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IN PURSUIT OF A MORE HOLISTIC, CITIZEN-CENTERED RESILIENCE STRATEGY: THE CASE OF PORTO ALEGRE, BRAZIL

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ABSTRACT

The concept of resilience is particularly applicable to urban planning if the complexity and various interconnected systems of a city are considered. The city of Porto Alegre has long been studied in academic circles for its tradition of citizen participation in local decision-making. Porto Alegre recently embarked on the development and implementation of a resilience strategy under Rockefeller's Foundation 100 Resilient Cities Project umbrella. This article uses descriptive exploratory methods to document the development and implementation of a Porto Alegre resilience strategy, which relied on the city's previous success in implementing innovative participatory methods. The institutionalization and regulatory frameworks necessary for the implementation of resilience strategies were also documented, uncovering a tripod of resilience that articulates relationships between civil society, government, and academia to achieve a successful implementation.

Keywords: Resilience; Resilient City; 100 Resilient Cities; Urban Sustainability; Porto Alegre.

INTRODUCTION

The world is going through a time of profound economic, social, and environmental changes and challenges. Currently, more than 55% of the world population lives in cities, which consist of complex structures of interconnected services and dense human settlements, creating impacts that challenge sustainable development and require long-term public policies (Malalgoda *et al*., 2016**;** Mendizabal *et al*., 2018; Hernantes *et al*., 2019; Conti *et al*., 2019).

The rapid population growth and the expansion of urbanization make cities more susceptible and vulnerable to environmental disasters and stresses of different orders. Policymakers must develop strategies that build a city's capacity to manage disasters.

Cities play a fundamental role in the development of solutions to systemic and global problems, not only because of their demographic and economic importance but also because of their ability to articulate people around agendas and projects for sustainable development (Jabareen, 2013; Conti *et al*., 2019).

Klein *et al*. (2017) and Mendizabal *et al.* (2018) argue that cities must structure new methods of governance and urban management, given the complexity and dynamics of urban centers in the 21st century. The development of city governance systems becomes critical in building a path for sustainable development and long-term plans (Conti *et al*., 2019). Chelleri (2012) argues that growing evidence on climate change, for example, requires that urban systems be transformed according to new development paradigms.

Jabareen (2013) reports that in recent years there has been increasing awareness of the risks that climate change poses for cities. The impact of climate change can be experienced through higher temperatures, rising sea levels, more intense storms, droughts, and heatwaves in urban settings. Meerow and Stults (2016) reinforce the critical relationship between urban centers and climate change, as cities contribute to climate change and at the same time are particularly vulnerable to climatic disasters.
Climate change, in particular, introduces new sources of uncertainty in cities, which puts pressure on local institutions to adapt to this reality (Meerow and Joshua, 2016). The word "resilient" is now very frequently used to discuss urban adaptation to climate change.

The idea of a resilient city is not new (Meerow and Stults, 2016). The word resilience comes from the Latin "*resilire*", which means the capacity that we have to be flexible at times when we

face adversity (Haruna *et al*., 2018; Liu and Song, 2020). The concept of resilience was first used by the ecologist C.S. Holling in the 1970s to refer to the ability of a system to maintain stability, basic functional characteristics or recover functionally when exposed to disturbance (Meerow and Joshua, 2016; Paidakaki and Moulaert, 2017; Haruna *et al*., 2018; Liu and Song, 2020).

Malalgoda *et al.* (2016) define resilience as the capacity to deal with stress or threats and remain unharmed. Liu and Song (2020) further elaborate on the concept, emphasizing on the capacity to quickly recover from disturbances due to emergencies, and Mendizabal *et al.* (2018) describe the concept in terms of the ability to absorb disturbances while maintaining functionality, adapting, and learning.

Haruna *et al.* (2018) argue that, given the complexity and the various interconnected systems in a city, the concept of resilience is particularly applicable to city planning. To better understand how the resilience concept applies and is of use to a complex city system, we must transcend the previous traditional definitions to explore how the concept has evolved across disciplines.

Our paper will examine and describe how Porto Alegre's resilience strategy was developed under the 100 Resilient Cities Project umbrella. The study will also identify innovative components in Porto Alegre resilience strategies, particularly in the area of participatory methods, analyze city resilience implementation measures through institutionalization and regulatory frameworks, and share lessons learned from stakeholders that participated in the process.

TOWARDS AN INTERDISCIPLINARY AND HOLISTIC VIEW OF RESILIENCE

Resilience is a subject reported in several areas of science - from physics to psychology - and constitutes an important field of research for urban studies (Meerow and Stults, 2016; Meerow and Joshua, 2016; Paidakaki and Moulaert, 2017; Haruna *et al.,* 2018; Mierzejewsk and Wdowicka, 2018; Liu and Song, 2020). Evans (2011) argues that the idea of a resilient city is changing the relationship between city and science, building a new urban ecology.

