

Urban Planning and Disasters: A Systematic Review PRISMA

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SUMMARY

Climate change is already witnessed today, future forecasts continue to warn us about the possible impacts of our actions in the short and long term. With an increase in extreme events and the population living in urban centers, more and more cities will experience the effects of disasters. Although there are policies aimed at dealing with disasters, we know that the current measures are not enough to minimize this scenario. To better understand the relationship between urban planning and disasters, this article carries out a Systematic, based on PRISMA. The methodology allows the analysis of the literature with greater rigor, transparency, and the possibility of replication. For this study, articles in English were considered, with the following terms: disaster, disaster risk reduction, hazard mitigation, urban planning, and master plan. The main findings of this review show us that good urban planning, guided by resilience and risk management, with broad social participation, can act in reducing vulnerability, risks, and the impact of disasters in cities.

Keywords: Disasters. Urban Planning. PRISMA. Climate Change.

1 INTRODUCTION

Climate change can already be observed in different regions of the world. Global warming is already producing clear effects and reliable forecasts show us that global temperature averages will increase. We have already added 1C° to the global average temperature and according to the new forecasts, in the coming decades, we can grow this number to about 1.5 C° to 2 C° on post-industrial revolution global temperature averages. Given this, the expansive occurrence of extreme phenomena will become even greater, even for events hitherto considered rare (IPCC, 2018, 2021).

According to the report prepared by the Intergovernmental Panel on Climate Change (IPCC, 2021), we may face an intensification and an increase in the frequency of heavy precipitation, climate extremes, floods, droughts, cyclones, tropical winds, and the effects of El Niño. Urbanization is another important factor related to the impacts of winds, precipitation, and runoff in cities, which also acts in the intensification of these phenomena in cities (IPCC, 2021; NOBRE, 2011).

It is possible to fathom climate change as a factor with strong implications for people, communities, cities, and even the safety of the planet (YIGITCANLAR; KAMRUZZAMAN, 2018). When addressing climate change and events such as heavy precipitation, we are referring to possible triggers of disaster. According to the United Nations Office for Risk Reduction (UNDRR, 2021), disasters result from the interaction of hazards with the exposure, vulnerability, and capability of communities to deal with these events and can cause various environmental impacts in addition to human and material losses.

This is the case of floodings which at first can take lives and damage infrastructures, properties, and heritages, affecting the industry and displacement people. In addition, they can produce several different traumatic effects, favoring the appearance of diseases and generating impacts on health and food (MISHRA; SETHI; SIDDIQUE, 2020).

Highlighting the fact of disaster does not arise only through climatic triggers is important. Factors such as human actions and the current model of life can corroborate for the occurrence and intensification of extreme events and disasters. Population densification and disorderly urban occupation, like in the precarious settlements lacking adequate infrastructure, also aggravate this situation.

The city is the space where countless urban and social challenges are manifested, and while it can present great opportunities, it also exposes its weaknesses. The urbanized space today houses a large part of the world population, about 55%, and may reach the mark of 70% by 2050 (IBGE, 2019; UNITED NATIONS, 2019).

As more people live in urban centers, the demand for services such as health, education, transport, housing, and the need for employment increases. Understanding that a disaster occurs when a hazard strikes a community that is unprepared or vulnerable to impacts, it is possible to understand the close relationship between urban planning measures and the prevention and mitigation of disasters.

Events such as the disasters that occurred in 2008 and 2011 in the cities of Santa Catarina and Rio de Janeiro, respectively, intensified discussions on the planning of disaster preventive actions. After a heavy precipitation episode, Santa Catarina instituted an emergency or public calamity in 74 municipalities, with more than 80,000 unsheltered people, while in Rio de Janeiro approximately 300,000 people were affected by the extreme event, each of these disasters accumulated about R\$ 4.8 billion in financial losses (BANCO MUNDIAL, 2012a, 2012b).

The discussions generated by the two disasters, especially in Rio de Janeiro, were fundamental for the publication of the National Policy for Civil Defense and Protection - PNPDEC, established by the Federal Law No. 12.608 of April 10, 2012 (SALEME; BONAVIDES, 2018). With a view toward disaster risk prevention and reduction, the PNPDEC provides a series of measures to act against disasters.

