloi, & Gurmu, 2020) |
| Review article | (Chaiechi, 2020), (Revich, 2022) |
| Quantitative Survey | (Duan et al., 2018) |

**Table 2** Research Methodology Trend.

planning, using data sourced from the 18 academic articles selected through a rigorous literature search and screening process. These articles were chosen based on their relevance to the research question and their focus on different types of risks in urban planning. The initial coding process involved a close reading of each article to identify key terms and concepts, such as "flood risk," "climate change adaptation," "social equity," "public health," "technological risks," and "financial strategies." After initial coding, the codes were grouped into broader categories based on their similarities and relevance to the research question. For instance, codes related to environmental hazards like "flood risk" and "climate change adaptation" were grouped under the theme "Natural Risks." The development of themes involved iterative review and refinement to ensure they accurately represented the data and covered all significant aspects discussed in the articles.

The identified themes were "Natural Risks," "Environmental Risks," "Social Risks," and "Other Risks," chosen based on their direct relevance to the research question, which focused on understanding the types of risks in urban planning that hinder decision-making and growth. These themes were justified by their frequency and prominence across the selected articles. For example, "Natural Risks" emerged as a significant theme due to the recurrent discussion of climate-related challenges in urban planning. Alternative themes considered, such as "Economic Risks" and "Technological Risks," were ultimately subsumed under broader categories like "Other Risks" to avoid redundancy and ensure a comprehensive overview.

The theme of "Natural Risks" encompassed risks related to natural disasters and climate change, such as floods, earthquakes, and extreme weather events, frequently highlighted as major challenges for urban planners. "Environmental Risks" included issues like pollution, loss of biodiversity, and sustainability challenges, linked to the impacts of rapid urbanization and inadequate environmental management. "Social Risks" covered challenges related to social equity, public health, and community cohesion, emphasizing the importance of addressing these risks to create inclusive and equitable urban environments. "Other Risks" included various risks such as technological failures, financial instability, and governance issues, which were less frequently discussed but still critical to comprehensive urban planning. This thematic analysis directly addressed the research question by categorizing and detailing the types of risks that hinder decision-making and growth in urban planning, providing insights into specific areas of concern and highlighting the need for targeted strategies to mitigate these risks.

Additionally the field of urban planning is evolving to address a variety of emerging risks and to implement innovative methods that enhance resilience, sustainability, and inclusivity. New risks such as cybersecurity threats, data privacy concerns, and the impacts of climate change demand advanced, integrated risk assessment models that combine traditional methods with technologies like GIS and AI. Social risks, including gentrification, displacement, and the needs of an aging population, require community-based and adaptive planning frameworks that prioritize social equity and flexibility. Additionally, economic volatility and the complexities of public-private partnerships necessitate robust financial strategies and transparent collaborations. To move the field forward, urban planners are increasingly using data-driven decision-making, incorporating big data analytics and real-time monitoring systems to inform and optimize planning processes. Emphasizing green infrastructure and circular economy principles also helps create sustainable urban environments. These innovative approaches ensure that urban planning can effectively manage contemporary challenges and foster cities that are resilient, adaptable, and inclusive.

## 4 DISCUSSION

The results of the scoping review presented in the following Table 3 were useful to draw the main themes that should be addressed for effective decision-making related to urban planning.