Malalgoda *et al.* (2016) also emphasize that the concept of resilience has been used by different sectors and areas of knowledge to rethink resilient communities, livelihood, and cities. Burnside-Lawry and Luis Carvalho (2016) point out that the concept of resilience has been adapted by policymakers as a tool to reduce susceptibility to shocks and stresses.

Leichenko (2011) defines urban resilience as the ability of a city or urban system to withstand a wide range of shocks and stresses or to quickly return to normal function. Chelleri (2012) portrays the resilient city as one capable of reducing its vulnerabilities and Vale (2014) describes the resilient city as one capable of responding to systemic threats from the environment.

Meerow and Stults (2016) underline that resilience is especially predominant in the climate change discourse. Krellenberg *et al.* (2016) warn that the idea of a resilient city is frequently discussed about climate change and an expanded view that leads to a new development paradigm is needed.

Paidakaki and Moulaert (2017) say that resilience is a concept in a continuous change, as it is a socially transformative process. Meerow and Joshua (2016) emphasize that the concept of urban resilience refers to the ability of a city to maintain itself or to quickly return to its functional conditions after stress or a shock situation and, at the same time, adapt and transform systems that can place at risk.

Haruna *et al*. (2018) define resilience as a system that can resist, absorb, and recover efficiently from hazards. Parting from that definition, they propose a more holistic resilient city concept based on five dimensions: infrastructure, social, ecological, economic, and institutional. Paidakaki and Moulaert (2017) argue that resilience is the ability of a system to not only return to normal after a catastrophe but also improve previous conditions.

Hernantes *et al*. (2019) describe a resilient city as an urban center able to resist absorb, adapt, and recover from unexpected events. This indicates maintaining critical services functioning and learn from shocks and stresses, to improve adaptative abilities and enhance local resilience. Jabareen (2013) shows that working with urban resilience requires complex thinking and methods. The complexity of structuring a resilient city is due to the countless citizens, systems, resources, and flows involved.

Leitner *et al.* (2018) point out that urban resilience, aligned with aspects of urban sustainability and smart cities, can become one of the most influential themes in the development of long-term urban policies of this century. They also argue that the theme of resilience is important for cities to attract international investment and make the city more open to political participation.

Meerow and Joshua (2016) explain that there is an inseparable relationship between resilience and sustainability, as resilience seeks to reduce the risk of disasters and the vulnerabilities of a city, setting necessary conditions for sustainable development. Judy Burnside-Lawry and Luis

Carvalho (2016) emphasize that sustainability, climate change, and disaster risk reduction are interlinked themes and an integrated challenge. Also, Chelleri (2012) highlights that the idea of resilience shares part of its structure with sustainability studies.

Burnside-Lawry and Luis Carvalho (2016) argue that, given the current level of global uncertainty, political agents must engage local communities to develop collaborative strategies and shared solutions for resilience. New models of participatory and collaborative governance are needed to strengthen aspects of democracy and citizen empowerment, which result in strengthening the resilience of cities (Conti *et al*., 2019).

Structuring a resilient built environment requires a multistakeholder approach, including governmental, social, private, and research institutions working together to develop integrated solutions (Malagoda *et al* 2016). Bianchi and Zacarias (2016) argue that an important tool to develop resilience plans that effectively consider the complexity of cities is the establishment of partnerships between governments, citizens, and civil society organizations interested in the disaster risk reduction process.

Campanella (2006) points out that a city can only become resilient with the participation of citizens, who must adapt behaviors in favor of sustainable development. Chelleri (2012) reinforces this idea by arguing that urban resilience is established through social learning processes, which make people change behaviors and adapt to the transformations of the world.

CITY RESILIENCE STRATEGY AND PROGRAM DEVELOPMENT

Improving learning and social involvement processes requires creating cities that think and establish long-term plans, which is one of the essences of resilient cities and also sustainability (Godschalk, 2003; Chelleri, 2012; Vale, 2014; Conti *et al*., 2019). Thus, Krellenberg *et al*. (2016) argue that persistence, transition, and transformation are often considered the three mechanisms or paths to urban resilience.

Appler and Rumbach (2016) also say that resilience is important to promote the capacity of the community to survive or adapt in face of stress. Therefore, they argue that historic resources are important to build local resilience, as historical places can preserve community identity during times of crises or after a disaster event. Based on this, we can understand the importance of the preservation of historical heritage for a resilient city.

Cities are faced with chronic and endemic problems, and resilience programs can assist in addressing issues such as water shortages, violence, food shortages, among others (Spaans and BasWaterhout, 2016). Developing resilience in a city is a complex task and city planners need to create indicators to measure the local resilience levels and their components (Haruna *et al.,* 2018). Indicators are essential for the evaluation of public policies and may serve as a guide for decision-making at various levels, allowing to measure progress and the achievement of objectives Souza *et al.* (2020).

Godschalk (2003) points out that resilient cities are built to be strong and flexible, rather than fragile. Its systems are designed to work even in the face of rising water, strong winds, earthquakes, and terrorist attacks. Krellenberg *et al*. (2016) report that the structuring of a city's resilience is seen as a crucial element of urban transformations.