Tools such as PNPDEC certainly help with contributions and advances on the issue, mainly if combined with measures such as the Master Plan, contingency plans and environmental education, housing and land policies, and especially adequate popular participation. These combined aspects can favor the reduction of disaster risk on a large scale, mostly by minimizing the damage and losses caused by these events (REANI et al., 2020).

City Statute, this instrument has an important role under measures that address the implementation of the social function of property. But the history of urbanism in Brazil shows that there is no way to boost new legal measures without looking out for society and its needs (MARICATO, 2002). Thus, some indications show that only the practice and the real understanding of the population, its vulnerabilities, and the interaction with the planning measures could bring significant results.

2 OBJECTIVE

In line with current discussions, this paper aims to identify, in the international literature, how disaster knowledge relates to the topic of urban and city planning, through a systematic review along the lines of the PRISMA methodology.

3 METHOD

The systematic review (SR) is a procedure performed to evaluate the existing literature in each field of knowledge, through a replicable and transparent protocol. According to Tranfield; Denyer; Smart (2003), SR is a key instrument for the academic research process, used

to manage and analyze the diversity of specific knowledge, besides providing evidence with quality, legitimacy, and authority.

Decision makers are increasingly looking for evidence-based knowledge to formulate solutions to political and social issues, as well as for methods that can identify gaps or emerging concerns, in which case systematic reviews can be more effective and provide more key information than single studies (PETTICREW; ROBERTS, 2006).

By adopting a protocol for conducting the study, it is expected that it will be possible, in future studies, to reproduce or audit it, conferring greater reliability and objectivity. For this study, the PRISMA set of items for reporting was adopted (PAGE et al., 2021), including the application of the checklist during its execution and a flow diagram with the steps performed.

3.1 Data Collection

To answer the question that guides this study, several tests were made with different terms and combinations, so that it was possible to obtain an adequate search protocol that would bring the study closer to a panorama capable of reaching the proposed objective.

Some points were previously defined, such as language and database. The English language was chosen because it is considered a universal language in sciences, thus more studies, and possibly more relevant evidence would be covered.

The chosen database was Web Of Science because it has a relevant collection of social science and disaster journals indexed in its archives. The search was performed in the Web Of Science - Main Collection database, searched by topic, with the search equation: (“disaster*” or “disaster risk reduction” or “hazard mitigation”) and (“urban planning” or “master plan”), performed on January 12, 2022.

