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Building Urban Resilience through Mega-Events: A Systematic Review using Text Mining and Natural Language Processing (NLP)

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Abstract

This research aims to investigate the relationship between urban resilience and urban mega-events and to gain a deeper understanding of the ways in which effective planning, sustainable development, and social capital can be utilized to enhance urban resilience. The research will seek to explore how urban mega-events can be planned in ways that not only have significant economic impacts but also promote strategies for enhancing resilience in cities. To investigate the relationship between urban resilience and mega-events, a systematic review of the existing literature (2500 articles) was carried out. To investigate the relationship between urban resilience and mega-events, a systematic review of 2,500 articles was conducted. However, it should be noted that the limitations of qualitatively reviewing such a large number of publications must be acknowledged. Therefore, the review process involved differentiating between keyword analysis and systematic literature analysis for identifying success factors and good practices.

Subsequently, eleven articles on different aspects of urban resilience and mega-events were subjected to lexical analysis (text mining) in order to measure and quantify the sentiment expressed in the articles. It is acknowledged that the number of articles included in the corpus is limited to 11. However, efforts have been made to ensure that the sample is representative of the wider corpus, with articles selected according to the following criteria: theme, keywords, and bibliometric search results.

A hierarchical analysis was also employed to group the articles into comparable groups. The results of this analysis provided a more comprehensive understanding of the prevailing views on urban resilience, the implications of mega-events on urban areas, and potential strategies for enhancing the resilience of cities.

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1. Introduction

As evidenced by pertinent literature, urban mega-events are ephemeral, large-scale events, such as the Olympic Games and world exhibitions, that invariably exert a profound impact on urban areas. They alter the priorities of urban agendas, initiate discussions about post-event usage, frequently stimulate urban redevelopment, and serve as instruments of inspiring ideas that promote economic growth (Müller, 2014). Notable examples of urban mega-events include the Shanghai 2010 World Expo, the London 2012 Olympic Games, and the 2014 FIFA World Cup. The impact of urban mega-events on urban resilience is contingent upon a number of variables, including the context, management, and governance of the events themselves (Viehoff & Poynter, 2015).

This research endeavors to elucidate the multifaceted relationship between urban resilience and urban mega-events, with a primary focus on understanding how these events can tangibly and intangibly transform urban development, planning processes, and urban fabric. The objective of this research is to elucidate how effective planning, sustainable development, and social capital can be harnessed to bolster a city's capacity for resilience in the face of the challenges and opportunities presented by mega-events. To enhance our analysis, we draw upon a diverse array of literature, providing a comprehensive backdrop for the cases examined.

While urban mega-events offer cities unparalleled opportunities for economic growth, infrastructure enhancement, and international recognition, they also present complex problems that require careful consideration. It is noteworthy that these mega-events are often top-down policies, master-planned, and often guided by investor interests. This raises questions about their compatibility with participatory planning and integrated development (Müller, 2015). Consequently, it is imperative to assess the transformative impact of urban mega-events on planning processes and urban structures.

The objective of this inquiry is to identify the potential trade-offs and synergies between urban mega-events and urban resilience, with a particular emphasis on their transformative impact on urban development, planning, and social fabric. Through a comprehensive analysis of mega-events and urban resilience, we aim to provide urban planners, policymakers, and stakeholders with a detailed understanding of the relationship between the two, enabling them to make informed decisions related to sustainable development and transformative urbanism. Furthermore, our work aims to contribute to the expansion of research investigating the intersection between mega-events and urban resilience in the twenty-first century, particularly in light of the rise of event-based urbanization and its implications.

In order to achieve this objective, we employ a combination of qualitative and quantitative methodologies, drawing upon a vast corpus of literature and case studies.

An examination of the relationship between urban mega-events and urban resilience is crucial because it can assist in the comprehension of the intricate and evolving impacts of these events on the host cities and their inhabitants. Urban mega-events can be viewed as opportunities for urban regeneration, economic growth, social and cultural development, and environmental improvement. However, they can also present challenges and risks, including social and economic displacement, increased pollution and traffic congestion, environmental degradation, and the exacerbation of existing vulnerabilities and fragilities in cities (Mair, Smith, 2021).

By investigating the impact of urban mega-events on urban resilience in diverse contexts and scales, we can identify optimal practices and strategies for planning and managing these events in an effective and sustainable manner, while also mitigating or avoiding their adverse effects. (Sánchez, Broudehoux, 2013) An examination of the relationship between urban mega-events and urban resilience can also assist in the critical thinking required to determine the role and responsibility of events in addressing the global issues of the century, such as climate change, poverty, inequality, and social justice. The objective of this paper is to examine the intricate relationship between urban mega-events and urban resilience, as well as the multifaceted impacts and opportunities that these events present for urban resilience..[1]

2. Literature Review

2.1. Definitions of urban resilience

Resilience is a concept that can help us understand complex issues related to sustainability and vulnerability, especially in highly dynamic and complex social systems like cities. However, the term resilience has different meanings and interpretations in different fields and domains, which creates confusion and inconsistency.

The meaning of resilience, and by extension, urban resilience, is not clear or agreed upon. Many publications have tried to address this debate. Some words in the resilience definition are often vague. The lack of a common definition makes it hard to apply or measure resilience in urban areas that are constantly changing (CSIS, 2014). This table shows some definitions of resilience from scholars in urban studies disciplines, highlighting how the concept has developed to cover multidimensional processes, dynamic adaptation and transformations involving a variety of actors and systems.

Table 1. Evolution of Urban Resilience Definitions

Author and date	Definition
Sharifi and yamagata (2016)	Urban resilience assessment is a process of measuring and evaluating the resilience of an urban system based on multiple dimensions, criteria, and indicators that reflect the characteristics and performance of the system under various scenarios
Yang, Clemente, Laffréchine; Heinzlef, Serre Barroca(2018)	Urban resilience refers to the ability of an urban system to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity.
Ribeiro and Gonçalves (2019)	Urban resilience is the capacity of a city and its social, economic, natural, human, technical, and physical subsystems to absorb damage, reduce impacts (i.e., changes, tensions, destruction, or uncertainty) from disturbances (e.g., shock, natural disaster, changing weather, disasters, crises or disruptive events), and adapt to changes in systems that limit its current or future adaptive capacity.
Chelleri and baravikova (2021)	Urban resilience is a dynamic process of adaptation and transformation that emerges from the interactions between multiple actors and systems across different scales and domains in response to disturbances and long-term changes.
Kapucu, Ge, Martin and williamson (2021)	Urban resilience refers to a multidimensional dynamic process among stakeholders aiming to prepare and adapt the urban environment to absorb and recover from external and internal disturbances and reduce urban vulnerabilities.

2.2. Definitions of Mega Event

Table 2. Evolution of mega-event definitions: Increasing scale and impact

Author	Definition
Arneger, Herz (2016)	Mega-events are "large-scale leisure events which have a major impact on their social context" and which "are typically planned, organized, and manipulated by powerful elites for their interests."
Grix, lee, branaggan 2019	Mega-events are “large-scale cultural (including commercial and sporting) events which have a dramatic character, mass popular appeal and international significance.”
Byers, hayday, pappous 2020	Mega-events are defined as “ambulatory occasions of a fixed duration that attract a large number of visitors, have a large mediated reach, come with large costs and have large impacts on the built environment and the population”.
Ludvigsen 2021	Mega-events are “hallmark events of international status or events so large that they affect whole economies.”
Ninov, dut, AlHallaq 2022	Mega-events are “major one-time or recurring events of limited duration, developed primarily to enhance the awareness, appeal and profitability of a tourism destination in the short and/or long term.”

The table reveals the evolution of the definition of mega-events over time, illustrating how it has progressively encompassed larger scale and broader implications.

In recent years, researchers (e.g. Ninov et al, 2022) have highlighted that mega-events, which includes significant one-time or regular occurrences, are making a major impact on both travel destinations and their profitability. These events are beneficial in increasing the fame of a region while boosting income over a long period of time.

The concept of mega-events has evolved over time as these events increase in themselves, gaining global exposure and economic impact. Originally seen as major sporting occasions, such as the Olympics or World Cup, the definition has now widened to include national events with significant cultural, economic or political implications. Definition of mega-events now encompasses an extensive range of occasions, ranging from the Olympic Games to city-wide world fairs or the G20 summit. By nature, mega-events can have a transformative effect on the area they take place in, usually bringing immense opportunities for development or big investments, as well as social, environmental and economic impacts. Mega-events also align with current geopolitical frameworks, and can reflect digital advancements and innovative visions. As the scale, implications, and international significance of these events increase, their importance and potential for meaningful changes is undeniable.

The complex nature of consistently defining mega-events can make their application in practice and their theoretical testing challenging. Given the divergent definitions used in various studies, comparing findings, extrapolating results, and establishing a coherent framework for the examination of mega-events under scrutiny all present challenges. However, not discouraged by these difficulties, researchers and academics have been diligently investigating the nuanced facets of mega-events, seeking a deeper understanding of their multiple impacts. One area receiving particular attention is the significant economic implications of mega-events. By exploring in detail the direct and indirect financial repercussions of hosting these colossal spectacles, researchers have produced a comprehensive picture that includes increasing tourist flows, growing employment opportunities, expansive infrastructure, and enhanced business prospects.

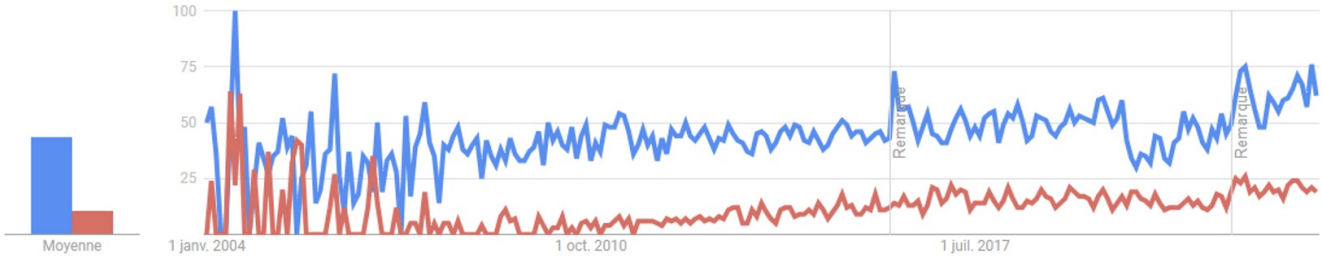

Figure 1. Evolution of the interest in “URBAN EVENT”(blue) and “URBAN RESILIENCE” (red) since 2004. (Google trends, 2023)

Table 3. Correlation matrix of the Google Data from 1/2004 – 07/2023

	URBAN RESILIENCE	URBAN EVENT
URBAN RESILIENCE	1	0.332
URBAN EVENT	0.332	1

The correlation between "Urban Resilience" and "Urban Event" is approximately 0.332, suggesting a weak positive correlation. This means that there is some association between the two variables, though it is not very strong.

It is crucial to understand that correlation does not necessarily mean causation. There may be a relationship between urban resilience and urban events, but one may not necessarily be causing the other. It could be a result of other external or internal factors.

To uncover what is causing the association between the two variables, further research and exploration is necessary. Further evaluation may ultimately reveal the specific influences on urban resilience and urban events.