Cities must structure projects and actions for sustainable development to absorb, resist and adapt to socioeconomic and environmental pressures (Leichenko, 2011; Bianchi and Zacarias, 2016). Godschalk (2003) and Evans (2011) argue that cities are systems vulnerable to natural disasters, and it is necessary to structure adaptation plans and mitigate the effects of these phenomena, making them more sustainable. This expresses the sense of a resilient city (Krellenberg *et al.,* 2016).

Urban resilience programs have gained ground recently due to the Rockefeller Foundation's "100 Resilient Cities" project (Liu and Song 2020). In 2013, the Rockefeller Foundation started this initiative during the celebration of its 100 the anniversary, setting aside $100 million for implementing resilience strategies in cities around the world, supporting each city with $ 1 million (Appler and Rumbach, 2016).

The Rockefeller Foundation (2015) defines urban resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience" and emphasizes that to establish a resilience strategy, the city must adopt a governance model based on the following principles: flexibility (to adopt strategies in response to changing circumstances), inclusion (collaboration and shared decision-making) and reflectiveness (use past experiences to make future decisions).

The 100 Resilient Cities Project assisted in the development of resilience strategies and programs around the world under 5 main principles: 1) help cities to develop a local resilience strategy; 2) promote public-private partnerships between the selected cities and a Rockefeller-designated "partners platform";

3) support cities with financial resources to hire a Chief Resilience Officer (CRO) for two years, who was the city resilience manager responsible for resilience strategy implementation; 4) promise a subsequent resilience dividend; and 5) establish a cities network to facilitate the exchange of experiences on urban resilience between the project members (Appler and Rumbach, 2016).

Newman *et al.* (2011) argue that resilient city is a term designed to go beyond "sustainable cities", driving the transformational aspects of the changes needed in cities to adapt to the long-term challenges faced by the planet. Fu and Zhang (2016) explain that applying the concept of resilience makes city design more sustainable. Brugmann (2012) reinforces that cities must adapt their structure, changing shapes and materials of the built environment so that urban areas become more resilient. It is a systemic urban change, which requires urban planners a new way of looking at reality.

In this context, Judy Burnside-Lawry and Luis Carvalho (2016) reinforce that social participation is a vital component to strengthen the resilience of communities and the development of partnerships. The authors also report that community resilience can be understood as the ability that a locality has to maintain, renew, and reorganize itself through the challenges and adverse events that may happen.

METHODS

The research employed the following qualitative research techniques that allowed for data triangulation: in-depth interviews with stakeholders from different sectors, direct field observation, and document analysis. Individuals who were selected for in-depth interviews represented key stakeholder groups who directly participated in the elaboration and implementation of the resilience strategy of the city of Porto Alegre. It is important to highlight that the interviews were conducted in person following all required ethical protocols. Data gathering from various sources allowed deepening the search for emerging elements (Creswell, 2017).

The interviews were recorded, transcribed and then imported into the qualitative data analysis software Atlas.Ti (Friese, 2012). The in-depth interviews and direct field observation took place between the 16th to the 18th of May 2019 in the city of Porto Alegre in Rio Grande do Sul. Table 1 shows the list of interviewed stakeholders.

Table 1 | Interviewed Stakeholders Profile

Interviewee	Profile
I1	Director of a Non-Governmental Organization (NGO)
I2	City Councilor
I3	Member of the City Hall, responsible for the resilience agenda.
I4	Researcher at the Federal University of Rio Grande do Sul
I5	International Organization Consultant
I6	Public Administration Technician

Source: Prepared by the authors (2020).

In addition to the interviews, four documents related to the Porto Alegre Resilience Strategy were analyzed: "Resilient Porto Alegre Guide", "Porto Alegre Resilience Strategy", the "Cezar Busatto Resilience Plan" (Law nº 12.629) and the "Sustainability Policy, Confronting Climate Change and Rational Use of Energy" (Complementary Law number nº 872), approved in November 2019 and January 2020, respectively. It is important to note that both laws resulted from the development of the Porto Alegre Resilience Strategy and, evidenced the implementation of a regulatory framework, so their inclusion in this study was critical.

Table 2 | Consulted Documents

Document	Description
Resilient Porto Alegre Guide	Technical document created by the Office of Innovation and Technology of the Porto Alegre City Hall and which defines resilience concepts and ideas recounts the city's resilience program, and summarizes the main guidelines and actions of the resilience strategy. (12 pages)
Porto Alegre Resilience Strategy	Technical document created by the City of Porto Alegre with support from the Rockefeller Foundation, consolidating the city's resilience strategy, including the delineation of objectives and goals. (71 pages)
Municipal Law nº 12.629/2019	The law establishing the Cezar Busatto Resilience Plan in the city of Porto Alegre and other measures.
Complementary Law number nº 872	Sustainability Policy, Confronting Climate Change and Rational Use of Energy.

Source: Prepared by the authors (2021).