| SOURCE | PURPOSE | CONTEXT | METHOD | RISK FOCUSED UPON | RESULTS/STRATEGIES |
|---|---|---|---|---|---|
| (Zhou & Liu, 2012) | The objective of this study is to provide a theoretical framework for the evaluation of significant risks in urban areas. | China | Case study | Urban major hazards, including dangerous goods, technical risks, and natural risks | Sustainable land-use safety planning |
| (Renn & Klinke, 2013) | The objective of this study is to provide a comprehensive and adaptable framework for risk governance, specifically focusing on its application to the risks associated with urban planning. | General | Theoretical paper | Social, financial, technical, and various other urban planning risks | Implement an effective risk governance framework |
| (Xue, 2014) | The research aims to critically examine the concept of eco-village/urban village as a vision for long-term sustainability, specifically from the viewpoint of an urban planner. The focus of this examination is on the spatial implications and planning process associated with this proposition. | General | Theoretical paper | Social and environmental risks | The use of multi-scalar methods within the planning framework is crucial in order to pursue the concept of degrowth effectively. The study closes by highlighting the intricate connection between paradigmatic social upheaval and spatial development, as well as emphasizing the crucial role that urban planning may assume in facilitating the transition towards regrowth. |
| (Rivera & Wamsler, 2014) | The objective of this study is to assess the degree to which adaptation to climate change is incorporated into the regulatory and policy frameworks that govern urban risk reduction. | Nicaragua | Case study | Climate-related risks (Natural risks) | Integration of climate change adaptation into disaster risk reduction and urban planning |
| Valtonen et al., 2015 | The objective of this study is to examine the planning and development procedures in urban development projects, specifically focusing on the distribution of risk. | Netherlands and UK | Case study | Various risks, such as urbanization, time-related risks, legal risks, and financial risks | Implementing effective risk allocation |
| (Zhao & Liu, 2016) | The objective of this study is to develop and execute a tool that aids in the facilitation of urban regional risk assessment. | China | Development of a tool called RiskUMH | Urban major hazards | GIS Geoprocessing technology and urban regional risk assessment process |
| (De Lotto et al., 2016) | The objective of this study is to define two potential intervention strategies for the city as methods of risk mitigation. | Italy | Analytic Network Process (ANP) | Natural Risks | Areal Change and Functional Change |
| (Saaty & De Paola, 2017) | This study aims to comprehensively enhance urban design concepts and demonstrate the practical application of contemporary decision-making theories in order to facilitate rational decision-making processes in urban development. | European cities | Analytical Hierarchical Process (AHP) | Technological, Social, Environmental, and Financial Risks | Proposed an optimal compact city model that served as an effective solution for the domains of design and urban planning. |
| (Löwe et al., 2017) | This study aims to provide a novel methodology for the adaptable assessment of flood risk adaptation methods across diverse urban development and climatic scenarios. | Australia | Case study | Flood Risk (Natural Risks) | The outcomes of the experimental configuration have the potential to be used as valuable input for robust decision-making frameworks. Consequently, this can further aid in the identification of flood risk adaption solutions that exhibit both economic efficiency and resilience to climatic fluctuations and urban layouts. |

(Contd.)

| SOURCE | PURPOSE | CONTEXT | METHOD | RISK FOCUSED UPON | RESULTS/STRATEGIES |
|---|---|---|---|---|---|
| (Duan, Wang, Fan, Xia, & de Groot, 2018) | The objective of this study is to examine the level of knowledge among users of urban green infrastructure about environmental risks, as well as to analyze their assessment of the influence of such risks on the well-being of the human environment. | China | Quantitative survey | Environmental Risks | Urban Green Infrastructures |
| (Sharma & Miyazaki, 2019) | The objective is to design a methodology for effectively incorporating hazard maps into the decision-making process for urban land-use planning. | Madang Province, Papua New Guinea | Analytical Hierarchical Process (AHP) | Natural Risks | |
| (Chaiechi, 2020) | The objective is to ascertain and comprehend the worldwide demand for sustainable urban planning by using novel interdisciplinary methodologies. | General | Review paper | Environmental Risks | |
| (Ongkowijoyo, Doloi, & Gurmu, 2020) | The objective of this study is to provide a unique hybrid risk assessment model that can effectively analyze the scale and impact pattern of substantial risks to urban infrastructure, with a specific focus on their implications for the community. | Australia | Fuzzy-based Failure Model Effect and Criticality Analysis and Social Network Analysis | Multiple risks, such as Environmental, Social, Political, Technical, and Economic | The model demonstrated its ability to effectively capture the impact of risk, considering not only its magnitude but also the level of association between individuals and risks, as well as the dynamic nature of impact spread. |
| (Taylor, Siame, & Mwalukanga, 2021) | The objective is to investigate the potential benefits offered by strategic urban planning in integrating climate risk factors into the decision-making processes of municipal administrations. | Zambia | Theoretical paper | Climate-related risks (Natural risks) | Implement an effective collaborative framework |
| (Rosa, Santangelo, & Tondelli, 2021) | The objective is to comprehend the significance of urban planning tools in enhancing the resilience of historical places and addressing climate change by means of enhancing disaster risk management for cultural assets. It is essential to delve into the subject matter. | Ravenna | Case study | Climate Risk damaging the cultural heritage | Enhancing the incorporation of cultural heritage risk management into urban planning frameworks. |
| (Cremen, Galasso, & McCloskey, 2022) | This study aims to provide a complete framework that utilizes simulation-based methods to evaluate the potential risk of earthquake-induced ground shaking in the future, which can be used to inform decision-making processes in the context of urban growth. | General | Case study | Earthquake Risk (Natural Risks | Implement a simulation-based framework that can guide decision-making |
| (Revich, 2022) | The primary objective is to direct attention toward the difficulties associated with the hygienic assessment of urban development. | Russia | Review paper | Social risks | |
| (Menteşe et al., 2023) | The objective is to prioritize the examination of the exposure element within the context of dynamic natural hazard risk, and this study emphasizes urban planning as the focal point for future exposure characterization. | Tomorrowville | Case study | Natural Risks | The successful execution of the suggested exposure data format showcases its ability to facilitate the creation of prospective urban visioning scenarios successfully. These scenarios are crucial for informing decision-making processes related to risk-sensitive and pro-poor urban planning and design in future cities. |