Distance Matrix - Orange

	2004-01-01	2004-02-01	2004-03-01	2004-04-01	2004-05-01	2004-06-01	2004-07-01	2004-08-01	2004-09-01	2004-10-01	2004-11-01	2004-12-01	2005-01-01
2004-01-01		1,829	0,760	2,713	2,713	4,772	3,170	4,734	0,137	2,714	2,644	0,502	0,877
2004-02-01	1,829		2,121	3,573	3,573	3,021	2,338	3,067	1,856	3,573	1,937	1,991	2,184
2004-03-01	0,760	2,121		1,953	1,953	4,815	3,840	4,699	0,654	1,954	2,293	0,287	0,151
2004-04-01	2,713	3,573	1,953		0,010	5,435	5,668	5,151	2,605	0,063	2,470	2,226	1,847
2004-05-01	2,713	3,573	1,953	0,010		5,435	5,668	5,151	2,604	0,052	2,470	2,226	1,846
2004-06-01	4,772	3,021	4,815	5,435	5,435		4,214	0,494	4,770	5,435	2,966	4,786	4,831
2004-07-01	3,170	2,338	3,840	5,668	5,668	4,214		4,505	3,263	5,668	4,264	3,597	3,939
2004-08-01	4,734	3,067	4,699	5,151	5,151	0,494	4,505		4,721	5,150	2,697	4,697	4,704
2004-09-01	0,137	1,856	0,654	2,605	2,604	4,770	3,263	4,721		2,604	2,581	0,381	0,761
2004-10-01	2,714	3,573	1,954	0,063	0,052	5,435	5,668	5,150	2,604		2,469	2,224	1,845
2004-11-01	2,644	1,937	2,293	2,470	2,470	2,966	4,264	2,697	2,581	2,469		2,395	2,258
2004-12-01	0,502	1,991	0,287	2,226	2,226	4,786	3,597	4,697	0,381	2,224	2,395		0,380
2005-01-01	0,877	2,184	0,151	1,847	1,846	4,831	3,939	4,704	0,761	1,845	2,258	0,380	
2005-02-01	3,030	1,898	2,803	3,124	3,124	2,314	4,116	2,045	2,984	3,123	0,656	2,861	2,784
2005-03-01	0,827	2,155	0,136	1,902	1,902	4,823	3,890	4,701	0,708	1,900	2,274	0,327	0,058
2005-04-01	0,722	2,097	0,146	2,011	2,011	4,809	3,792	4,698	0,601	2,008	2,310	0,221	0,166
2005-05-01	1,504	0,432	1,731	3,194	3,193	3,289	2,610	3,283	1,509	3,192	1,761	1,607	1,783
2005-06-01	0,622	2,045	0,226	2,121	2,120	4,797	3,695	4,697	0,497	2,117	2,351	0,125	0,276
2005-07-01	2,415	0,940	2,430	3,378	3,378	2,399	3,131	2,329	2,397	3,376	1,217	2,392	2,447
2005-08-01	4,147	3,376	3,694	3,135	3,134	3,081	5,628	2,635	4,074	3,132	1,540	3,841	3,634
2005-09-01	3,282	2,115	3,046	3,280	3,280	2,187	4,287	1,880	3,234	3,277	0,842	3,107	3,022
2005-10-01	1,054	2,288	0,336	1,692	1,691	4,861	4,090	4,718	0,932	1,686	2,219	0,552	0,188
2005-11-01	0,355	1,805	1,052	2,990	2,990	4,789	2,946	4,778	0,407	2,987	2,809	0,768	1,144
2005-12-01	1,968	2,949	1,213	0,788	0,785	5,118	4,949	4,891	1,851	0,773	2,209	1,470	1,091
2006-01-01	1,647	2,699	0,898	1,107	1,105	5,010	4,643	4,811	1,528	1,096	2,169	1,147	0,770
2006-02-01	0,803	2,136	0,240	1,967	1,965	4,819	3,845	4,702	0,675	1,960	2,296	0,308	0,174

Table 4. Distance matrix of the Google Data from 1/2004 – 07/2023 (partial extract)

Distance matrix can show significant changes or transitions in urban resilience or urban events may be visible as large distances in the matrix. These points can help identify critical periods where events significantly impacted urban resilience or vice versa.

By comparing the distance matrix with the correlation matrix, we can identify if there are any correlations between the two.

If certain time points have high correlation values and low distance values, it suggests that urban resilience and urban events are related during those periods.

we notice some dates that have interesting coefficients like 01/05/2004 with the coefficient of 0.01 searching for the event corresponding to the date we find The International Conference for Renewable Energies that is a conference organized from June 1 to June 4, 2004, in Bonn, Germany by various UN member countries, following the World Summit on Sustainable Development in Johannesburg, South Africa.

Continuing our analysis of this time series, we find the coefficients of 0.093 on 01/11/2016 in second place, corresponding to the series of earthquakes that struck central Italy, devastating the region's often ancient heritage. According to an initial estimate by the authorities, some 5,000 sites have suffered varying degrees of damage.

This shows us that although the correlation index is low 0.332, the distance matrix shows that the coefficients show significant events for both variables (event and urban resilience) this could be an interesting approach to the time series methodology and probably to eventual prediction models for time series.

2.3. Influential publications in urban resilience and mega-events in literature: an overview with the biliometric analysis

The essential skill of bibliometric analysis lies in its ability to reveal the complexity of scholar papers by unraveling the transmission of knowledge, intellectual networks, and the evolution of research fronts. By meticulously examining citation and co-citation networks, co-authorship networks, and bibliographic coupling, researchers can uncover vital information about the dynamics of scientific communities, the impact of research publications, and the emergence of paradigm-shifting ideas.

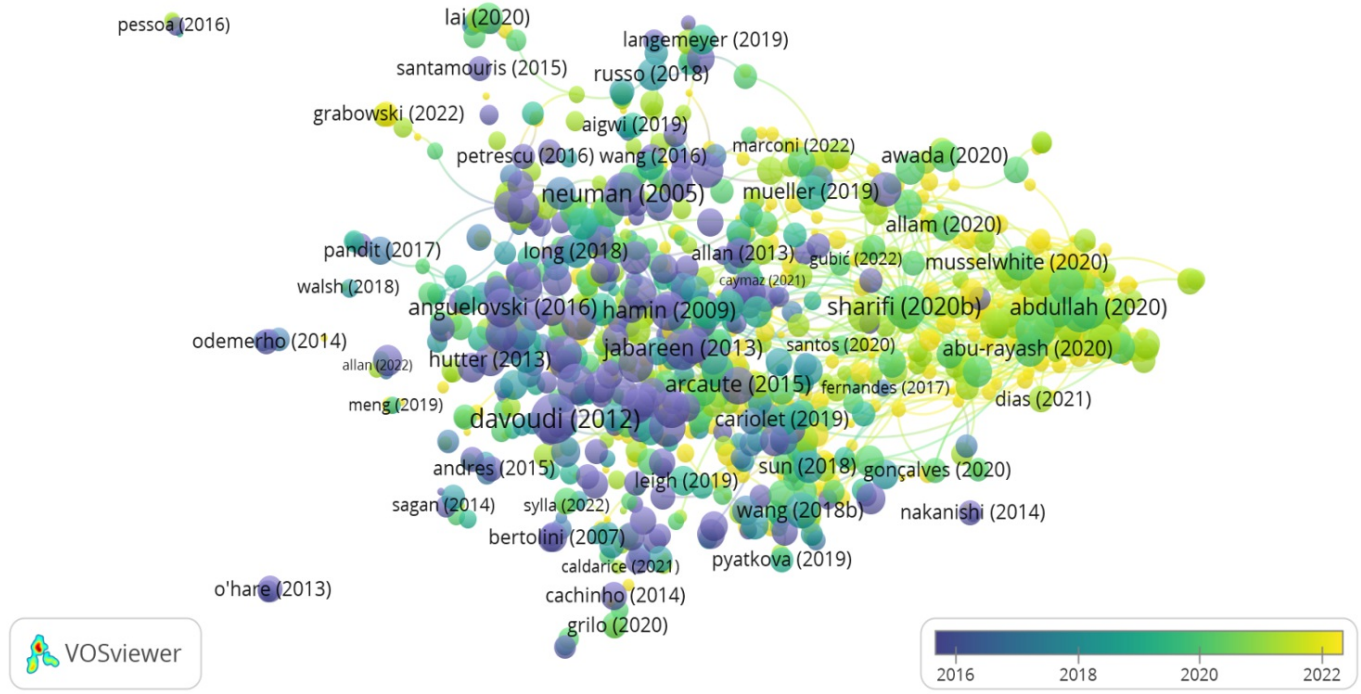

Figure 2. *Influential publications in the urban resilience literature: by VOSviewer (the author, 2023)*

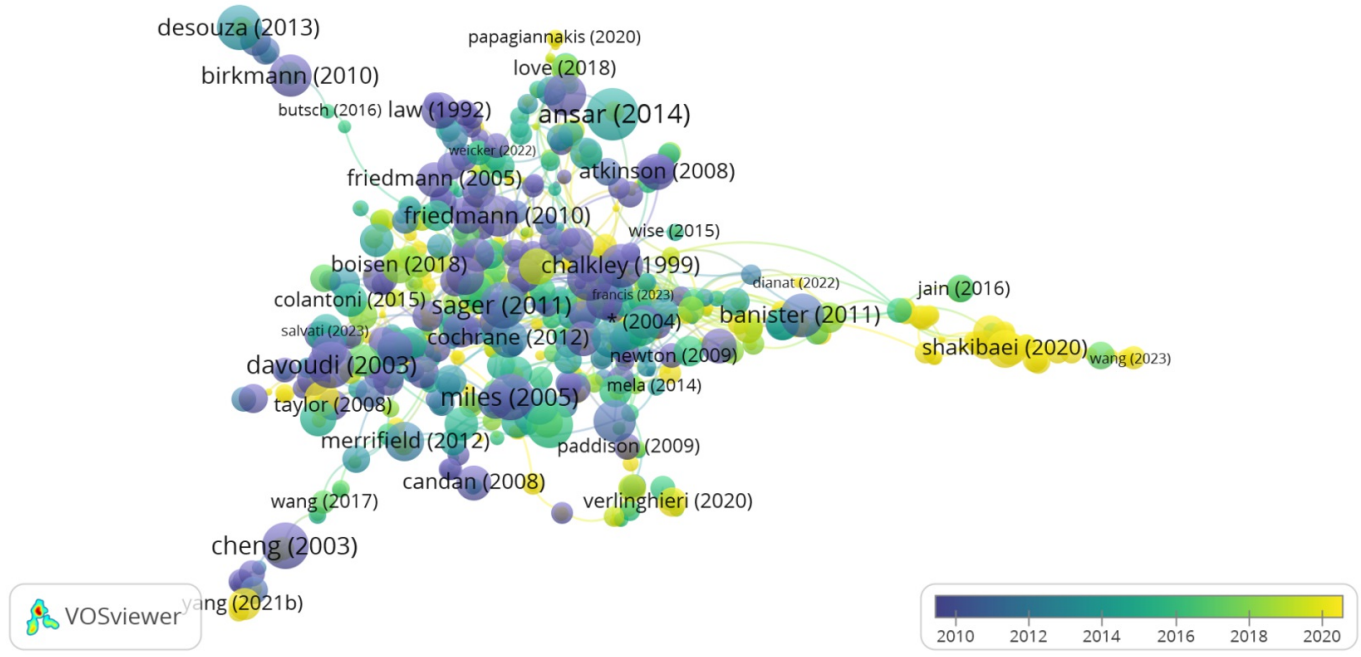

Figure 3. *Influential publications in the Mega Event literature: by VOSviewer (the author, 2023)*

The co-citation network of urban resilience literature and mega-events in the "dimensions" database is a fascinating way to visualize the influential publications that have shaped the discourse on this topic. (More than 5000 articles are used in this simulation.) The figure uses circles (nodes) to represent references cited in the literature and lines (edges) to show co-citations, meaning two references are cited together. The bigger the node, the more connections it has. The colors

show communities of related publications, revealing thematic clusters.