Chart 1: Exclusion and Inclusion Criteria

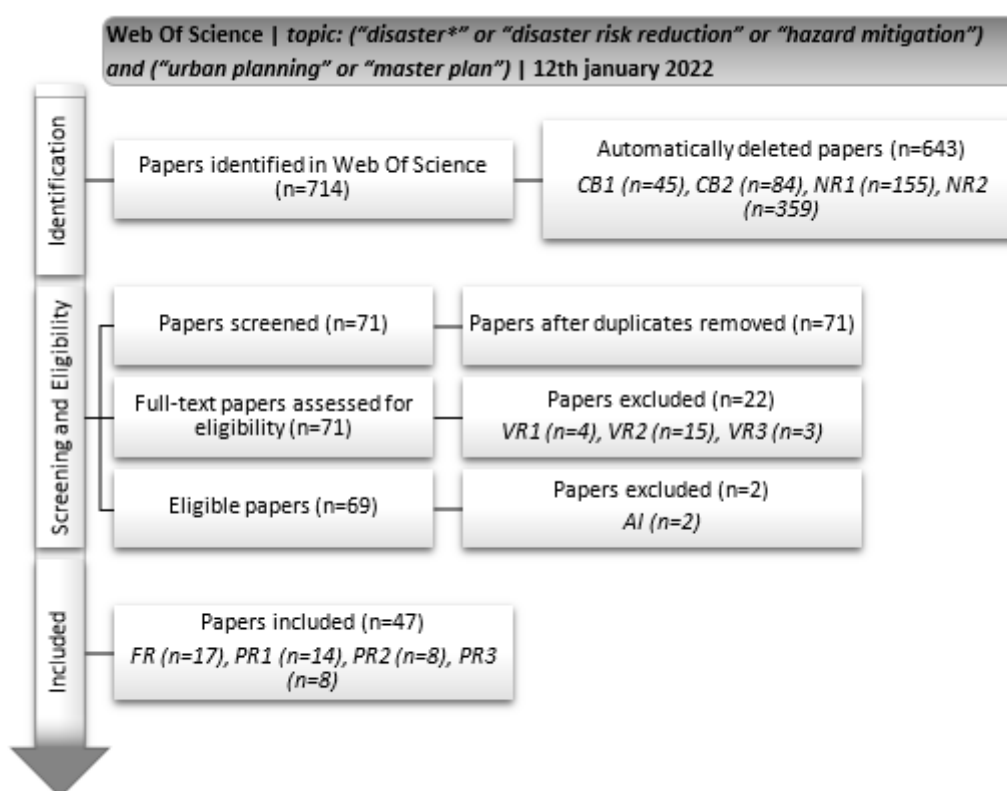
E/I	Critério	Justificativa	Código
Exclusion	Search Criteria (CB)	Language is not English	CB1
		The year of publication does not cover the period 2011-2021	CB2
	Access Unavailable (AI)	Full text of record is not available for access	AI
	Unrelated (NR)	The record is not an Article, Review Article, or Early Access Article	NR1
		Registration does not match with Web Of Science categories Multidisciplinary Science, Urban Studies, Social Science Interdisciplinary, Regional Urban Planning, Management, Public Administration	NR2
	Loosely Related (VR)	Terms are used as examples only	VR1
		Terms appear only in keywords and/or references	VR2
Terms are just expressions quoted		VR3	
Inclusion	Partially Related (PR)	The article deals with the terms as support to reflect on challenges or related issues	PR1
		The urban planning vs disaster relationship is just one of the points addressed in the article	PR2
		One or more of the terms does not appear explicitly	PR3
	Strongly Related (FR)	The main objective of the article is to discuss the relationship between urban planning and disasters	FR

Source: Own elaboration based on Liao et al., 2017.

From the data collection performed, the inclusion and exclusion criteria established in Chart 1 were applied, according to the steps described in Figure 1. The initial sample contained 714 articles, with automatic exclusion performed within the Web Of Science platform (criteria CB1 and CB2, NR1 and NR2, available in Chart 1), 71 articles were selected for complete and manual analysis.

Of the 71 articles, two could not be located in their complete form, being excluded from the analysis. The remaining 69 articles were analyzed, through full reading, to verify eligibility through the established criteria (Chart 1). The ineligible articles underwent a second analysis before the final decision. Of these articles, 22 were excluded due to lack of adherence being classified according to the VR1 (n=4), VR2 (n=15), and VR3 (n=3) criteria.

Figure 1: PRISMA flow chart



Source: Own elaboration based on Page et. al, 2021

4 RESULTS

Of the 69 articles available for full analysis, 22 were excluded for having vague adherence to the theme and not presenting sufficient depth to qualify for SR. The criterion with the highest number of excluded articles, VR2, is justified by the appearance of recommendations at the end that refer to urban planning and disasters, not to mention this profound discussion throughout the article.

Table 1: Papers Excluded

Criteria	Total
VR1	4
VR2	15
VR3	3
Total	22

Source: Own elaboration

Of the 47 articles eligible for the SR, 36% were classified in the FR criterion, indicating that the search engine brought a significant number of results capable of reaching the objective of this review. The second criterion with the highest number of articles, PR1, is partially related to the theme, showing that the relationship between urban planning and disasters is often used to discuss or understand correlated themes.

As can be seen in Graph 1 most publications on this theme are found in England, with 26 publications. The themes of the journals with the most publications are the cities, urban planning, and disasters axis. The United States, India, Chile, and Indonesia remain with the highest number of case studies, the most referring to geospatial conditions and previous extreme events, such as Hurricane Katrina, which marked the history of the place and the relationship between urban planning and disasters.