**Table 3** The Results of the Scoping Review.

The themes generated are a result of a detailed scoping review process conducted in the study. This section outlines the discussion of the main themes, which are the main risks involved in urban planning projects that hinder the decision-making and growth of these projects.

### 4.1 NATURAL RISKS (CLIMATE-RELATED RISKS)

Natural risks, specifically within the realm of urban planning, include a range of challenges stemming from environmental elements and natural occurrences, including but not limited to floods, earthquakes, climate change, and severe weather incidents. The potential consequences of these dangers may have significant repercussions for urban areas. Even though while doing urban planning, the focus is on resolving these concerns by incorporating strategies to promote resilience and mitigate susceptibility, these risks pose a threat to urban planning projects. Natural risks have the potential to manifest unpredictably, resulting in significant devastation to both human lives and property (Sharma & Miyazaki, 2019). According to Menteşe et al. (2023), it has been shown that urban development methods often have a role in exacerbating damages and losses caused by natural risks. Cities that do not effectively handle natural risks often face significant economic losses and the displacement of their residents after natural disasters. In regard to this, many researchers have focused on how natural risks are an important consideration in urban planning to ensure the effective development of projects.

Rivera and Wamsler (2014) used a case study approach to examine the Nicaraguan situation, doing a comprehensive analysis of relevant documents. Rivera and Wamsler (2014) conducted a study that centered on the amalgamation of climate change adaptation and disaster risk reduction within the context of urban planning. The objective of this integration is to effectively mitigate the consequences of climate-related disasters and the associated risks. Rivera and Wamsler (2014) placed significant emphasis on climate change as a key risk factor that requires careful consideration in urban planning due to its detrimental effects on planning initiatives. The formulation of laws and regulatory frameworks pertaining to environmental concerns, disaster risk reduction, and urban planning is indicative of broader advancements in comprehending climate change adaptation. The notion has undergone a transformation from a narrow perspective to a more inclusive framework, including the safeguarding of both the natural and human environment. Furthermore, this approach must be integrated into all facets of urban sector endeavors. The study conducted by Rivera and Wamsler (2014) also revealed that the incorporation of climate change adaptation into urban planning is severely constrained due to the absence of contemporary regulatory and operational planning tools. Urban planning projects face potential risks due to inadequate regulatory planning regulations and laws pertaining to natural risks. Additionally, current frameworks fail to address climate-related challenges and vulnerabilities within urban environments adequately.