The figure labels the most important nodes (degree > 45) with the lead author's name, initial, and year. This helps identify key references quickly. The figure uses the VOSviewer algorithm to arrange the nodes so that closer relationships are more visible.

This visualization helps researchers see the complex interconnections between publications in urban resilience and mega event literature. It also helps them find prominent works, thematic clusters, and the intellectual landscape of urban resilience.

2.4. Selected publications in the urban resilience and Mega-Events in literature

The selection of the 11 papers was made after a bibliometric analysis (graph analysis) of the most influential authors and according to citations. The number of papers was limited to 11 by selecting themes that cover all the fields that contain our key themes: urbanism, resilience, evenement, tourism.

Table 3. Literature review 2015-2023 (keywords:urban resilience, Events, Tourism), (the author, 2023)

Name of the article	Date of publication	Author name	Field of study	Topic of the article
COVID-19 Pandemic: Rethinking Strategies for Resilient Urban Design, Perceptions, and Planning	2021	Safin et al	Urban planing	difficulty to assess various changes to develop urban planning and design in the post-COVID-19 world
Urban resilience: A conceptual framework	2019	Ribeiro and Pena Jardim Gonçalves	Urbanism	How urban resilience can be defined, measured, and improved by urban planning
The application of resilience theory in urban development: a literature review	2022	Kong, Mu, Hu, Zong	Environmental science	How resilience theory can be used to understand and assess the impacts and outcomes of urban development
What makes an event a mega-event? Definitions and sizes	2015	Müller	Leisure studies	How mega-events can be defined and classified based on four dimensions
Geodesign, Resilience and the Future of Former Mega-Event Sites	2018	Minner	Urban planning	How geodesign can be used to transform former mega-event sites into resilient and sustainable urban parks
Resiliency Assessment of Road Networks during Mega Sport Events: The Case of FIFA World Cup Qatar 2022	2021	Serdar, Al-Ghamdi	Sustainable Development	The article discusses the importance of assessing the resilience of road networks during Mega Sport Events (MSEs) to ensure their success and create a lasting positive legacy.
Glocal Tourism and Resilient Cities: The Case of Matera "European Capital of Culture 2019	2019	Ivona, rinella, rinella	Sustainable Development	Matera's experience as the European Capital of Culture in 2019 and The city's ability to merge local cultural heritage with global tourism trends and its commitment to revitalization and sustainability

Defining urban resilience: A review	2020	Meerow, Nowell, Stults	Landscape and Urban Planning	This paper reviews the scholarly literature on urban resilience and concludes that the term has not been well defined
Urban Infrastructure Resilience Assessment During Mega Sport Events Using a Multi-Criteria Approach	2021	Serdar, Al-Ghamdi	Sustainable Development	This paper propose the development of a multi-criteria-based integration approach that can allow the combination of different evaluation results from different assessment methods that ensure that the infrastructures are suitable for hosting mega sports events. and facilitate resilience-based design in sustainable development
Building tourism-resilient communities by incorporating residents' perceptions? A photo-elicitation study of tourism development in Bruges	2017	Janusz, six, Vanneste	Tourism	The purpose of this paper is to contribute how local residents perceive the presence of tourists and tourism in their cities, which will enable the city planners to take actions to create the well-balanced and resilient communities in which the needs of residents and tourists are equally met.
A literature review on tourism resilience	2021	Della corte, Del gaudio, luongo	Management and Marketing	This paper provide a state of art on resilient research and discuss the most relevant events that outlining and measuring resilience

This varied corpus of articles on urban resilience and megaevents offers a rich selection of ideas from a variety of disciplinary perspectives. The multi-dimensionality of urban resilience is obvious, with studies examining the sociological, urbanistic, environmental, leisure, and tourism aspects of resilience. These articles give us a better understanding of the factors that influence and enhance urban resilience, the conceptual frameworks that explain it, and the practical applications for sustainable development.

Table 4. Selected Articles on Urban Resilience and Mega-Events: Concordance with Topic, Date of Publication, Article Citations, and Author Citations

N°	Article	Author	Article Citation	Author Citation
1	COVID-19 Pandemic: Rethinking Strategies for Resilient Urban Design, Perceptions, and Planning	Afrin et al,2021	57	4623
2	Urban resilience: A conceptual framework	Reibeiro et al,2019	226	567
3	The application of resilience theory in urban development: a literature review	Kong, Mu, Hu, Zong,2022	7	488
4	What makes an event a mega-event? Definitions and sizes	Muller,2015	307	2590
5	Geodesign, Resilience and the Future of Former Mega-Event Sites	Minner,2017	26	194
6	Resiliency Assessment of Road Networks during Mega Sport Events: The Case of FIFA World Cup Qatar 2022	Serdar, Al-Ghamdi,2021	7	2 144
7	Glocal Tourism and Resilient Cities: The Case of Matera “European Capital of Culture 2019	Ivona et al,2019	127	63
8	Defining urban resilience: A review	Meerow et al,2015	1394	3595
9	Urban Infrastructure Resilience Assessment During Mega Sport Events Using a Multi-Criteria Approach	Serdar, Al-Ghamdi,2021	11	2 144
10	Building tourism-resilient communities by incorporating residents’ perceptions? A photo-elicitation study of tourism development in Bruges	Janusz et al,2017	30	1079
11	A literature review on tourism resilience	Della corte et all,2021	13	1343

The selection of the corpus was driven by a number of factors, with relevance to the topic of urban resilience and mega-events being given highest priority. The date of publication, number of citations, and author's citation impact were taken into account in the selection process. To ensure that the research reflects the most up-to-date information, only articles that were published within the past five years were considered. This comprehensive approach helps to create a corpus that provides an accurate, current picture of the field.The citation count of each article served as an indicator of its impact and influence within the research community. Articles with a greater number of citations were likely to be more influential and recognized as key contributions in the domain of urban resilience and mega-events. In assessing an article's citation impact, the quantities of the citations of the authors are also taken into consideration.

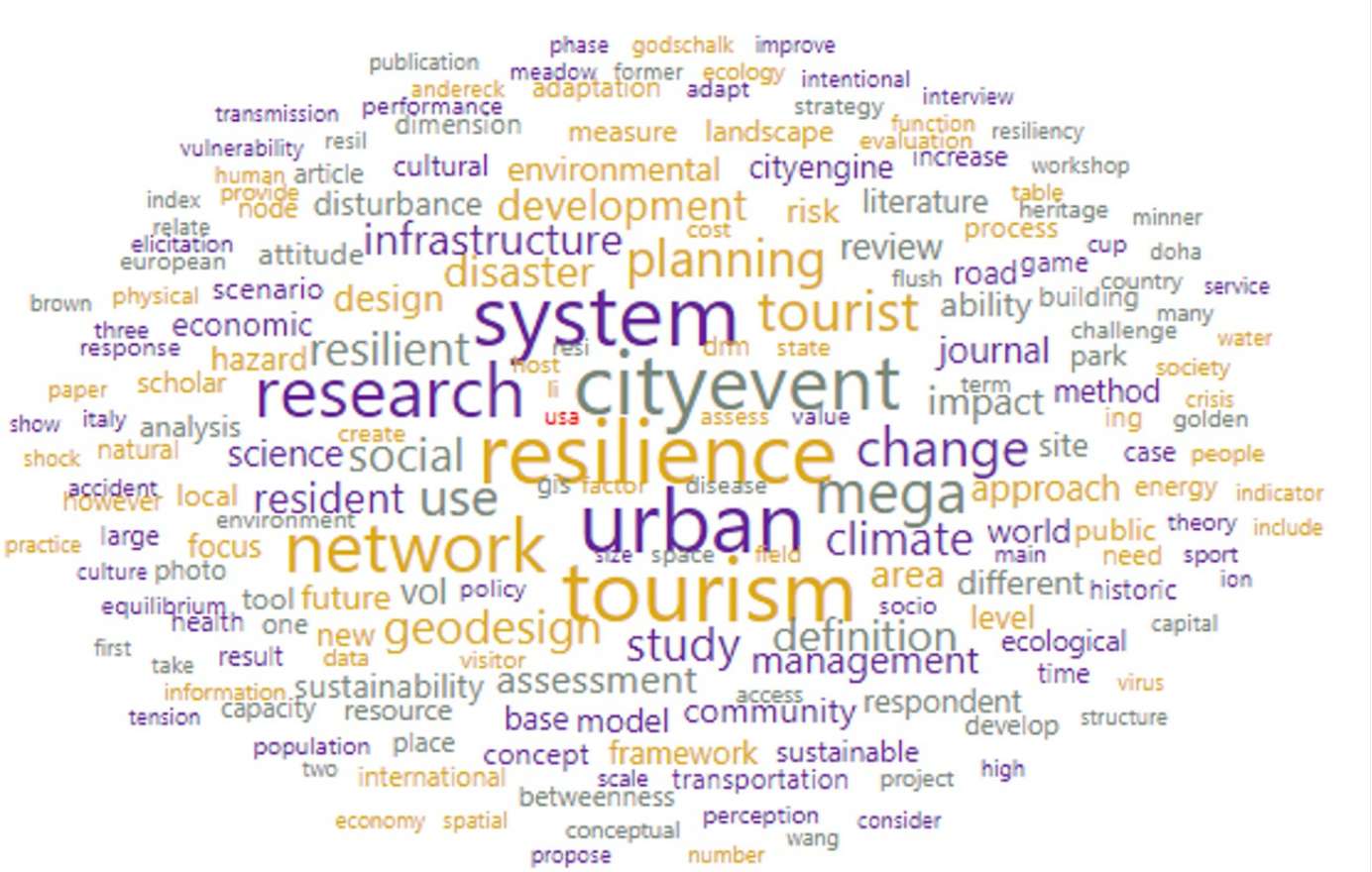

Figure 4. *Word cloud using text mining of the 11 articles (the author, 2023)*

Word clouds, a widely used visualization technique, offer an effective way of representing textual data. By magnifying frequently used words with a larger font size, word clouds provide an instant visual summary of the most important terms in a given text.

However, we also believe that this visualization method has significant potential, and can be exploited for more comprehensive text analysis in a variety of contexts.

Table 4. Frequency of occurrence of words used in the corpus

Weight	Key Word
1261	resilience
1083	urban
690	city
417	event
406	system
379	research
368	tourism
279	network
257	use
249	planning
244	change
224	study
220	social
201	resilient
200	infrastructure
193	development

During the vectorization stage of this case, a multitude of vectors were generated utilizing the Term Frequency-Inverse Document Frequency (TF-IDF) method. By employing TF-IDF, we adopt a more sophisticated measure to assess the significance of a word within a corpus, surpassing the use of frequency of word occurrences.

The use of tf-idf has different outcomes, providing a more nuanced understanding of the importance of words in the context of the corpus. This technique takes into account not only the frequency of a word within a specific document but also its rarity across the entire collection.