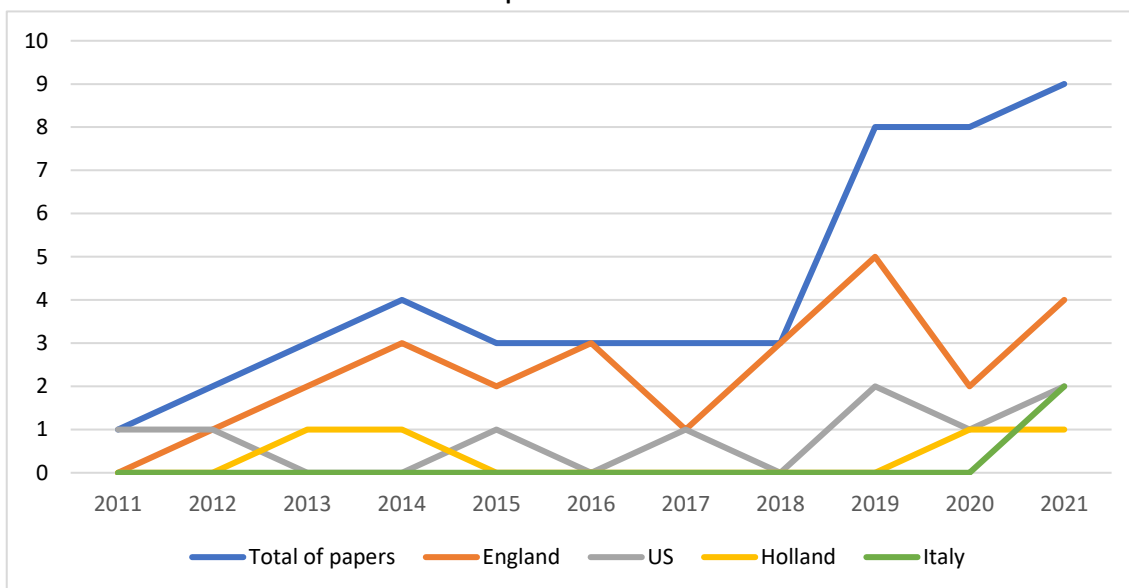
Table 2: Papers Included

Criteria	Number of papers	%
FR	17	36%
PR1	14	30%
PR2	8	17%
PR3	8	17%
Total	47	100%

Source: Own elaboration.

The most present type of method was qualitative, mainly applied through case studies, document analysis, interviews, and bibliographic studies. Quantitative research, however, due to the nature of the theme, appears in a smaller number, being applied mainly for statistical data analysis.

Graph 1: Publications



Source: Own elaboration.

The complete analysis of the articles allowed for the preparation of Chart 2, with the categorization of the articles according to the main concepts that emerged and guide the discussions present in the studies. The seven most relevant and recurring concepts are Disasters, Risk and DRR (Disaster Risk Reduction), Climate Change, Vulnerability, Resilience, Urban Planning, and Participation.

It is possible to observe that we live in a time of unprecedented global change and that climate change and disasters are closely related. Although not all disasters are directly attributable to climate change and increased greenhouse gas emissions, these disasters represent, on average, two-thirds of all disasters (WAMSLER; LAWSON, 2012).

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Table 3: Methods of analysed papers

Method		Papers
Quantitative / Qualitative	Mixed methods	1
	Case study	15
Qualitative	Bibliographic study	10
	Documentary analysis and interviews	8
	Interviews and Exploratory Study	5
	Literature review	3
Quantitative	Data analysis	5
Total		47

Source: Own elaboration.

From the concept of disaster found in this review, it is possible to notice a certain pattern or consensus, regarding the current approach: disasters are not mere effects of nature. This perspective was not always accepted, nor has it been consensual. At first, disasters it was

understood as acts of God evidencing the human inability to act. In a second moment, disasters were redefined as acts of nature, but since the 1970s-1980s, disasters have been looked at as arising from human acts (MAES et al., 2018).

The social sciences have been dissociating the word “natural” from disasters. The current approach encompasses social concepts, mainly the social relations and capitalist methods of social organization (RÍOS, 2015). The conception of disasters as a product of human processes of vulnerability creation is currently widely accepted by the literature, raising the question of what society itself can do to reduce and support disaster risk reduction (GONZALEZ-MATHIESEN; MARCH, 2018; JOHNSON). ; BLACKBURN, 2014).