Sharma and Miyazaki (2019), Menteşe et al. (2023), and Taylor, Siame, and Mwalukanga (2021) have elucidated the influence of various natural risks on decision-making processes pertaining to urban planning endeavors. Sharma and Miyazaki (2019) devised a methodology for using multi-hazard maps to facilitate informed decision-making on risk in urban planning and land-use development in Papua New Guinea. According to the authors, the use of this technique enables urban planners to assess the vulnerability of potentially appropriate locations to natural disasters. According to Sharma and Miyazaki (2019), the use of maps that provide spatial data on the occurrence of natural risks, such as landslides, floods, and earthquakes, is crucial for planners and environmental managers in their decision-making process on the selection of suitable areas for land-use development. In a related study conducted by Menteşe et al. (2023), the authors focused on Tomorrowville, an urban testbed designed to simulate urban environments resembling Nairobi (Kenya) and Kathmandu (Nepal). The study put forth an extensive data framework for future exposure, aiming to enhance the connection between conventional urban planning methods and proactive decision support systems that prioritize the well-being of individuals in the face of disaster risks. According to Menteşe et al. (2023), the authors presented four levels, namely land use, structures, homes, and people, and found that natural risks have an adverse impact on all of these layers. The potential consequences of these risks on the four aspects above may pose problems to the well-being of residents and have implications for the economic landscape of the region. The technique proposed by Menteşe et al. (2023) has the potential to enable urban planners to effectively identify and use both present and future risk scenarios, hence facilitating the process of urban planning and design. Another study by Taylor, Siame, and Mwalukanga (2021) has also focused on climate risks that are involved in strategic urban planning in the context of Zambia. The authors have also indicated that it is important to integrate climate considerations into high-level city planning to ensure effective decision-making. Taylor, Siame, and Mwalukanga (2021) also mentioned that it is important to collaborate to share information related to climate risks, have stakeholder engagement, and have a regulatory framework to manage these risks. A study by De Lotto et al. (2016) has also indicated that the impact of natural risks on society and the economy is magnified in urban settings and are susceptible to high-risk occurrences. Consequently, such disasters provide a heightened risk in relation to the potential exposure of the populace and the susceptibility of their physical and economic resources. De Lotto et al. (2016) indicated that

urban planning considers natural risks to mitigate their adverse effect and improves the capacity of metropolitan areas to withstand and recover from various risks.

Other studies have focused on specific natural risks and how these are important to be considered in urban planning projects. For instance, Cremen, Galasso, and McCloskey (2022) have focused on earthquake risk, and Löwe et al. (2017) have focused on flood risk. In the study conducted by Cremen, Galasso, and McCloskey (2022), the authors developed a framework that could be leveraged to determine the optimum among a set of potential earthquake risk-reduction policies, considering the risk dimensions of interest to stakeholders and a multitude of uncertainties inherent in future projections of urban landscapes. Also, such approaches may be leveraged to support decision-making on urban planning/design and related policies, accounting for varied stakeholders' perspectives and priorities around the concept of risk (Cremen, Galasso, & McCloskey, 2022). In another study, Löwe et al. (2017) also developed a framework but for flood risks. Löwe et al. (2017) also found that flood risks are an important consideration in urban planning as they can prevent land and property damage. The authors also indicated that effective urban planning policies are an efficient measure to reduce flood risk. Also, master planning control of future development, gradual implementation of measures throughout the catchment, development of zoning allowing dynamic feedback mechanisms from increasing risks into city development, and a one-off investment in increasing infrastructure are some significant measures to control flood risks that can be considered in urban planning (Löwe et al., 2017).

One of the studies (Rosa, Santangelo, & Tondelli, 2021) presented a very interesting viewpoint that was related to the impact of natural risks on the urban planning of cultural sites. A study conducted by Rosa, Santangelo, and Tondelli (2021) in the context of Italy with the case of the cultural heritage site of the Santa Croce Church identified how changes in climate conditions are affecting the cultural and heritage sites. The authors indicated that urban planning projects and tools must be integrated with cultural heritage risk management to reduce the adverse effects of these risks on the sites.

In the realm of decision-making, urban areas need to create rigorous rules in order to guarantee the resilience of buildings against natural risks. In addition, it is essential to establish efficient disaster response procedures and allocate resources towards the development of early warning systems in order to safeguard the well-being of individuals and mitigate the extent of destruction. The actions implemented have a significant influence on the expansion of metropolitan areas. On the other hand, the implementation of proactive actions aimed at mitigating these risks may effectively save human lives and valuable assets, sustain economic equilibrium, and foster investment opportunities. The sustainable development of urban areas is contingent upon the implementation of urban planning that emphasizes measures aimed at mitigating risks and creating resilience. This approach enables cities to prosper and flourish despite environmental constraints.

### 4.2 ENVIRONMENTAL RISKS

The terms natural risks and environmental risks might seem similar, but they are different in this area of research as per the thematic analysis. Natural risks are related to climate change those, but environmental risks are more related to a range of challenges related to the natural and built environment, pollution, and sustainability. For instance, Chaiechi (2020) has outlined that rapid urbanization has led to increased environmental risks that have an impact on infrastructure and natural habitats, making sustainable urban development crucial. Chaiechi (2020) underscores the importance of environmental risks and climatic considerations in urban planning research. It calls for a comprehensive and modern approach that incorporates regional climate data and socioeconomic factors, especially in tropical regions. The research encourages collaboration between researchers and practitioners to address the evolving challenges in urban sustainability, considering the environmental risks that urbanization brings.