The analysis process was carried out following the three coding cycles prescribed by Charmaz (2006). The first cycle, open coding, follows a process of organizing the data, constructed from the sources of evidence, and assigning category labels (code). This process is based on the understanding and searches for theoretical explanations of the participant's real language, the text of documents, or observed events (Santaña, 2012). The second is the axial coding cycle that is applied to group the codes based on the convergence of theoretical explanation, previously found in the literature review (theory-driven), or categories that emerged from the data (data-driven). Axial coding seeks cause and effect relationships, explanations, properties, and others. In this stage of the research, the categories were aligned to consolidate the research results. Finally, we use selective coding to refine the initial categories and establish meanings in the relationships and explanations combined with theoretical and empirical evidence.

It is important to highlight that despite the three cycles present a hierarchical relationship of construction of the theoretical, the cycles can happen concurrently (Charmaz, 2006; Saldaña, 2012). An important aspect of this research is that each coding stage was followed by a process conducted in pairs, and it reinforced the reliability in research findings due to the convergence of observations addressed by more than one researcher to ensure triangulation (Hussein, 2009).

Furthermore, the data were also analyzed using a constant comparison technique, so we carried out the coding and analysis activities in a concomitant and circular manner, which allowed us to validate the categories of analysis (Charmaz, 2006; Saldaña, 2012). This process follows a flow towards the aim of the research objectives and is not tied to the process linearly. Based on the codification process and constant comparison technique, the theoretical sampling is increased, i.e., several incidents found (Santaña, 2012). To validate the theoretical saturation in the information collected, and to search for new incidents by increasing the database, we performed the "Codes-Primary Documents Table" available in the Atlas.Ti software (Ronzani *et al.,* 2020). This test presents the frequencies of the codes in categories established in the analysis phase and allows us to identify the relationships between categories and interviewees (Friese, 2012).

We point out that some incidents (quotations) clipped from evidence sources represent more than one code (label category). This situation is called co-occurrence, and it is even used as a guide in the axial and selective coding phase (Friese, 2012; Ronzani *et al*., 2020). It is worth mentioning

that the use of Atlas.Ti was fundamental for the performance of this type of analysis. We emphasize that Atlas.Ti allows us to relate the codes in their contexts and establish a coefficient of co-occurrence, which is determined by the proximity or overlap of codes in the same context, that is, a text segment of the interviews, documents, and notes that were selected and classified with the respective codes assigned to this segment. Based on the applied procedures, it was possible to understand the research phenomenon and present the results that follow in the next section.

RESULTS

The city of Porto Alegre is the capital of the State of Rio Grande do Sul, located in the southern region of Brazil. The city has 495,390 km2 of territorial area and 1,488,252 inhabitants, with the Municipal Human Development Index (MHDI) being 0.805, which means a very high human development (IBGE, 2010). Porto Alegre has a long tradition in participatory processes due to having implemented the participatory budget for more than three decades, which allowed the creation of a strong local participation culture and the development of sustainability agendas (Célérier and Botey, 2015). This process was inaugurated as a result of an opening in the Brazilian political environment in the 1980s after a rupture with authoritarian and centralized power previously instituted by a military regime. Participatory ideologies were particularly adopted in Porto Alegre, where organized sectors of society sought to build mechanisms that would effectively influence public administration in Brazil (Rocha 2009).

The Porto Alegre resilience program formally started in December 2013, when the city was selected to participate in the Rockefeller Foundation's 100 Resilient Cities project. According to the interviewees and the document *Resilient Porto Alegre Guide*, this was ground zero for the development of the city's resilience strategy and the eventual development of accompanying legal and institutional frameworks.

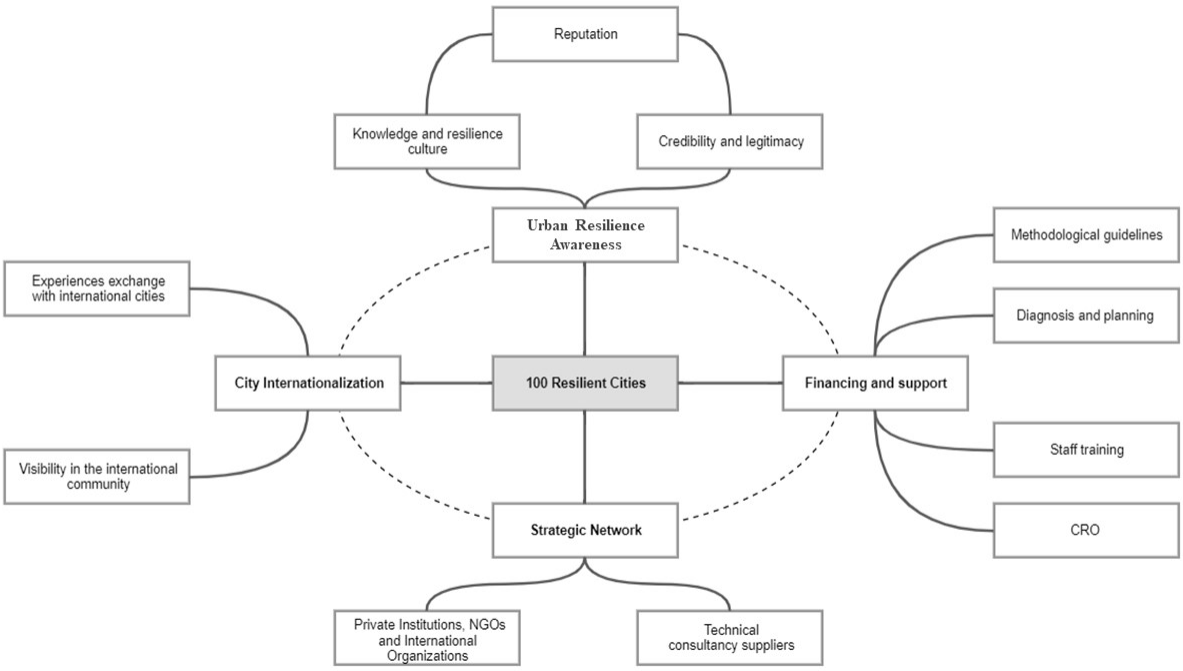
The interviewees highlighted that the main strength of Porto Alegre is the participation of civil society, derived from the participatory budgeting processes, which were created in the late 1980s. Such a foundation was crucial in its selection as one of the Rockefeller Foundation's 100 Resilient Cities project. The local participation culture also led to the development of a city resilience agenda.