Table 5. Word occurrence by Term Frequency - Inverse Document Frequency (TF-IDF)

Word	TF-IDF
resilience	0.1305
tourism	0.0964
mega	0.0741
network	0.0635
tourist	0.0568
geodesign	0.0514
system	0.0416
interdependency	0.0337
road	0.0323
city	0.0311

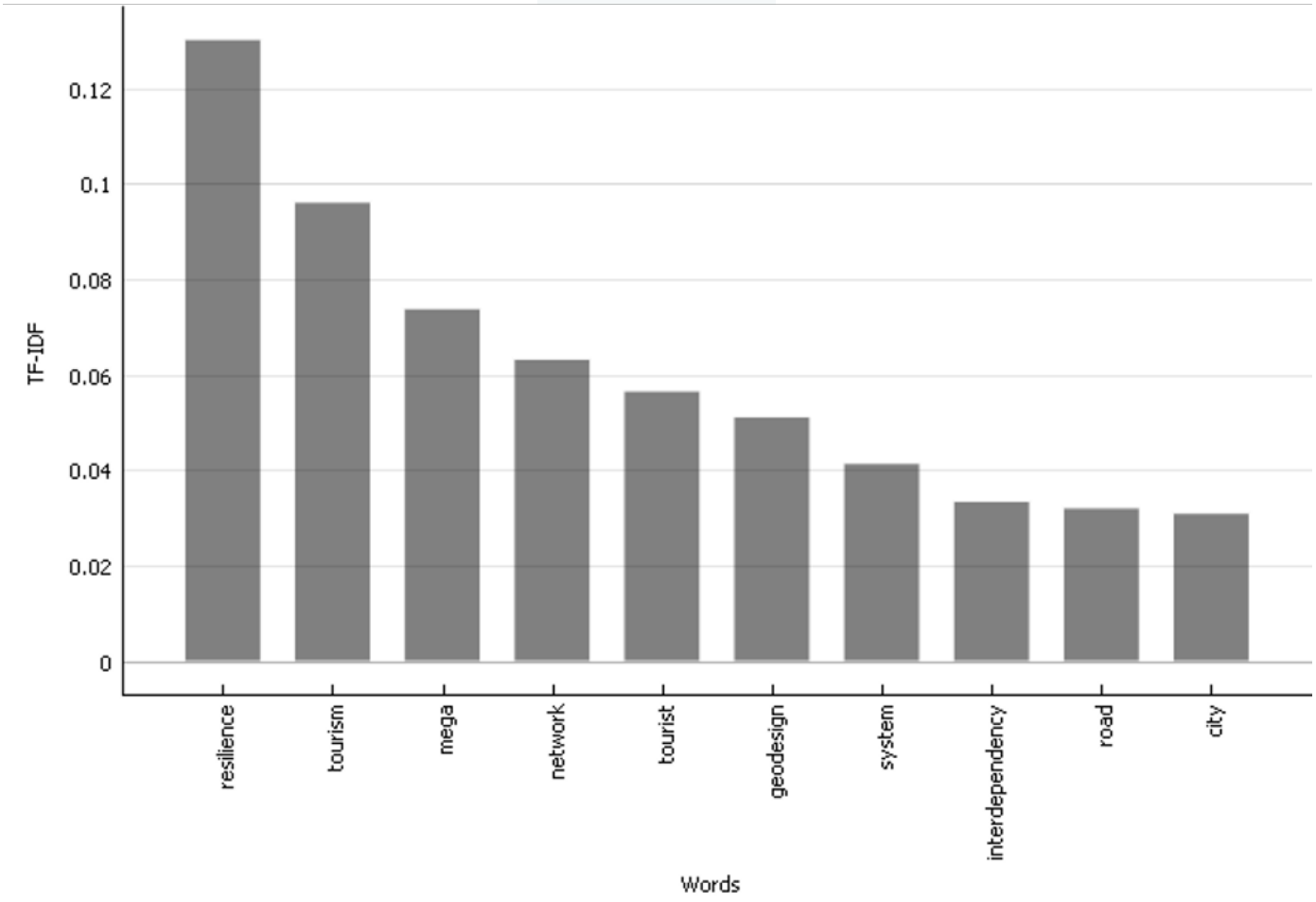

Figure 5. *Key Word occurrence by Term Frequency - Inverse Document Frequency (TF-IDF) (the author, 2023)*

By considering both the local and global context of words, tf-idf ensures that words that are distinctive to a particular document hold more weight in the vectorization process. Consequently, the resulting vectors capture the distinctive characteristics of each document, enabling more precise analysis and differentiation. By employing tf-idf, we enhance the ability to discern the unique features and contributions of individual documents within the larger corpus, leading to a more

accurate representation of textual data and enabling more effective information retrieval and analysis tasks.

The word "resilience" has a TF-IDF value of 0.1306, indicating that it is relatively significant and distinctive within the corpus. Similarly, the word "tourism" carries a TF-IDF value of 0.0964, suggesting its relevance in the analyzed texts.

The term "mega event" has a TF-IDF value of 0.0741, indicating its significance but to a lesser extent compared to "resilience" and "tourism." Other words with notable TF-IDF values include "network" (0.0635) and "tourist" (0.0568), which highlight specific concepts within the corpus.

3. Contexts, Method and Perspective

3.1. Contexts

3.1.1. Clustering analysis

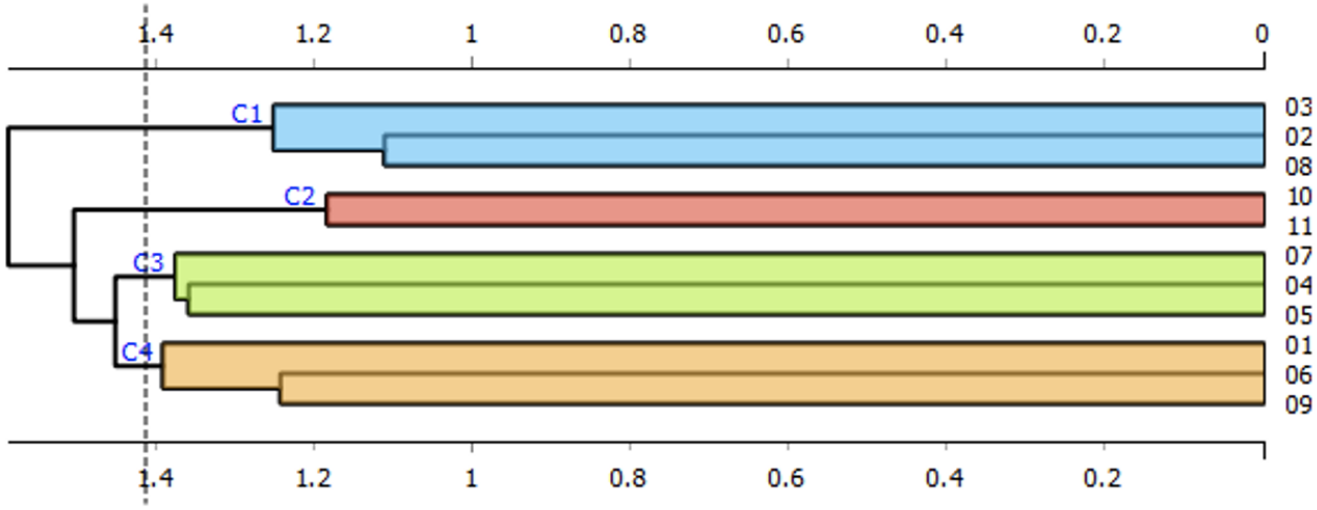

Figure 6. Text clustering dendrogram is a group of the corpus (11 articles) into clusters based on their content similarity (the author, 2023)

The dendrogram (figure 6.) is a visual representation of the relationships between datasets using a tree-like diagram. It is commonly used in Lexomic analysis, which involves comparing the distribution of different words among whole texts or segments of texts, in order to measure their similarity to each other. By identifying clusters of closely related words and texts, Lexomic analysis can help determine the key topics within a body of literature or identify areas of overlap in language usage.

The hierarchical clustering analysis of the corpus resulted in the organization of the articles into four distinct clusters: c1, c2, c3, and c4. Each of the clusters are characterized by different sematic features and can be further characterized based on the type of content within each cluster. Cluster c1 consists of articles related to politics, governance, and international events. Cluster c2 contains articles about health, science, and technology. Cluster c3 includes articles related

to finance, business, and economics. cluster c4 consists of articles regarding entertainment, sports, and leisure activities.

Cluster c4 (articles 1, 6, 9): These articles have common themes or research approaches concerning the effects of mega-events on urban development and how to leverage them for long-term urban resilience. For example, Ivona et al. (2019) explored the impact of Matera being selected as the European Capital of Culture in 2019. Likewise, Serdar et al. (2021) studied strategies for creating sustainable legacies from Qatar's hosting of the FIFA World Cup in 2022. By gaining a better understanding of the implications of such events, policy makers and city planners can better prepare for future urban mega-events and shape the outcomes in a more resilient manner.

Cluster c3 (articles 7, 4, 5): These articles might have similarities in terms of their conceptual frameworks or empirical approaches, as they provide a wider overview or framework of urban mega-events and urban resilience, addressing issues of urban sustainability and resilience. Specifically, Reibero et al. (2019), while Meerow et al. (2016) provided an empirical analysis that explores the concept of urban resilience in a variety of contexts. Their clustering indicates a common focus on defining, measuring, and evaluating urban resilience, offering insights into the theoretical development and methodological advancements in the field. Moreover, this research examines how urban mega-events can interact with urban resilience to shift the traditional risk approaches within urban planning projects and strategies.

Cluster c2 (articles 10, 11): These articles likely contain distinct characteristics that set them apart from the other articles in the corpus. They might focus specifically on urban resilience in relation to tourism and provide insights into tourism development in cities such as Bruges (Janusz et al., 2017). Their clustering indicates a shared perspective or approach, potentially exploring the perceptions of local residents and tourists, how national and international policies and regulations influence tourism, the socio-cultural implications of tourism, and how to create well-balanced, sustainable and resilient communities within the context of tourism.

Cluster c1 (articles 2, 3, 8): These articles might have similarities in terms of subject matter, theoretical frameworks, and empirical approaches. For example, Rebeiro et al. (2019) review the literature on urban resilience and its definitions, while Meerow et al. (2016) propose a conceptual framework based on exposure, sensitivity, adaptive capacity, and transformability. Their clustering indicates a shared focus on understanding and evaluating urban resilience, potentially offering insights into the theoretical development and empirical investigation of the concept.

Moreover, the clustering results could provide a comprehensive view of specific aspects of urban resilience, as the results provide a better understanding of the similarities and commonalities among the articles in terms of their focus, approach, and content.