Risk can be understood as the probability of being affected by adverse effects (LEON; MARCH, 2016; MANDA, 2014b; WAMSLER; LAWSON, 2012). The relationship expressed in $R=H*V$ is not intended to be a mathematical formula, but the representation of a qualitative notion, where any imbalance between the components can trigger a higher risk. The process of disaster risk reduction is commonly divided into a sequence of four phases: mitigation supports the reduction of the and long-term consequences of a hazard; preparedness minimizes the impact of a possible event; response aims to face the disaster and its immediate consequences; and recovery seeks to help victims return to their previous normal lives, creating new opportunities for development (LEON; MARCH, 2016).

Vulnerability, understood as a component of the risk equation and initially stemming from disaster studies, has been developed in various ways over time across fields, referring here not only to a low level of disaster resilience but also to the lack of existing mechanisms and structures to respond to and recover from hazards (BHANJEE; ZHANG, 2020; WAMSLER; LAWSON, 2012).

For Jacobs (2019) these processes of vulnerability creation converge with natural risks for disaster production. Ludwig et al. (2020) indicate the understanding of disasters as processes of social construction, which allows us to highlight the expressive lack of balance between natural and social systems, pointing out the relevance of urban planning in mediating interactions between the environment and the lack of organization and structuring of cities.

Chart 2: Categorization of papers

Category	Concept	Authors
Disaster	Based on its consequences, being the product of an unplanned city. The result is caused by an unmediated risk. Causes the interruption of a community functioning causing losses and damages. It is a product of social construction and how we relate to nature.	Alnaimat; Choy; Jaafar, 2017; Aoki, 2017; Ariyanti et al., 2020; Awad; Dali; Nordin, 2020; Chan; Wey; Chang, 2014; Ciccaglione, 2019; Desouza; Flanery, 2013; Gonzalez-Mathiesen; March, 2018; Inzulza-Contardo; Gatica-Araya, 2018; Jacobs, 2019; Johnson; Blackburn, 2014; Oteng-Ababio; Sarpong, 2015; Parthasarathy, 2016; Platt; So, 2016; Ríos, 2015; Scitaroci et al., 2021.
Risk and DRR	Risk can be understood as the probability of being affected by adverse effects, symbolized by the equation R (risk) = H (hazard) * V (vulnerability), and can be managed and reduced through the DRR (Disaster Risk Reduction) composed of four phases: mitigation, preparedness, response, and recovery.	Ariyanti et al., 2020; Coetzee; Van Niekerk, 2013; Jacobs, 2019; Leon; March, 2016; Maes et al., 2018; Manda, 2014; Oteng-Ababio; Sarpong, 2015; Siriwardane et al., 2021; Wamsler; Lawson, 2012.
Climate Change	Acts on the increase and intensification of extreme weather events, often aggravated by the need to reduce vulnerability, indirectly impact cities, mainly in developing countries.	Chu, 2016; Jacobs, 2019; Jon, 2020; Mensah; Ahadzie, 2020; Wamsler; Lawson, 2012.
Vulnerability	Susceptibility to damages, in this context strongly linked to the social context of the communities. How certain groups can suffer more or less intensely from the impacts of a disaster.	Bhanjee; Zhang, 2020; Butcher-Gollach, 2015; Chu, 2016; Jacobs, 2019; Johnson; Blackburn, 2014; Leon; March, 2016; Ludwig; Mattedi; Avila, 2019; Manda, 2014; Ramyar; Ackerman; Johnston, 2021; Yu; Malecha; Berke, 2021.
Resilience	A holistic approach that characterizes the ability of a system to avoid damage, absorb its impacts, recover, learn and reestablish post-event or change. A key concept for cities is the management of cities.	Berke et al., 2021; Gonzalez-Mathiesen; March, 2018; Ramyar; Ackerman; Johnston, 2021; Scitaroci et al., 2021; Sethi et al., 2021; Shaker et al., 2019; Spencer et al., 2020; Steiner, 2014; Trundle, 2020; Yu; Malecha; Berke, 2021.
Urban Planning	Governance measures needed to achieve sustainable, resilient, inclusive, and efficient urban development. Should be defined by strategies that enable the provision of resources to reduce vulnerability and risk. Preferably, should maintain close interaction with the community. Despite its limitations, it is understood as a central piece in the relationship with disaster risk.	Ariyanti et al., 2020; Awad; Dali; Nordin, 2020; Berke Et Al., 2021; Chu, 2016; Chu; Anguelovski; Carmin, 2015; Desouza; Flanery, 2013; Echendu; Georgeou, 2021; Gonzalez-Mathiesen; March, 2018; Hooper, 2018; Jacobs, 2019; Johnson; Blackburn, 2014; Kim; Rowe, 2013; Leon; March, 2016; Ludwig; Mattedi; Avila, 2020; Maes et al., 2018; Manda, 2014; Maynard et al., 2017; Myers; Walz; Jumbe, 2020; Nikuze et al., 2019; Scitaroci et al., 2021; Thompson, 2012; Yang, 2019.
Participation	Communities play an active role in the response phase. The current understanding is that this knowledge should be included in planning through participatory governance.	Aoki, 2017; Ariyanti et al., 2020; Chu, 2016; Comerio, 2014; Desouza; Flanery, 2013; Echendu; Georgeou, 2021; Talia, 2021.