Porto Alegre's proactively sought participation in the 100 Resilient Cities project as an initiative to find solutions to pressing problems. Three important drivers shaped Porto Alegre's resilience framework and led the city to create a resilience strategy: a) Institutional, driven by political leadership and the Rockefeller Foundation's project; b) Environmental, due to the impacts of climate change; c) Socio-economic, motivated by insecurity, the municipality's economic crisis and social inequality.

The document *Porto Alegre Resilience Strategy* reinforces these drivers based on a diagnosis of the city, which at the time faced several problems and acute risks, such as floods, economic crisis, air pollution, urban violence, and irregular land occupation, among others (Porto Alegre, 2017).

Joining the Rockefeller Foundation's 100 resilient cities project allowed Porto Alegre to become part of an international city network that connected city planners from different parts of the world. The main benefits that the city obtained by participating in this movement are shown in Figure 1.

Figure 1 | Resilient POA: benefits of 100 Resilient Cities Network



Source: Authors (2021).

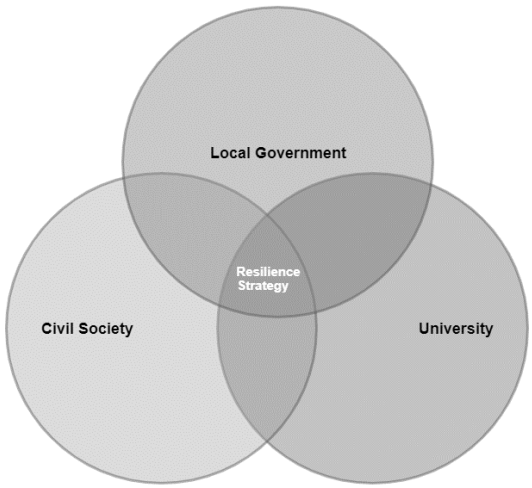
Participating in the 100 Resilient Cities allowed Porto Alegre to derive the following benefits: a) City Internationalization, achieved through the international cities network, allowing the exchange of experiences and resilience knowledge with other participating cities, as well as increasing the city's international visibility; b) Strategic Network, leading to new contacts with the private sector and suppliers financed by the Rockefeller Foundation, in addition to the development of partnerships with NGOs and international organizations; c) Financing and support, through the contribution of US $ 1 million that enabled the payment of the Chief Resilience Officer (CRO) and the technical consultancy staff for the elaboration of the resilience strategy; d) Urban Resilience Awareness, through knowledge acquisition under the "seal" of an international organization, which gave credibility to project development and effective stakeholder engagement.

The exchange of experiences with other cities in the 100 Resilient Cities network allowed Porto Alegre to have benchmarks for public resilience policies, reducing the time needed for decision making and project implementation. Results emphasize the importance of the Rockefeller Foundation's influence on the continuity of the resilience project in Porto Alegre, bound by a signed agreement.

The development of the Porto Alegre resilience strategy occurred in stages, with the financial support of the Rockefeller Foundation to facilitate the hiring of specialized consultants such as Accenture. The first stage was preparing a diagnostic survey for urban resilience. Second, the city sought partners and engaged stakeholders through participatory processes for the formulation of the Urban Resilience plan. Third, proposed intervention areas and regions were defined, in addition to conducting training sessions and local discussions. Having completed the diagnosis and formulation of the resilience plan, the public authorities carried out a technical evaluation to verify the feasibility of the proposals, filtering the various proposed contributions to identify relevant stakeholders. Finally, regional plans and the city's Resilience Strategy were defined (Porto Alegre, 2015).