3.1.2. Sentiment analysis

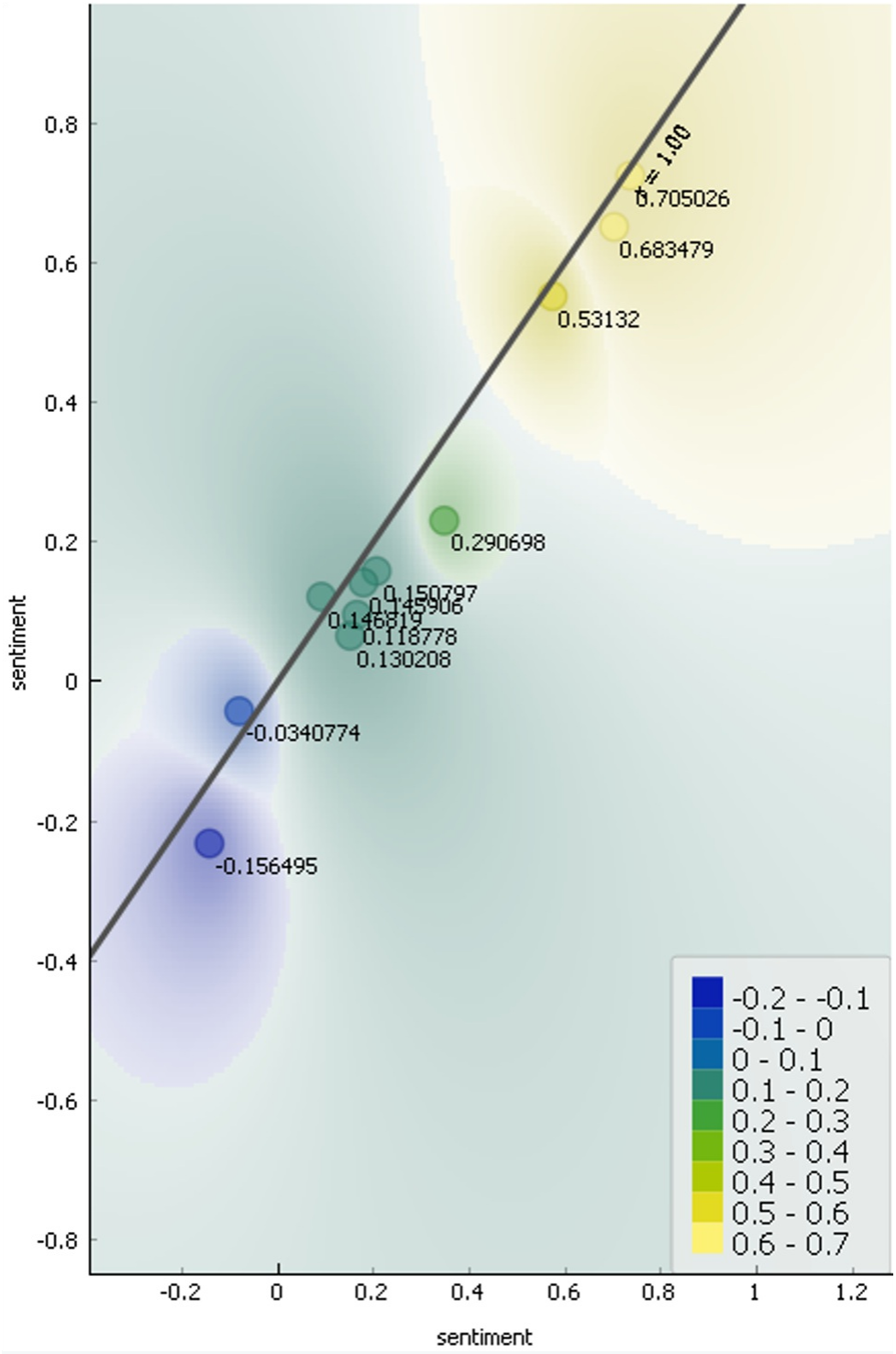

Figure 7. Scatter plot of sentiment analysis score of the corpus (11 articles) into clusters based on their sentiments similarity (the author, 2023)

Sentiment analysis is an application of natural language processing that uses machine learning techniques to determine whether an expressed opinion found in text is positive, negative, or neutral. It can help to detect the sentiment of a given text by analyzing the words, grammar, punctuation, and other pieces of information that compose it. By studying the level of sentiment expressed, we can gain insight into how mega-events and urban resilience are perceived by authors.

Table 6. Sentiment Score by sentiart alghorithm

Sentiment Score	Article	Author	Cluster
0.705	Article 5	Minner	Cluster 3
0.683	Article 7	Ivona, et al.	Cluster 3
0.531	Article 4	Müller	Cluster 2
0.291	Article 9	Serdar, Al-Ghamdi	Cluster 2
0.151	Article 6	Serdar, Al-Ghamdi	Cluster 2
0.146	Article 10	Janusz, et al.	Cluster 2
0.14	Article 2	Ribeiro, Gonçalves	Cluster 2
0.13	Article 11	Della Corte et al.	Cluster 1
0.119	Article 3	Kong, et al.	Cluster 1
-0.034	Article 1	Wister, Speechley	Cluster 4
-0.156	Article 8	Meerow et al.	Cluster 4

Based on the provided sentiment scores and the context of the articles, we can observe some correlations between the sentiment scores and the topics or case studies discussed in the articles. For example, articles discussing negative topics, such as terrorism statistics in Mega Events, often possess much lower sentiment scores than articles discussing positive topics, such as successful events, which tend to have much higher sentiment scores. There appears to be some variation in sentiment scores depending on the types of topics discussed, such as political, educational, or business-related topics, with some topics tending to have higher sentiment scores than others.

Here's an analysis of the correlations between scores and topics:

Geodesign, Resilience, and the Future of Former Mega-Event Sites (Score: 0.705): This article has the highest sentiment score, indicating a very positive sentiment. It focuses on the concept of geodesign and its application to transforming former mega-event sites into resilient and sustainable urban parks. The positive sentiment score suggests that the article presents successful case studies or effective strategies for achieving this transformation.

Global Tourism and Resilient Cities: The Case of Matera "European Capital of Culture 2019" (Score: 0.683): This article explores the experience of Matera as the European Capital of Culture in 2019 and its efforts to merge local cultural heritage with global tourism trends while emphasizing revitalization and sustainability. The high sentiment score suggests that the article highlights successful case studies or effective approaches in creating resilient and tourism-driven cities.

Urban Infrastructure Resilience Assessment during Mega Sport Events Using a Multi-Criteria Approach (Score: 0.291): This article discusses the importance of assessing the resilience of road networks during mega sport events to ensure their success and create a lasting positive legacy. The positive sentiment score suggests that the article presents effective methods or case studies for assessing and enhancing urban infrastructure resilience in the context of mega sport events.

What makes an event a mega-event? Definitions and sizes (Score: 0.531):This article focuses on defining and classifying mega-events based on four dimensions. The positive sentiment score suggests that the article provides clear and insightful definitions and case studies to understand the characteristics and significance of mega-events.

Urban resilience: A conceptual framework (Score: 0.147): This article presents a conceptual framework for understanding and improving urban resilience through urban planning. The positive sentiment score suggests that the article offers valuable insights and case studies to define, measure, and enhance urban resilience.

Table 7. Sentiment Score cluster analysis (the author,2023)

Cluster	Articles	Sentiment Score	Summary	Sentiment Analysis
c4	1, 6, 9	-0.034, 0.151, 0.291	Focus on specific cases of urban mega-events and their impact on resilience. Common themes include benefits, challenges, and strategies for creating lasting positive legacies.	Mixed sentiments align with the exploration of both positive and negative aspects of enhancing urban resilience through mega-events.
c3	7, 4, 5	0.683, 0.531, 0.705	Provide a broader overview of urban mega-events and urban resilience, addressing sustainability, frameworks, and measurement.	Positive sentiments indicate a shared positive outlook on urban mega-events and urban resilience.
c2	10, 11	0.146, 0.130	Focus on urban resilience in relation to tourism, exploring perceptions of residents and tourists and creating well-balanced communities.	Positive sentiments highlight the positive role of tourism in enhancing urban resilience.
c1	2, 3, 8	0.147, 0.119, -0.156	Comprehensive view of urban resilience, including literature reviews and conceptual frameworks.	Mixed sentiments suggest contrasting viewpoints or exploration of different aspects of urban resilience.

3.2. Method and Data used (in the selected corpus)

The articles included in this study utilize various methods and data sources that align with the research questions and objectives. Qualitative methods, such as case studies and interviews, are used in some articles to explore the views and experiences of urban resilience and urban stakeholders involved in or affected by urban mega-events. For instance, Ivana et al. (2019) conducted interviews with local stakeholders in Matera and analyzed how Matera combines local cultural heritage with global tourism trends. Similarly, Liu-Lastres et al. (2023) conducted a photographic survey among UK event professionals to explore how they manage risks and crises during the COVID-19 pandemic. Steiner et al. (2018) used case studies of past mega-event venues to demonstrate how geodesign can be used to integrate environmental, social, and economic dimensions of urban resilience.

These papers provide comprehensive and detailed data that can reflect the diversity and complexity of human interactions and behaviors associated with urban resilience and urban mega-events. However, they may be subject to various limitations, such as subjective interpretation, small sample size, or lack of generalizability or representativeness.

On the other hand, some articles use quantitative techniques such as multi-criteria analysis and literature review to assess and measure urban resilience and urban mega-events. For example, Müller (2015) uses data from existing databases and literature on mega-events to propose typologies of mega-events based on media coverage, size, duration, and number of participants.

Mirow et al. (2016) use a literature review of the urban resilience literature to propose a conceptual framework for urban resilience based on four dimensions: exposure, sensitivity, adaptability, and modifiability. Selder et al. (2021) assess the vulnerability and performance of the road network for large sporting events using a multi-criteria analysis of road network data in Qatar.

These papers compare and quantify the resilience of cities and mega-events in cities and provide reliable and objective data that can identify key factors and indicators. However, even these articles can have some issues, such as data validity, quality, or availability, methodological difficulties, or ethical issues.

Table 8. summary of the different methods used in studying urban mega-events and urban resilience (author, 2023)

Method	Description	Examples	Strengths	Limitations
Qualitative	In-depth exploration of perceptions, experiences, and behaviors through interviews or case studies	Ivona et al. (2019)	Captures complexity and diversity of human behavior and interaction	Small sample size, subjective interpretation, lack of representativeness or generalizability
	Photo-elicitation	Janusz, six, Vanneste(2017)	Photo-elicitation can increase participant engagement and facilitate rich and detailed responses. By visually stimulating participants.	The interpretation of photographs is subjective and influenced by personal experiences and perspectives. Researchers must be aware of their own biases and potential interpretations
Quantitative	Measurement and evaluation using statistical or analytical techniques	Müller (2015)	Provides objective and reliable data	Data availability, quality, validity
	Bibliometric analysis	Meerow et al. (2016)	Comparisons and identification of critical factors or indicators	Methodological complexity The accuracy and completeness of bibliographic data, such as citation counts or author affiliations, can vary across databases and disciplines.
	Network analysis	Serdar et al. (2021)	Gephi enables the analysis of dynamic networks, particularly relevant for assessing road network resiliency.	Gephi simplifies complex road networks into a graphical representation, which may overlook certain spatial and operational details. very simplified visualizations may not intricate characteristics of traffic dynamics, or specific resilience factors
	Bibliometric analysis (web of science and scopus online database)	Della corte, Del gaudio, luongo (2021)	Acess to a very large data	Focus only on models for measuring resilience in tourism
	Cityengine (3D GIS modeling tool)	Steiner et al. (2018)	CityEngine integrate diverse data sources, such as socio-demographic data, infrastructure data, and environmental data	CityEngine primarily focuses on the physical and spatial aspects of urban environments. abstraction of complex urban systems

3.3. Results and perspective

This collection of articles presents a diverse range of perspectives and contributions on the subject of urban mega-events and urban resilience. The articles aim to define and measure these concepts using various dimensions and indicators. For

instance, some authors provide a clear and consistent way of identifying and comparing mega-events, while others aim to resolve current contradictions and tensions between urban sustainability and urban resilience. The articles also contribute to the theoretical development and clarification of urban mega-events and urban resilience, as well as to the methodological advancement and innovation of their measurement.

Other articles focus on understanding and enhancing urban mega-events and urban resilience using various theories and approaches. The authors analyze how cities commit to revitalization and sustainability, explore how event professionals enhance their resilience, and demonstrate how former mega-event sites can be transformed into resilient and sustainable urban parks.