In another study by Duan, Wang, Fan, Xia, and de Groot (2018), the authors investigate the perceptions of urban green infrastructure users in Guangzhou regarding the impacts of environmental risks, including poor air quality, flooding events, and high temperatures, on human environmental well-being. The findings indicate that these environmental risks significantly affect various aspects of well-being, emphasizing the importance of addressing them in urban planning. Duan, Wang, Fan, Xia, and de Groot (2018) recommended involving urban green infrastructure users in the planning and design of green spaces. Urban planning should prioritize urban green infrastructure and involve users in the planning process to create more resilient and livable cities.

Decision-making may include the implementation of regulations aimed at controlling pollution, the formulation of land use plans that foster the creation of green spaces and mitigate environmental conditions, as well as the establishment of sustainable mobility alternatives such as public infrastructure. These choices play a crucial role in the development of cities that prioritize ecological responsibility and enhance the overall well-being and livability of their citizens. The significance of mitigating environmental risks is considerable since municipalities that proficiently handle these risks often draw investment, cultivate economic expansion in sustainable sectors, and enhance the overall well-being of their residents. Urban planners have a crucial role in formulating policies and implementing projects that effectively reconcile economic expansion with environmental sustainability and public health, thus contributing to the enhancement of urban areas in the long term.

### 4.3 SOCIAL RISKS

Social risks within the realm of urban planning involve a diverse array of obstacles that have an impact on the welfare, standard of living, and social cohesion of urban societies. These risks include a range of manifestations, such as concerns pertaining to public health, disparities in social equity, the cohesiveness of communities, and the availability of fundamental services. Within the realm of urban planning, the significance of these risks cannot be overstated since they have a substantial effect on the decision-making processes undertaken by decision-making authorities and urban planners. Numerous scholars have directed their attention toward the examination of social risks inherent in urban planning, which have the potential to impede the progress of such initiatives. For instance, Revich (2022) examined many dimensions of urban planning and their connection to social risks in the context of Russia. The author emphasized that the fundamental purpose of Russian urban planning does not prioritize the creation of an effective urban environment, with rules often influenced by developers. According to Revich (2022), there is a growing trend of population density in major urban areas, accompanied by a lack of specific crucial metrics in Russian assessments of sustainable urban development, such as the presence of fine particulate matter in the atmosphere. This situation highlights the need to prioritize improvements in urban planning practices. In addition, the author offers a critical analysis of the inadequate incorporation of hygienic evaluations within the frameworks of "smart cities" and "healthy cities," advocating for a more holistic approach to urban planning that takes into account public health considerations and the provision of green spaces. The study also examined the COVID-19 pandemic and explored the correlation between urban environmental variables, such as air pollution and population density, and the transmission of COVID-19 (Revich, 2022). The study emphasized the need to do more in-depth research on these aspects in order to establish preventive measures aimed at safeguarding the well-being of urban people and comprehending the importance of air quality and green areas inside urban environments.

In the study conducted by Xue (2014), an exploration was undertaken to examine the correlation between eco-villages, also referred to as urban villages, and the notion of degrowth within the context of urban planning. Xue (2014) also underscored the dual influence of place, including both environmental and social dimensions. The observation highlighted that eco-villages serve to advance certain social frameworks and principles while also imposing limitations on personal autonomy and liberty, which might conflict with the ideals of a degrowth society. Xue (2014) emphasized the capacity of urban planners to serve as proponents and implementers of degrowth principles via the development of strategies that prioritize both environmental preservation and social sustainability. Xue (2014) recognized the intricate nature of addressing the existing unsustainable urban development practices and emphasized the need for planners to strategically collaborate with stakeholders that share similar perspectives via constructive discourse and the establishment of consensus.