The results demonstrate that Porto Alegre presented a holistic and integrated resilience strategy planning scheme, achieved by three different groups of stakeholders from different spheres - civil society, government, and academia - creating a more balanced, transparent, and collaborative governance scheme that allowed the development of a local resilience strategy.

Figure 2 | Resilience Tripod



Source: Authors (2021).

We show that civil society participation was carried out by a Non-Governmental Organization (NGO) called Urban Intelligence Center (*Centro de Inteligência Urbana)* (CIUPOA), while the local government was represented by city hall and academia was represented by the Federal University of Rio Grande do Sul (UFRGS). A comparative analysis shows that this resilience tripod represented a new method for building a resilience strategy in the Rockefeller Foundation's 100 Resilient Cities network. Despite this, there was a centrality of the project in local government, which became a challenge for the other stakeholders.

The research also points out that local changes in administration have slowed down some actions of Porto Alegre's resilience strategy since each political mandate imposes an agenda with varying priorities. Despite this, the city's resilience strategy resulted in the enactment of two laws: a) Municipal Law No. 12,629/2019, which establishes the Cezar Busatto Resilience Plan in the city of Porto Alegre, and; b) Complementary Law number 872 (Porto Alegre, 2019; Porto Alegre, 2020). It is important to note that both laws were the result of more than five years of discussions and development of the resilience project, which allowed the resilience policy to mature until its effective institutionalization.

Table 3 | Legal statements resume

Law	Main statement
Municipal Law No. 12.629/2019	The law institutes the municipal resilience plan, which addresses environmental, economic, and social issues, including urban mobility, encouraging the use of public transport and alternative modes; the legalization of land through a land tenure regularization program, to mitigate socio-environmental imbalances; the prevention of risks to climatic catastrophes, mainly flooding and landslides; the establishment of a culture of peace; the promotion of a low environmental impact economy, clean technologies, and innovation, among other measures.
Complementary Law number 872	The law provides for the preservation of the city's climate system through a series of initiatives; accountability for environmental damage; the control of GHG emissions; the institution of environmental education programs; encouraging the development of clean technologies; prioritizing collective and non-polluting modes of transport; the institution of a recycling program; the conservation of environmentally protected units; control and treatment of effluents; among other measures.

Source: Authors (2021).

It is worth mentioning that Paragraph 4 of Municipal Law No. 12,629/2019 defines resilience as "the capacity of individuals, communities, institutions, companies, and systems in a municipality to survive, adapt and grow, regardless of the types of chronic stresses and acute shocks they experience". Likewise, the interviews demonstrated the importance of thinking from individual to collective resilience, to first raise awareness among individuals to establish a resilience plan. Furthermore, the law establishes that the city of Porto Alegre aims to become an urban resilience model for Latin America by the year 2025.

Interviewees were also asked to share the main lessons learned throughout this process that can serve as best practices by other cities that also want to implement an urban resilience plan. Table 4 summarizes the main lessons learned.

Table 4 | Building local resilience: lessons learned

Lessons	Understading
Accumulate shared capital	A multistakeholder debate will allow for the accumulation of knowledge around common causes to build solutions at the community level.
Technical Expertise	The importance of preparing public officials on technical issues related to urban resilience.
Learning to deal with something new	Importance of breaking paradigms in public administration to foster new projects and innovation.
Materiality and applicability	Give materiality to the concept to leave the abstract or ideological zone, to give life to the concepts of resilience.
Plan for the long term	Resilience policies require a long-term vision and strategies, based on participatory and integrative governance.
A systemic view of resilience	Resilience is a transdisciplinary subject and involves environmental, social, and economic themes. It must be thought holistically to improve communities' livability conditions.
Develop strategic alliances	Building partnerships is critical to achieving resilience. To build a resilient community you must be willing to give up something for the sake of the other.
Prioritize programs and projects based on indicators	Creation of a methodology to assess, diagnose and prioritize the various projects to meet the demands and suggestions of the population.
Engage political leaders	Engage government officials in resilience projects so that they can be institutionalized and have the required regulatory framework. Make political leadership aware.
Develop a participatory resilience strategy	Construction of a governance structure based on diversity and local participation networks to achieve common goals.
Participate in international networks and projects	Participating in international cities' networks encourages discussions, the exchange of experiences and knowledge, and discussions on project development.
Interdisciplinary education for resilience	Interdisciplinarity as a method to raise awareness among individuals and local communities to build resilience.
Importance of local characteristics and vocations	Each city needs to understand its reality and establish its resilience vision.
Resilience must be adaptive	The city must be adaptive to learn and evolve.
Resilience as way of living	Resilience does not depend strictly on infrastructure, as it can be implemented through individual actions and daily behaviors.

Source: Authors (2021).