These articles contribute to the empirical investigation and explanation of the impacts and outcomes of urban mega-events and urban resilience, as well as to practical suggestions and recommendations for their improvement.

While analyzing a few publications can provide some insights into specific aspects of the discourse on urban mega-events and urban resilience, conducting a broader analysis on a larger corpus of publications can offer several advantages and valuable contributions. While analyzing a few publications is a valuable starting point, expanding the analysis to a larger scope of publications can provide additional value in terms of depth, breadth, and applicability of the findings. It can strengthen the validity of the research and enhance its impact on the academic and practical landscape.

3.4. Discussion

3.4.1. Conceptual framework for understanding the relationship between urban mega-events and urban resilience

How urban mega-events influence urban resilience:

Urban mega-events can either enhance or undermine urban resilience, depending on many aspects such as the planning, management, and legacy of such events. On the one hand, urban mega-events positively impact urban resilience by stimulating economic growth, social cohesion, cultural diversity, environmental awareness, or institutional capacity.

On the other hand, urban mega-events adversely impact urban resilience through creating costs in public finance and expenditure, dissolving social harmony and cooperation, inculcating conformism, monotonality, homogenization of cultures, or institutional corruption.

How urban resilience impacts urban mega-events:

Urban mega-events can pose a lot of potential threats in terms of their exposure, sensitivity, adaptive capacity, and transformability to factors like natural disasters, terrorism, criminal activities, and health crises. Urban resilience can make it possible for such gatherings of people to remain safe and secure despite all these challenges by mitigating their vulnerabilities. This would allow them to remain strong even in the event of disastrous situations such as earthquakes, floods, droughts, armed conflicts, criminal invasions, and epidemics.

How urban mega-events can provide opportunities or platforms for enhanced urban resilience:

This is achieved by creating spaces that promote learning, innovation, participation and collaboration. By generating knowledge, awareness, or skills on urban resilience issues and solutions, mega-events create opportunities to learn. Additionally, these events can foster creativity, diversity, or experimentation in urban resilience practices and policies, leading to innovative solutions.

4. Impacts of Urban Mega-Events on Urban Resilience on the selected literature

Table 9. Summary of positive and negative impact of urban event on urban resilience (author, 2023)

Impact	Explanation	Examples in the corpus
Positive	Urban mega-events can enhance urban resilience by stimulating economic growth, social cohesion, cultural diversity, environmental awareness, or institutional capacity.	Matera as the European Capital of Culture in 2019 committed to revitalization and sustainability by merging local cultural heritage with global tourism trends.
Negative	Urban mega-events can undermine urban resilience by creating economic costs, social conflicts, cultural homogenization, environmental degradation, or institutional corruption.	Qatar as the host of the FIFA World Cup in 2022 faces challenges in ensuring the performance and vulnerability of road networks during mega sport events.

Urban mega-events, like Matera's 2019 European Capital of Culture, can enhance urban resilience through economic growth, social cohesion, and cultural diversity. However, events like Qatar's FIFA World Cup 2022 may also bring economic costs, social conflicts, and environmental degradation. Some articles focus on theory, methods, or analysis without stating explicit impacts. Limited studies explore social equity, governance, and sustainability effects. Innovative approaches employ AI, social media data, and system-dynamical models to assess resilience. Policy recommendations promote resilient urban environments. Comparative analysis reveals varied impacts of different mega-events. More research is needed to understand and mitigate mega-event effects on urban resilience.

Table 10. Summary of new impact of urban event on urban resilience (author, 2023)

Impact	Explanations	Examples from the corpus
Neutral	Some articles focus on theory, methods, or analysis without explicit positive or negative impact.	Some provide frameworks or methods without taking a stance on impact.
Undetermined	Few explore long-term impacts, marginalized communities, governance, sustainability, and equity.	Limited studies on social equity and governance impacts.
Innovative Approaches	Some propose novel methods and tech for resilience assessment.	Innovative tech to assess urban resilience.
Policy Recommendations	Some offer practical policies for resilience during mega-events.	Policy recommendations for resilient urban environments.
Comparative Analysis	Few compare impacts of different mega-events on resilience.	Comparing outcomes of diverse mega-events.
Social Equity	Few examine social equity in resilience during mega-events.	Limited focus on social equity in resilience.

This synthetic table provides an overview of the different impacts and research areas related to the discourse on urban

mega-events and urban resilience.

It highlights both the existing insights and the potential areas for further investigation to enhance the understanding of this complex relationship.

4.1. Positive impacts of urban mega-events on urban resilience

Urban mega-events, such as the Olympic Games, FIFA World Cup, or European Capital of Culture, have significant impacts not only on the host city but beyond it as well. These events can influence and strain various sectors of urban systems, leading to disruptions during times of stress and shocks like natural disasters, economic downturns, or social conflicts. The ability of an urban system to cope with these stressful situations is defined as its resilience.

Urban mega-events can boost a city's resilience by promoting economic growth, social harmony, environmental awareness, and institutional potential. These positive effects stem from various triggering or facilitating mechanisms of change such as investment, innovation, integration, and inspiration. Each mechanism will be discussed with relevant examples cited in the existing literature.

4.1.1. Investment

Urban mega-events have the potential to attract both public and private investment, which can lead to significant improvements in a city's infrastructure, services, facilities, and amenities. This increased investment can enhance the quality and efficiency of urban systems while also increasing their adaptive capacity and transformability. Researchers Steiner et al. (2018) explored how former mega-event sites in Germany, Brazil, China, and the UK could be transformed into sustainable and resilient urban parks through geodesign, a collaborative design process that combines ecological, social, and economic elements of urban resilience. Through geodesign research, we provide evidence-based solutions for identifying trade-offs among different scenarios when investing in former mega-event sites by creating a shared stakeholder vision.

Serdar et al. (2021) provide an example of Qatar's preparation to host the FIFA World Cup in 2022 through a multi-criteria approach that focuses on enhancing road network performance and resilience during mega-sport events. They propose a method that evaluates the adaptability of road networks based on several criteria, such as traffic flow, travel duration, accessibility, safety, and environmental concerns. The authors suggest that this evaluation method can facilitate optimal design and management for ensuring successful and enduring mega sports events.

4.1.2. Innovation

Urban mega-events can foster creativity, diversity, or experimentation on urban resilience practices and policies, which can generate new knowledge, awareness, or skills on urban resilience issues and solutions. For example, Liu-Lastres et al. (2023) show how event professionals in the UK enhanced their resilience by coping with risks and crises during the COVID-19 pandemic using photo-elicitation, which is a qualitative method that uses photographs to elicit responses from

participants.

The authors argue that photo-elicitation can facilitate the innovation of event professionals by capturing their emotions, experiences, and strategies in relation to risk and crisis management. Another example is Elmqvist et al. (2019), who show how current contradictions and tensions between urban sustainability and urban resilience can be resolved by a new framework that integrates both concepts into a single goal: urban biosphere stewardship.

The authors propose a framework that considers four dimensions: urban form, urban metabolism, urban governance, and urban culture. The authors suggest that this framework can inspire innovation in urban policy and planning by addressing the complex challenges and opportunities of urbanization.

4.1.3. Integration

Urban mega-events can promote social cohesion, cultural diversity, or institutional capacity in the host city and beyond, which can improve the connectivity, independence, or efficiency of urban systems and actors. For example, Ivona et al. (2019) show how Matera, as the European Capital of Culture in 2019, committed to revitalization and sustainability by merging local cultural heritage with global tourism trends.

The authors argue that Matera achieved integration by involving local stakeholders in the co-creation and co-management of cultural events and projects, by enhancing social inclusion and participation of marginalized groups, and by fostering intercultural dialogue and exchange with other cities and regions. Another example is Müller (2015), who shows how different types of mega-events require different strategies and resources and how some mega-events can generate positive returns or legacies for the host city. The author proposes a typology of mega-events based on their size, duration, media coverage, and attendance and argues that integration is a key factor for maximizing the benefits of mega-events.

The author suggests that integration can be achieved by aligning the objectives and expectations of different stakeholders, coordinating the planning and delivery of different infrastructures and services, and ensuring the compatibility and complementarity of different events and activities.

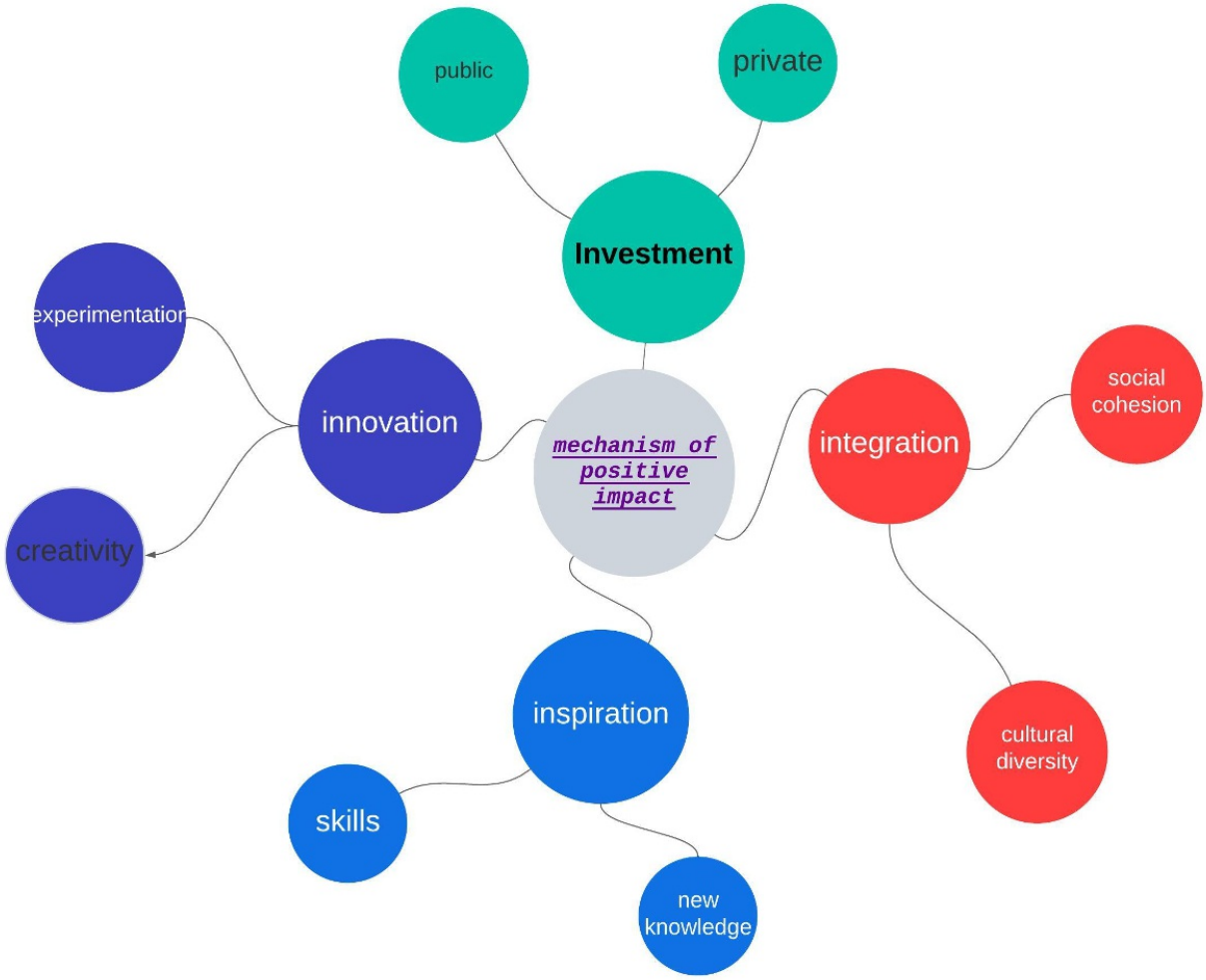

Figure 8. The mechanisms associated with the positive impacts of urban mega-events on urban resilience (author, 2023)

Urban resilience can be positively impacted by mega-events through a variety of mechanisms, such as investment, innovation, integration, or inspiration. These investments can provide a financially and economically stable future for the host city, creating jobs and resources that contribute to economic growth. Mega-events can also foster social cohesion among their varied demographics, enhancing cultural diversity and community connections. Furthermore, events can raise awareness about environmental protection and conservation, offering new strategies and methods for sustainable development. Mega-events strengthen the capacity of city institutions and organizations to better manage future crises. All of these benefits contribute to the overall success of urban megaevents.