Fonte: Own elaboration.

The vulnerability has grown as a result of continued development in risk-prone areas and a lack of planning (YU; MALECHA; BERKE, 2021). It can be conceived in several ways, such as urban - where dynamics are analyzed - or social - a subset of urban vulnerability that emphasizes the coping of different social units of the same socioeconomic structure, considering multiple factors (BHANJEE; ZHANG, 2020).

Historically, urban centers were perceived as places of refuge from disasters. However, today, they are better described as disaster and risk hotspots, which lead not only to disruptions

in city functionalities, but also to the intensification and generation of urban and environmental risks, new hazards of inequality and poverty, and the reduction of development and capital investments (WAMSLER; LAWSON, 2012).

In a global context where cities have become focal points for disasters due to factors such as population growth, lack of governance, and rapid expansion of informal settlements, at least conceptually, planning has a clear role in disaster risk reduction and can manage and modify the arrangements, functions and continued growth or decline of cities and regions. Through this, risk factors, such as location-specific risks and vulnerabilities, can be mitigated (GONZALEZ-MATHIESEN; MARCH, 2018; HOOPER, 2018; LEON; MARCH, 2016; MYERS; WALZ; JUMBE, 2020; NIKUZE et al., 2019).

In recent decades, there was a movement from a culture of emergency to a culture of resilience within disaster management, DRR, and planning policies (CICCAGLIONE, 2019; PLATT; SO, 2016). Resilience seems to establish a clear path to address disaster risks, but the challenge of translating resilience from a descriptive, multifaceted and useful ideal to ongoing risk management practices in urban planning remains (GONZALEZ-MATHIESEN; MARCH, 2018).

The holistic approach to achieving resilience defines the need to overlap or connect different aspects – natural and spatial resources, cultural heritage, community, and planning – aiming to reduce socioeconomic vulnerabilities that influence disasters, threats, and aspects that can trigger or augment them. (SCITAROCI et al., 2021).

Since 1973, the term resilience has entered the social sciences through the literature on global environmental change, political ecology, and disaster studies, and is increasingly used to conceptualize the ideal characteristics of an urban system that can withstand natural hazard events and direct and indirect impacts of climate change (JOHNSON; BLACKBURN, 2014).

For Ciccaglione (2019), based on urban planning documents, it is possible to say that the culture of resilience is not very articulated in terms of preparation for potentially catastrophic events, but rather for the more general development of the territory, thinking about economic resilience. This is a timely concern as most cities are not equipped to meet the demand caused by the combination of population growth, immigration, rural-urban migration, and climate change (SHAKER et al., 2019).

Moreover, the resilience approach in complex, dynamic, and sociocentric environments like cities has been insufficient to address the subjective values inherent in decision-making (TRUNDLE, 2020). But when control measures and proper planning are effective urban development assists in protecting communities, rather than increasing their vulnerability, and urban regulations and policies are methods of control and guidance for urbanization to prevent problems associated with the growth of cities and take advantage of the benefits that come from their expansion (ECHENDU; GEORGEU, 2021).