### 4.4 OTHER RISKS

Apart from the above-identified risks, some researchers have focused on multiple risks involved in urban planning. According to Valtonen et al. (2015), extensive urban development initiatives often span many decades and include substantial expenditures from both private and governmental sectors. The authors conducted a comparative analysis of Finland, the Netherlands, and the UK since these nations exhibit distinct planning and development approaches and possess divergent systems. The presence of diverse financial risks is a significant obstacle for urban planning initiatives across various nations due to variations in regulatory frameworks. Ongkowijoyo, Doloi, and Gurmu (2020) conducted the study in the context of urban infrastructure systems, specifically related to water infrastructure, and identified the risks involved. The authors identified various risks that are involved. For example, natural risks, such as climate change, water shortage, and pollution; social risks, such as water supply and demand, water misuse, limited access to water, and population; political risks, such as uncertain political conditions, poor policies and regulations; technical and operational risks, such as maintenance, poor water quality, defects in devices, and challenges related to water distribution; economic risks, such as uncertain water costs, inflation, exchange rates, and other sub-categories of risks can hinder the urban infrastructure creating challenges for the urban planning and its related decision-making (Ongkowijoyo, Doloi, & Gurmu, 2020). In a study conducted by Saaty and De Paola (2017), the authors also indicated various priority elements in the risk model, which were technological, social, environmental, and financial risks. The authors also indicated that future research must consider design and urban planning and include these risks and other elements for a better system. Renn and Klinke (2013) developed a risk governance framework to address various risks related to urban planning. The authors also indicated that the use of the analytical differentiation of risk characteristics, namely complexity, uncertainty, and ambiguity, serves to provide a comprehensive approach toward risk governance and urban planning.

Two articles, Zhou and Liu (2012) and Zhao and Liu (2016), have specifically focused on 'urban major hazards' that have guided the risk management framework in these articles. Zhou and Liu (2012) focused on examining the potential dangers linked to significant hazards, such as dangerous goods, technical risks, and natural risks, and further incorporating these variables into feasible land-

use safety planning is a viable approach to safeguarding urban areas. This strategy aids in managing the risks related to major accidents, improving the precision and practicality of emergency response plans, and fostering urban planning projects (Zhou & Liu, 2012). Zhao and Liu (2016) also evaluated the regional risks of major hazards, such as urbanization, time-related risks, legal risks, and financial risks for ensuring public safety, which is also an important aspect of urban planning.

It can be observed that there are various infrastructural, design, technical, and operational, among many other risks related to urban planning are involved that can significantly influence the growth and decision-making of urban planning projects.

In summary, the study's findings highlighted a broad spectrum of risks associated with urban planning, including natural, environmental, social, and various other complex risks that affect decision-making and hinder urban development. Practical applications of this research are crucial for policymakers, urban planners, and other stakeholders to enhance urban resilience and sustainability. Policymakers and urban planners can leverage hybrid risk assessment models that combine traditional methods with advanced technologies such as GIS and AI, enabling more accurate risk predictions and informed decision-making. Climate adaptation strategies, such as integrating green infrastructure like parks, green roofs, and urban forests, are essential for mitigating the impacts of extreme weather events and promoting environmental sustainability. Engaging local communities in the planning process ensures that development projects meet the needs of all residents, preventing gentrification and promoting social equity. This can be achieved through community workshops and surveys to gather input on proposed projects. Additionally, developing resilient financial strategies that include diverse funding sources and transparent public-private partnerships is vital for economic stability. The use of big data analytics and real-time monitoring systems can optimize public services and infrastructure management, while designing flexible infrastructure that can be easily modified or upgraded enhances resilience against various risks. Policymakers should implement regulatory frameworks that mandate the inclusion of risk assessments in urban planning projects and provide funding for sustainable infrastructure initiatives. Urban planners should utilize advanced risk assessment tools and engage communities to address their needs effectively. By applying these recommendations, stakeholders can create more resilient, sustainable, and inclusive urban environments, addressing the complex risks identified in the study. To provide a clearer understanding of how these risks impact decision-making, an 'in-progress' matrix has been developed to map these types of risks to specific ways they hinder urban planning processes Table 4.