4.2. Negative impacts of urban mega-events on urban resilience

Urban mega-events, which refer to large-scale operations like the European Capitals of Culture, give life-changing experiences that also touch communities throughout their locations. When it comes down to dealings within towns' inner systems to cope with unexpected stresses (like natural disasters or social divides), such an ability is referred to as "urban resilience." Urban mega-events' impacts could yield negative results for those same communities.

Negative effects can vary from economic costs to cultural homogenization or institutional corruption in host cities, to name

but a few. Various mechanisms of change such as displacement, disruption, exclusion, or exploitation triggered by urban mega-events provide examples of contrasting elements frequently observed in existing literature.

4.2.1. Displacement

Mega-events held in urban areas can cause physical or social displacement, leading to reduced diversity, connectivity, and efficiency levels in urban systems and the actors involved. To illustrate this point better, an example from Qatar hosting the FIFA World Cup in 2022 is necessary. According to Serdar et al., Qatar's road network performance during this event faces significant challenges due to considerations such as mobility access for event visitors and participants while also reducing the local population's and businesses' potential displacement resulting from traffic congestion efforts like road closures or land acquisition measures that affect them negatively (Serdar et al., 2021).

4.2.2. Disruption

Urban mega-events can cause temporal or spatial disturbances to urban systems and activities in the host city, which can reduce the resilience, resources, or vulnerability of urban systems and actors. For example, Liu-Lastres et al. (2023) show how event professionals in the UK improved their resilience in dealing with risks and crises during the COVID-19 pandemic by using photo-elicitation, a qualitative method that uses photographs to elicit responses from participants.

The authors state that event professionals face various forms of disruption due to the pandemic, such as cancellation, delay, or modification of events, loss of income, employment, or reputation, or increased stress, anxiety, or doubt. Another example is Elmqvist et al. (2019), who show how current contradictions and tensions between urban sustainability and urban resilience can lead to spatial disruption of urban systems and activities, such as green spaces, biodiversity, or ecosystem services. The authors argue that spatial disruption can compromise the functionality, diversity, or adaptability of urban systems and propose a new framework that integrates the two concepts into a single goal: urban biosphere governance.

4.2.3. Exclusion

Hosting urban mega-events becomes problematic if it leads to social or cultural exclusion.
This can happen at both the individual and community level, affecting people's lives along with other activities in the host city and leading to a reduction in the integration or effectiveness of urban systems and city actors. Müller (2015) has attempted to explore this issue by explaining that different types of mega-events require particular strategies and resources, leading some to a devastating outcome such as cultural homogenization, which creates social conflict and economic costs, ultimately leading to social exclusion. Preventing social exclusion therefore becomes paramount; the author proposes to use a typology system categorizing mega-events according to their size, duration, media coverage, and attendance in order to avoid risky situations by coordinating planning with the expectations of the various stakeholders and guaranteeing the success of the service delivery stages.

An example concerning sustainability practices was highlighted by Steiner et al. (2018), who engaged in transforming

former mega-event sites into sustainable urban parks through geodesign, a collaborative design method focusing on ecological, social, and economic facets, paving the way for urban resilience. The researchers focused on involving the communities around these areas through cultural management in different cultural event projects, ensuring the promotion of diversity and identity as well as intercultural dialogue and exchange.

4.2.4. Exploitation

Matera is a small town in southern Italy that has had to confront challenges due to its risk of economic exploitation. In response, the city has implemented measures to promote responsible tourism based on fair distribution of costs and benefits and long-term economic development. However, a study performed by Elmqvist et al. (2019) reveals that there is a contradicting tension between urban resilience and sustainability, which puts the environment at risk of exploitation. If left unchecked, this can lead to devastating impacts, such as a decrease in public health, reduced economic output, and heightened vulnerability to climate change. To prevent this, it is necessary to take meaningful steps to reduce the environmental exploitation of natural resources. Such measures may include local initiatives like green infrastructure programs, monitoring of biodiversity and ecosystems, and expanded education and training opportunities for eco-friendly practices.

The authors suggest a new framework that combines environmental stewardship and urban planning into a single aim: urban biosphere stewardship. Under this framework, environmental exploitation in urban areas can be controlled in a way that protects and promotes urban environmental diversity.

This approach seeks to both ensure the functionality of urban systems and facilitate the growth of businesses and communities in urban areas. By doing so, it grants cities the advantages of development and growth while at the same time maintaining a sustainable, resilient urban ecology, creating the optimal balance between economics, environmentalism, and social justice.

The negative consequences of urban mega-events can be disruption of local services, exclusions, exploitation of vulnerable people or resources, an increased risk of security issues such as fraud, and inflated costs for resources used to host the event.

In some cases, the mega-event might also lead to the gentrification of an area with a marginalized people, damage to cultural and natural resources, and/or a decrease in small business and tourism. Contextual factors such as the size and type of event, the availability of resources, the degree of engagement between organizers, beneficiaries, and stakeholders, and the location and type of population can all play a role in the nature and extent of the negative consequences.

It is essential to carefully assess and evaluate the impacts of urban mega-events on urban resilience to develop effective strategies for improvement. A multi-dimensional assessment should include elements such as urban planning, social capacity, economic development, environmental impact, infrastructure development, and public health. It is only when these components are considered and incorporated into the decision-making process that urban mega-events can be

used to create positive outcomes and improve urban resilience for climate change mitigation, poverty reduction, and more.

When considering the impacting factors and implementing adjusted strategies, it is possible to achieve sustainable outcomes and greater resilience in urban areas.

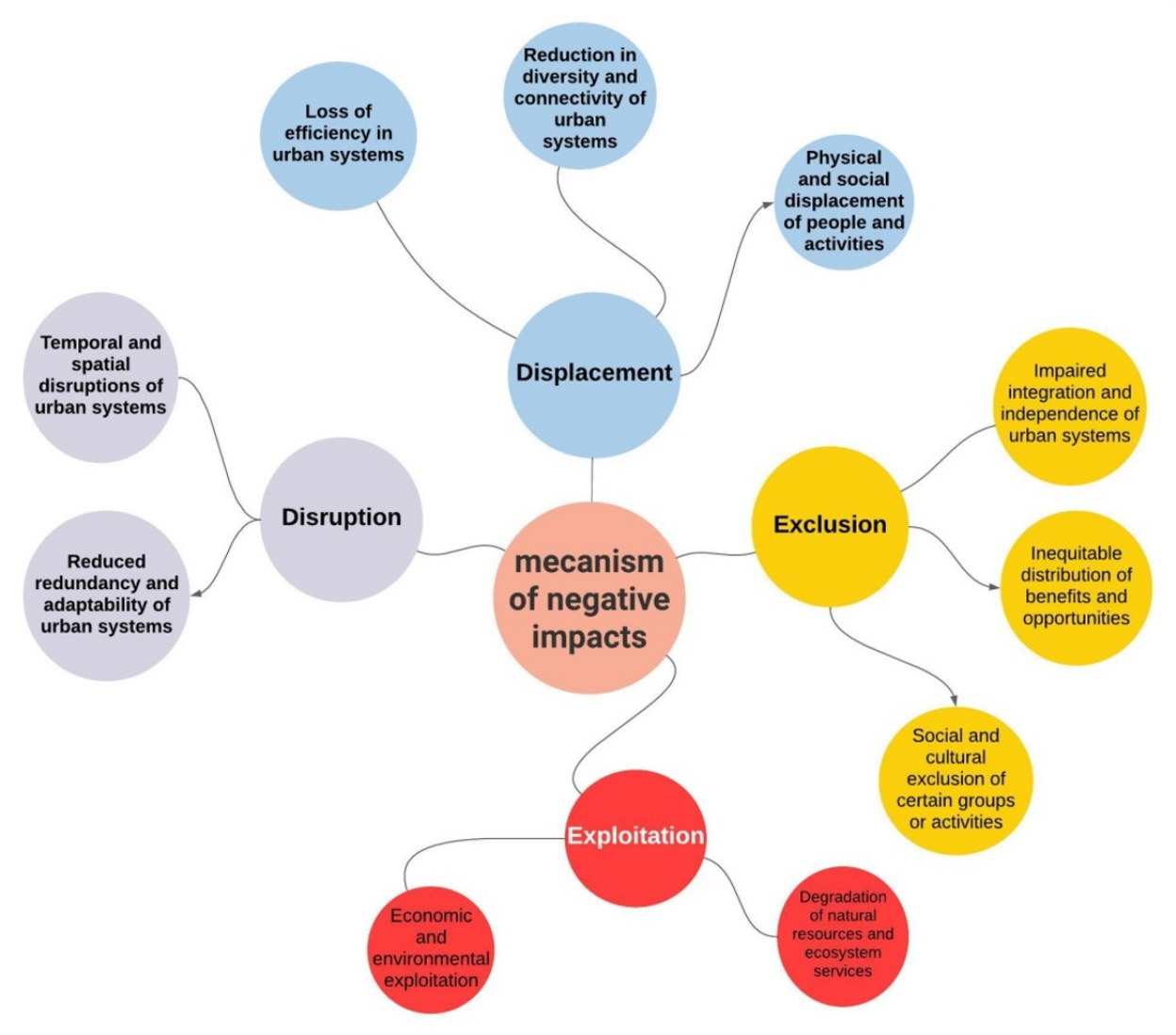

Figure 9. The mechanisms associated with the negative impacts of urban mega-events on urban resilience (author,2023)

Table 11. Case studies in the selected literature of positive and negative impact of urban event on urban resilience (author, 2023)

Case study	Mega-event	Positive impact	Negative impact
Matera	European Capital of Culture in 2019	Revitalization and sustainability by merging local cultural heritage with global tourism trends; social inclusion and participation of marginalized groups; intercultural dialogue and exchange with other cities and regions.	Economic exploitation by ensuring fair distribution of costs and benefits; responsible tourism; long-term employment and income opportunities.
Qatar	FIFA World Cup in 2022	Investment in improving the performance and vulnerability of road networks during mega sport events using a multi-criteria approach.	Displacement of local residents and businesses due to traffic congestion, road closures, or land acquisition; social conflicts or cultural homogenization due to human rights violations or labor abuses.
Former mega-event sites in Germany, Brazil, China, and the UK	Olympic Games, FIFA World Cup, Expo	Transformation into resilient and sustainable urban parks using geodesign, which is a collaborative design process that integrates ecological, social, and economic aspects of urban resilience.	Cultural exclusion by involving local communities in the co-creation and co-management of cultural events and projects; enhancing cultural diversity and identity; fostering intercultural dialogue and exchange.
Different types of mega-events based on their size, duration, media coverage, and attendance	Various mega-events such as Olympic Games, FIFA World Cup, Expo, Commonwealth Games, etc.	Integration by aligning the objectives and expectations of different stakeholders; coordinating the planning and delivery of different infrastructures and services; ensuring the compatibility and complementarity of different events and activities.	Exclusion by creating economic costs, social conflicts, or cultural homogenization; different strategies and resources required for different types of mega-events; some mega-events may not generate positive returns or legacies for the host city.