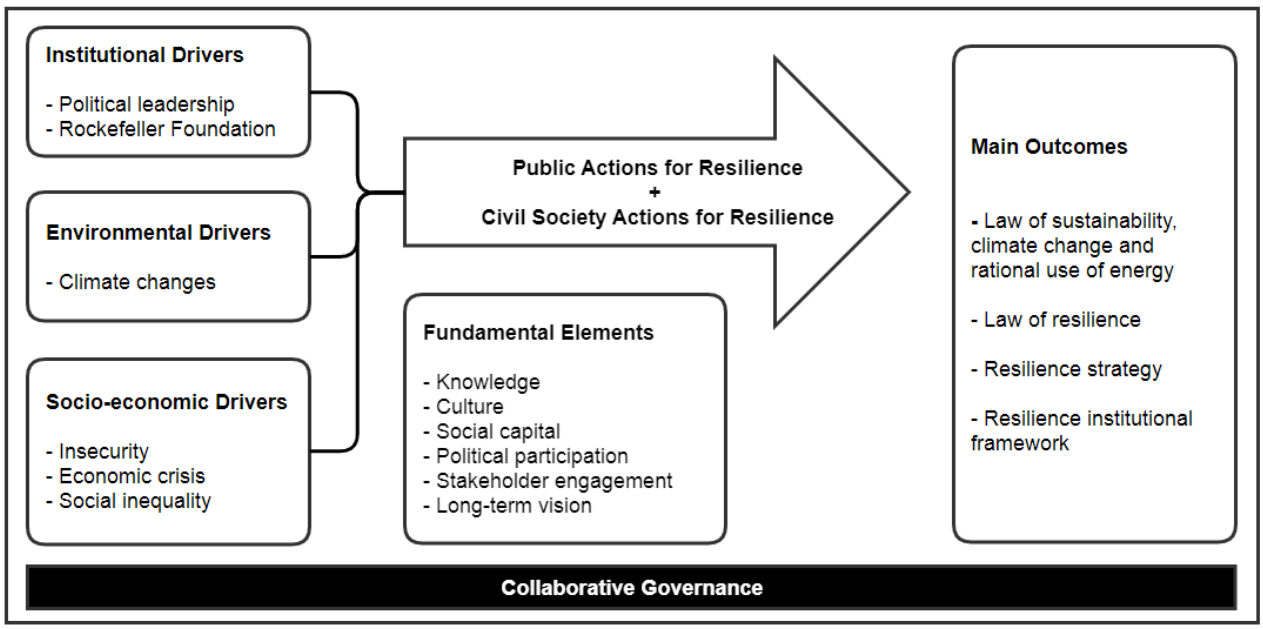
Research results indicate that the creation of the resilience strategy in Porto Alegre brought a series of benefits to the city, as it created a new dynamic to think about resilience and the need to structure programs and projects for future generations, such as the revitalization of the Fourth District - an old industrial district - through the creative economy and entrepreneurship. Besides, all resilience discussions facilitated obtaining financial resources and partners for the implementation

of projects, such as the Development Bank of Latin America (CAF), the Inter-American Development Bank (IDB), and the World Bank.

One example of key projects resulting from the resilience development process was the reestablishment of the city's rural area through new zoning of the Master Plan. Classifying these agricultural properties as urban negatively affected local producers through an increased tax burden and a more burdensome regulatory framework. The rural area of Porto Alegre is located in the extreme south of the city and has about 450 agricultural properties - 10% with certified production of organic food, intending to be pesticide-free by 2033. These farms are also responsible for supplying local farmer´s markets and street fairs.

In summary, Figure 3 illustrates the Porto Alegre Resilience Framework resulting from the drivers that motivated the development of the resilience strategy, contextual elements, and the main outcomes to date.

Figure 3 | Porto Alegre Resilience Framework



Source: Authors (2021).

The development of Porto Alegre's resilience strategy faced a series of challenges, but the process ultimately resulted in its institutionalization by law, as presented in Figure 3. The document *Porto Alegre Resilience Strategy* confirms the process and that resulted in the institutionalization of resilience. The final document covers a series of themes and actions that the city would aim to pursue, including the following: having a diversified economy that fosters creative, collaborative economies and new technologies; developing degraded areas of the city; exploring the agricultural production potential of the rural area and stimulating the production of organic and family farming; strengthening a culture of peace; adopting risk prevention policies, mainly those of flooding and landslides; preventing the occupation of areas susceptible to these risks; having a land tenure regularization process capable of eliminating informal occupations; strengthening sustainable urban mobility; and having a management model that promotes a culture of resilience in all actions of the city through participation and a collaborative governance process (Porto Alegre, 2017).

DISCUSSION

The Porto Alegre resilience program broke with the traditional idea that resilience is strictly related to the agenda of climate change, presenting a holistic view of the concept, similar to that in Krellenberg *et al.* (2016). The literature review emphasizes the connection between the themes of resilience, climate change, and disasters (Chelleri, 2012; Jabareen, 2013; Meerow and Stults, 2016; Leitner *et al*., 2018). However, the case of Porto Alegre shows a departure from these recurring themes, showing that cities, especially those that suffer from social deficits, can become more resilient by prioritizing socioeconomic stability and human well-being.