| TYPE OF RISK | SPECIFIC RISKS | HOW THEY HINDER DECISION-MAKING |
|---|---|---|
| **Natural Risks** | Floods | Create uncertainties in land-use planning. |
| | Earthquakes | Require costly infrastructure adaptations. |
| | Extreme weather events | Disrupt construction schedules and increase maintenance costs. |
| | Climate change | Necessitate long-term adaptive strategies, complicating immediate plans. Increase the need for comprehensive risk assessments and disaster preparedness plans. |
| **Environmental Risks** | Pollution | Impact public health, requiring changes to zoning and land-use policies. |
| | Loss of biodiversity | Necessitate the integration of green spaces, which can limit development areas. |
| | Sustainability challenges | Demand sustainable building practices, increasing initial project costs. Introduce the need for ongoing environmental monitoring and mitigation efforts. |
| **Societal Risks** | Social equity issues | Require inclusive planning processes, potentially slowing decision-making. |
| | Public health concerns | Necessitate health impact assessments, adding to project complexity. |
| | Community cohesion | Require balancing diverse stakeholder interests, complicating consensus building. |
| | Gentrification and displacement | Mandate affordable housing policies, affecting project feasibility and design. |
| **Other Complex Risks** | Technological failures | Increase the need for robust infrastructure, raising costs and complexity. |
| | Financial instability | Introduce funding uncertainties, affecting project timelines and scope. |
| | Governance issues | Governance issues |
| | Political instability | Create unpredictability in policy frameworks, affecting long-term planning. |
| | Public-private partnerships | Require clear accountability and transparency, complicating project management. |

**Table 4** In-Progress Matrix Mapping Types of Risks to Decision-Making Challenges in Urban Planning.

## 5 CONCLUSION AND FUTURE RECOMMENDATIONS

The present study has identified a range of risks associated with urban planning initiatives, including ecological, environmental, social, and other diverse issues. The scoping study has yielded some suggestions for future scholars and practitioners. Interdisciplinary cooperation has substantial potential to provide considerable benefits for urban planning research. Researchers need to persist in their interdisciplinary efforts, spanning diverse fields like environmental science, economics, social sciences, and technology, in order to cultivate comprehensive resolutions for urban predicaments. It is essential to prioritize the advancement and implementation of sophisticated risk assessment methods and frameworks, as they play a pivotal role in comprehending and managing urban dangers with efficacy. In light of the increasing occurrence of natural risks and climate-related risks, as well as the extensive literature on this subject matter, academics must prioritize the investigation of resilience and adaptation measures. In addition to the aforementioned measures, policymakers need to prioritize the development of resilient infrastructure, early warning systems, and climate change adaptation strategies in order to address and mitigate these risks effectively. Researchers need to maintain a strong focus on highlighting the significance of data-driven decision-making in the context of urban planning. This emphasis is crucial since the process of collecting, analyzing, and visualizing data effectively plays a pivotal role in facilitating well-informed decision-making. In addition to natural and environmental risks, future academics need to direct their attention towards other types of risks, including technical, operational, political, and economic risks. These risks, too, have a detrimental influence on the decision-making processes associated with urban planning projects. Frequent occurrences of these dangers might pose significant damage to urban project efforts. Researchers need to undertake an in-depth exploration of financial risk management within the realm of urban planning. This entails the formulation of robust financial planning techniques, a comprehensive understanding of economic volatility, and the efficient allocation of resources. Future research in the field of urban planning should prioritize the exploration and analysis of various risks and difficulties that urban areas face. This exploration should be conducted via an interdisciplinary approach, fostering cooperation across different fields of study. Additionally, future research must develop and use novel techniques for assessing risks in urban planning. Emphasis should also be placed on enhancing the resilience and sustainability of urban areas, as well as promoting social inclusion. Lastly, future research should aim to establish effective policy frameworks that can effectively handle the risks and challenges faced by urban areas. By giving priority to these domains, academics have the potential to make significant contributions towards the advancement of urban settings that are more resilient, sustainable, and inclusive.

## COMPETING INTERESTS

The authors have no competing interests to declare.

## AUTHOR AFFILIATIONS

**Salhah Sulaiman Alhassani** orcid.org/0009-0008-3635-6910
University of Sharjah, College of Engineering, Industrial Engineering, UAE

**Radhi M. Alzubaidi** orcid.org/0000-0003-2807-2826
University of Sharjah, College of Engineering, Civil Engineering Department, UAE

**Aseel Ali Hussien** orcid.org/0000-0001-7446-5503
University of Sharjah, College of Engineering, Architectural Engineering Department, UAE

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**TO CITE THIS ARTICLE:**
Alhassani, SS, Alzubaidi, RM and Hussien, AA. 2024. Navigating Uncertainties: A Scoping Review of Risks in Urban Planning. *Future Cities and Environment*, 10(1): 10, 1–14. DOI: https://doi.org/10.5334/fce.230

**Submitted:** 03 December 2023 **Accepted:** 21 May 2024 **Published:** 06 June 2024