By seeking to solve multiple objectives urban planning establishes processes to achieve better spatial arrangements than those that would occur without intervention, relying on strategic combinations such as emergency planning and territorial planning (GONZALEZ-MATHIESEN; MARCH, 2018). In extreme situations, urban planning can lead efforts considering pre-event, emergency, and recovery phases (AWAD; DALI; NORDIN, 2020).

Chu, Anguelovski, and Carmin (2015) suggest that for policymaking purposes, the planning process must adopt broadly inclusive and involves a wide variety of actors and institutions to contribute to greater procedural justice, producing equitable outcomes. Involving

the community to intervene in local problems in coordination with other institutions and governance structures becomes a relevant process in disaster governance as an essential aspect of urban planning and mitigation (COMERIO, 2014; DESOUZA; FLANERY, 2013; PARTHASARATHY, 2016).

It is possible to say that the effects of disasters are not distributed homogeneously in space (LUDWIG; MATTEDI; AVILA, 2020). This expression of vulnerability refers not only to the characteristics of the territory but also to its social construction. Coetzee and Van Niekerk (2013) report that the legacy of apartheid and rapid urbanization were two crucial elements in the formation of vulnerable urban societies in South Africa, where many were forced to live in marginalized and unsafe areas.

Jacobs (2019) evidences the impact of social justice issues, arguing about the importance of planning to provide attention to the unequal effects of disasters, especially for women and black people. Bhanjee and Zhang (2020) also reflect on the gender and cultural differences that typically place women in a position of greater vulnerability due to lower wages and responsibility for family care in multiple cases.

People become the key point when we talk about the relationship between urban planning and disasters. They suffer the destructive effects, but they also play a significant role in the timing of response and recovery. Citizens shape the patterns of a city, including the social, economic, environmental, and dynamics aspects of the governance network (DESOUZA; FLNERY, 2013). These results demonstrate the need for a more comprehensive integration between disaster risk reduction and planning, strengthening not only mitigation but also adequate response and resilience (LEON; MARCH, 2016).

5 CONCLUSION

The relationship between disasters and urban planning permeates several concepts. Population growth, high demand for goods, and services, adequate settlements, and the rural-urban migratory flow interacting with the cities' lack of structure to deal with these demands become the perfect scenario for the intensification of social vulnerability.

The unprepared cities then become the main stage for disasters to occur, as they concentrate people in risk-prone areas and fail to institute disaster planning, management, and mitigation efficient measures. This is reflected in the increased number of registered disasters and calculated losses and damages.

The threats are accentuated not only by social elements but by people's way of living and producing, which directly impacts our relationship with the environment and climate change, already witnessed and projected for the future. These effects intensify and expand the occurrence of extreme events.

It is possible to say that disasters are not entirely avoidable, considering that we do not have the conditions to prevent specific extreme events, such as earthquakes and hurricanes. However, leaning on planning and management measures, it is possible to act both in the construction of more resilient cities and in developing ways to reduce and stop climate change. These actions allow us to mitigate risks, better preparedness, respond and recover.

Planning can act to ensure that people can live in safe areas, with structured settlements, with access to quality services, income, and equal and inclusive social participation. This is not to say that such a task is easy, or that there is an ideal formula to adhere to it. In any case, planning becomes basilar to risk reduction, even with the difficulties encountered in practice.

Despite not being completely avoidable, disasters are constructions of society itself and its way of living and occupying spaces. If cities continue to produce vulnerabilities, we will continue to face risks and threats. Thus, disasters are as much about how institutions function, as their strategy in the face of risk, as they encompass natural, social and political issues.

Incorporating the concept of resilience into the disaster and planning discourse seems to be a good way forward. This includes the relevance of measures that integrate community knowledge and the people themselves since they are the ones who are the most aware of the needs and gaps faced.

Many perspectives can be adopted to better understand the framework of urban planning and disasters. The relationship between vulnerability and disaster prevention is explicit. Flawed planning can intensify inequalities and the very expression of vulnerability, but structured, participatory, and intelligent planning can promote an attitude of resilience, risk management, and mitigation.

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