Paidakaki and Moulaert (2017) highlight that few publications address the socio-political debate over the meaning of resilience and its practices and our study helps to fill this gap in the literature. Our research demonstrates that thinking about urban resilience can mean developing long-term policies in the social, environmental, and economic areas. Thus, the concept is intrinsically related to sustainability but presents principles such as adaptability and growth, regardless of the types of chronic stresses and acute shocks that a city may suffer (Porto Alegre, 2019). Based on this, we can underline the hypothesis that resilience is a way for cities to achieve sustainability.

Haruna *et al.* (2018) highlighted in their research that resilience is an important theme for urban planning, which we corroborate with our study. Resilience thought systemically can serve as the main strategy for local governments that seek sustainable development, as it can become operational at different levels of government.

The research also demonstrates that Porto Alegre sought to adapt its infrastructure and characteristics of the built environment to remain resilient and avoid problems such as floods. The importance of the design of the built environment was presented in the study by Malalgoda *et al.* (2016), and the City Resilience Law illustrates how the regulatory framework considers such elements, providing for the optimization of energy, transport, and anti-flooding systems (Porto Alegre, 2019).

The resilience agenda also can effectively engage stakeholders, as pointed out by Malalgoda *et al.* (2016) and Hernantes *et al.* (2019). In the case of Porto Alegre, the resilience strategy was articulated with broad social participation, through what we called "Tripod of Resilience", which was formed by civil society, government, and academia. Collaborative governance systems are essential to enable continuity in public policy and to develop sustainable cities (Conti *et al*., 2019).

Regarding stakeholder engagement, our research revealed that resilience has the power to attract important players for project development, such as international organizations and funders. There is an international understanding of the need for cities to pursue development models based on the principles of urban resilience.

During the interview process, we realized that civil society and academia stakeholders who participated in the entire development process of the resilience strategy in Porto Alegre described the project as stagnant. However, in the view of respondents in government there was no end to the process, but rather the beginning of a new moment with the institutionalization of all multistakeholder efforts and a regulatory framework, through Municipal Law No. 12.629 / 2019 and Complementary Law Number 872.

In our perspective, another important result of the years of work in creating the resilience strategy of Porto Alegre, was the reclassification of the rural area in the city's master plan, since local food production is a fundamental strategy to deal with food-related crises and adverse events, as pointed out in the study by Spaans and BasWaterhout (2016).

Finally, we monitored whether the instituted policies of resilience and sustainability in Porto Alegre would undergo any adjustment to address the public health crisis imposed by COVID19, following Spaans and BasWaterhout (2016) framework that pointed out the need for cities to implement resilience plans to deal with chronic problems such as disease outbreaks. However, to date, there have been no changes as a result of the COVID-19 pandemic.

CONCLUSION

The objective of this research was to document and analyze the resilience strategy of the city of Porto Alegre and we carried out this analysis over two years by conducting in-depth interviews, direct observation in the field, and document analysis that included monitoring authorization and publishing of legal frameworks.

Resilience is in a sense the ability to develop and maintain the sustainability of a territory. Thus, resilience is not a restricted to climate change issues, but it also includes the socio-economic dimension of sustainable development and which should not be seen as a mere semantic issue but must be internalized in the desires of society and public policies of a city. Our research shows that resilience may reach beyond the ability to recover from adverse effects, taking us back to the social issues of communities and the preparation of individuals to survive in extreme conditions. Thus, we realize that resilience is linked to the need for a change in culture and awareness, underscoring the need to take this agenda to public debate for building more resilient cities.

According to Jayanthan & Singh (2016), participatory citizenship and democratic social responsibility are closely related, as both include the monitoring and evaluation of public policies. One way to build a democratic environment conducive to making cities more resilient is precisely to facilitate relations between citizens and governance institutions. Porto Alegre had the advantage of having developed participatory methods that led to the successful implementation of a resilience strategy in a democratic context.

The 100 Resilient Cities Project from Rockefeller Foundation was fundamental for Porto Alegre to start the debate and to bring this agenda to the forefront, which resulted in policies that led to a more resilient and sustainable city. Besides, the project was fundamental to involve and train public

officials and broader segments of society, which appropriated the process by active participation.

In Porto Alegre, the diffusion of knowledge about resilience through political participation and collaborative governance systems was fundamental for the engagement of civil society and academia in the project. Therefore, the already developed culture of participation in the city was a facilitating element to prioritize actions and allow the construction of the resilience strategy.

Our study contributes to filling gaps in studies on urban resilience, pointing out the need for cities to work on the concept holistically and according to their territorial needs and context. Despite this, the results cannot be generalized, which is the main limitation of this study.

Regarding future studies and due to the COVID19 pandemic, we recommend to researchers interested in the topic carry out research that investigates actions and projects that explore the relationship between resilient cities and the shock caused by pandemics. Another recommendation is to carry out an evaluation metric for resilience projects, such as an urban resilience coefficient.

Finally, we emphasize that urban resilience is not just a matter of institutional design or law, but a matter of empowering individuals through the integration of different stakeholders through an effective collaborative governance process. Only then can we be assured of conducting a legitimate process that would lead to increased resilience at the local level.

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