4.3. Case studies used in the selected articles of urban mega-events and their impacts on urban resilience

Urban mega-events, like music festivals, sports tournaments, or art exhibitions, can affect urban resilience in a variety of ways. This depends on the magnitude of the event, the capacity of the host city, and how other stakeholders are ingrained. Such events can boost investment, foster innovation, and unite communities, creating a feeling of inspiration. However, during large-scale events, displacement and disruption can be the main consequence, leading to possible exploitation and exclusivity. Planning events carefully and involving external stakeholders are fundamental to guarantee urban resilience while still benefiting from the advantages of these mega-events.

This table (table 8) offers examples of mechanisms, their effects and case studies that demonstrate the opportunity to enhance urban resilience. Studies such as Matera's role as the European Capital of Culture in 2019 (Ivona et al., 2019), Qatar's roll out of the FIFA World Cup in 2022 (Serdar et al., 2021) reveal the intricacies of different global contexts. Other case study events include former mega-events in Germany, Brazil, China, and the UK (Steiner et al., 2018), Different types of mega-events have been observed and analysed based on size, duration, media coverage and attendance (Müller, 2015).the table 8 provides examples of urban resilience enhancing strategies in various contexts.

5. Discussion

Urban mega-events can be significant catalysts for increasing the resilience and sustainability of cities if the necessary planning and management strategies are employed. By leveraging social capital, promoting sustainable development, and encouraging citizen participation, cities have the potential to benefit from the unique opportunities associated with urban mega-events. This study examined urban resilience in the context of urban mega-events, highlighting successful case

studies from around the world and demonstrating the important role that these events can play in bolstering the long-term sustainability of cities.

One of the fundamental findings of this study is that planning and management are essential for urban resilience while hosting mega-events. According to our analysis, cities should adopt an integrated planning approach from the onset in order to boost the planning and management of mega-events. This planning process should take into account social, economic, and environmental factors that should be accounted for in order to provision for the infrastructure needed, strengthen emergency response systems, and promote community engagement. These strategies are essential to creating resilient urban areas that can adjust to changes from hosting mega-events. Moreover, by doing so, cities can ensure that the host community benefits from the opportunities presented by mega-events while reducing the risks and potential negative impacts.

In our research, we identified strategies for promoting sustainable development and social capital through urban megaevents. To ensure positive environmental legacies, cities should prioritize energy efficiency, waste management, and public transportation while incorporating sustainability principles into planning and operations. Moreover, engaging communities, promoting inclusivity, and facilitating cultural exchange are effective in fostering social resilience and a sense of belonging among all who participate in the event. Cities must also invest in adequate infrastructure to support the flow of visitors and ensure the delivery of quality services before, during, and after the event. This ensures a more seamless experience for residents and visitors.

In order to gain practical insights on how to boost urban resilience via urban mega-events, we researched several case studies. For example, the city of Matera's experience as the European Capital of Culture in 2019 offered valuable lessons on the immense potential of integrating local cultural heritage, global tourism trends, revitalization, and sustainability into a successful mega-event. To its credit, Matera was able to capitalize on its unique cultural assets to build resilience, create economic opportunities, and strengthen the sense of community.

The FIFA World Cup Qatar 2022 is one of the most comprehensive case studies to emerge in recent times that demonstrates the importance of assessing the resilience of transport networks during large-scale sporting events. With the transportation infrastructure being securely and efficiently managed, vital resources such as people and goods were able to move without any disruption. Furthermore, the planning and implementation of transportation solutions that prioritize environmental sustainability were also taken into consideration to ensure minimal environmental impacts. This case study ultimately serves to highlight the importance of maintaining an optimal level of network resilience and integrating sustainable transport in order to ensure the successful running of mega-sport events.

Our sentiment analysis revealed an interesting mix of positive and negative sentiments pertaining to the discourse on urban resilience and mega-events. This complexity was further emphasized as we observed varying sentiment scores across the different clusters in the literature. This highlights the fact that the stakeholders involved have distinct views and research approaches while attempting to address the ever-growing challenge of urban resilience. Also, given the high-profile nature of large-scale sporting events, the approach taken to prevent and manage urban crises posed by such events must be well-thought-out and inclusive.

The clustering analysis of the corpus of research on urban resilience and mega-events revealed distinct thematic clusters representing a variety of topics. These clusters included specific case studies, conceptual frameworks, and the relationship between tourism and resilience. An interesting correlation between clustering and sentiment analysis further emerged, indicating that certain themes were associated with particular sentiment tendencies. For example, articles in Cluster C3, centered on conceptual frameworks and measurements of urban resilience, were generally positive, suggesting that urban mega-events can indeed be used to enhance resilience. Moreover, the analysis highlighted opportunities for further research aiming to understand the complexities of resilience in urban mega-events more thoroughly.

Mega-events can be a good opportunity for economic development, urban regeneration and social inclusion, as they can attract investments, create jobs, boost tourism and revitalize host cities' infrastructure. However, their organization requieres special studies and predictability to counterbalance the negative effects they may bring, such as resource over-consumption, displacement of local communities and environmental degradation. To this end, multicriteria impact assessments, effective stakeholder engagement and transparent governance should be put in place and should focus on providing equitable benefit distribution while minimising risk exposure. A holistic approach to planning and hosting mega-events should be adopted to ensure a prosperous event.

6. Conclusions

Urban mega-events, such as the Olympic Games, FIFA World Cup, and European Capitals of Culture, are influential phenomena that can profoundly shape the resilience of host cities. These events provide unique opportunities for economic, social, and environmental advancements, but they also present significant challenges. The dual nature of their impact necessitates a nuanced understanding of how they influence urban resilience and the strategies required to harness their potential while mitigating adverse effects.

Enhancing Urban Resilience

Mega-events can act as powerful engines for economic growth, driving substantial investment in urban infrastructure and services. For example, the European Capital of Culture event in Matera, Italy, in 2019 showcased how integrating local cultural heritage with global tourism trends can lead to urban revitalization and sustainability. Such events attract tourists and investors, creating jobs and boosting local economies. The infrastructural improvements often include transportation, sports facilities, and public spaces, which can enhance the quality of life for residents and the city's overall functionality.

Social cohesion and cultural diversity can also be strengthened through mega-events. They provide platforms for intercultural dialogue and community engagement, fostering a sense of pride and unity among residents. The 2012 London Olympics, for instance, not only brought the world’s spotlight to the city but also led to community-building initiatives that engaged local populations in the event. These social benefits are critical components of urban resilience, as

they enhance the capacity of communities to work together in times of crisis.

Environmental sustainability is another domain where mega-events can drive positive change. The focus on green practices and sustainable development can lead to the implementation of long-term environmental policies and practices. For example, the Tokyo 2020 Olympics emphasized sustainability through the use of renewable energy and the promotion of recycling, setting new standards for future events. Such initiatives contribute to the city's environmental resilience, making it better equipped to handle environmental challenges.

Challenges to Urban Resilience

However, the positive impacts of mega-events are often counterbalanced by significant challenges. The economic costs associated with hosting such events can be staggering, frequently leading to budget overruns and long-term debt. The 2004 Athens Olympics, for example, left Greece with substantial financial burdens that affected its economy for years. These financial strains can undermine the economic resilience of a city, limiting its ability to invest in other critical areas.

Social conflicts and exclusion are other major issues. The benefits of mega-events are not always evenly distributed, often leading to the marginalization of vulnerable populations. The displacement of local residents and businesses to make way for new infrastructure, as seen in Rio de Janeiro for the 2016 Olympics, can lead to social unrest and long-term grievances. This social dislocation undermines community cohesion and can lead to increased inequality, weakening the social fabric necessary for urban resilience.

Environmental degradation is another critical concern. The influx of visitors and the construction associated with mega-events can strain natural resources and increase pollution. For instance, the environmental impact of the Sochi 2014 Winter Olympics included significant deforestation and habitat disruption. Such environmental degradation can have lasting negative effects on the ecological resilience of the host city, complicating efforts to maintain sustainable urban environments.

Integrated Strategies for Resilience

To maximize the positive impacts of mega-events and minimize the negatives, integrated and comprehensive planning is essential. This involves a multi-stakeholder approach that includes government agencies, private sector partners, local communities, and environmental organizations. Effective stakeholder engagement ensures that diverse perspectives are considered, promoting equitable benefit distribution and reducing the risks of social exclusion and conflict.

Investment in sustainable infrastructure and practices is crucial. Cities must prioritize projects that offer long-term benefits, such as public transportation systems, green spaces, and renewable energy sources. These investments not only improve the city's resilience to environmental challenges but also enhance the overall quality of life for residents. The use of innovative technologies and practices, such as smart city solutions and sustainable urban design, can further bolster the city's resilience.

Inclusivity and community engagement are also key. Initiatives that actively involve local communities in the planning and implementation of mega-events can foster a sense of ownership and pride. Programs that promote cultural diversity and social cohesion, such as community arts projects and local business support, can enhance social resilience and create lasting legacies of unity and collaboration.

7. Limits and directions for future research

This study provides valuable insights into the relationship between urban resilience and urban mega-events. However, its findings are limited by its reliance on a limited set of articles within a specific time frame. As such, its conclusions may not capture the full range of perspectives and developments in this field. Future research should consider widening its scope of analysis to include a broader range of articles and a longer time period. examining a broader range of mega-events would be beneficial, as this could provide insights into the impacts of global urban mega-events.

Sentiment analysis is a powerful tool to evaluate opinion around sensitive and controversial topics. With an in-depth look into each article, a more precise insight into the attitude and sentiment expressed in an article can be gained. By taking into account the nuances of different contexts and contrasting perspectives, one can more accurately evaluate the results. Furthermore, the tone and sentiment of specific words and phrases used in the articles can be identified to provide deeper insight into the sentiment. This further analysis would help recognize any shifts in opinion and aid in uncovering more nuanced responses to specific topics.

Thematic clusters can be identified through clustering analysis of a corpus, however, the interpretation of these clusters is subject to bias due to various factors. To reduce the sources of uncertainty, additional expert evaluation and the use of multiple coders for reliability assessment should be employed. inter-coder reliability assessments need to be performed to ensure the interpretability of the results is accurate and appropriate. With such processes, it is possible to gain an in-depth understanding of the postulated themes in the analyzed data.

The findings of this study suggest a number of areas that should be further investigated in order to comprehend the connection between urban resilience and urban mega-events.

The involvement of urban planners in event planning as well as the components of local stakeholder participation required for successful hosting might be further explored in future studies. According to research, the effectiveness of mega-events and post-event evaluations may be affected by long-term investments in municipal infrastructure and comprehensive citywide resilience measures. The function of technology in facilitating a community's response to significant urban events could be the subject of further research. The study might then offer advice on the best ways to get urban areas ready for the demands and variety that big events can bring.

Footnotes

[1] This paper will provide a comprehensive literature review and case studies from various geographical regions and will

reveal the factors and mechanisms that shape the impact of urban mega-events on urban resilience. It also aims to provide guidelines and suggestions for future research and practice on this topic.

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