

ARTICLES

ENVIRONMENT, GOVERNANCE AND DEVELOPMENT

ADAPTATION TO THE IMPACTS OF CLIMATE CHANGE FROM THE PERSPECTIVE OF THE CITY OF RECIFE MASTER PLAN

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Abstract

Defining measures for climate change adaptation is a complex task given the existence of social, environmental, and economic demands, particularly in cities with poor urban infrastructure. As a result of analysing the revision process of the Recife Master Plan, it is possible to observe that a reduction in the social and environmental vulnerabilities has implied carrying out more consistent studies, which may entail the implementation of structuring measures, and that environmental sustainability requires multilevel governance, with policy reforms on a global, regional and local scale, difficult to implement in the short term, although necessary for refocusing climate policies and for overcoming the inability to provide resources for a tailored adaptation infrastructure. The path to building a resilient city that provides a safer environment for the future depends on an inclusive development model, which enables the population to improve urban conditions and minimize the impacts brought about by extreme weather events.

Keywords

Urban Planning; Adaptation; Sustainability; Resilience; Environmental Management.

ADAPTAÇÃO AOS IMPACTOS DAS MUDANÇAS CLIMÁTICAS NA PERSPECTIVA DO PLANO DIRETOR DA CIDADE DO RECIFE

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Resumo

É complexa a tarefa de definir medidas de adaptação às mudanças climáticas diante da existência de demandas sociais, ambientais e econômicas, sobretudo em cidades que apresentam infraestrutura urbana deficiente. Como resultado da análise do processo de revisão do Plano Diretor do Recife (PDDR), vê-se que a redução das vulnerabilidades socioambientais implica a realização de estudos mais consistentes, que possam acarretar a implementação de medidas estruturadoras, e que a sustentabilidade ambiental demanda uma governança multinível, com reformas políticas em escala global, regional e local, de difícil aplicação no curto prazo, mas necessárias para reorientar as políticas do clima e superar a inabilidade de prover os recursos para uma infraestrutura adequada à adaptação. O caminho para construir uma cidade resiliente, que proporcione um ambiente mais seguro para as futuras gerações, depende de um modelo de desenvolvimento inclusivo, que permita melhorar as condições urbanas para a população e minimizar os impactos ocasionados pelos eventos climáticos extremos.

Palavras-chave

Planejamento Urbano; Adaptação; Sustentabilidade; Resiliência; Gestão Ambiental.

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Introduction

The city of Recife, in the Brazilian Northeastern state of Pernambuco, presents similar social and environmental vulnerabilities to other Brazilian metropolises, a scenario resulting from an exclusionary development model and lack of investment in urban infrastructure. Strongly susceptible to the effects of climate change, this adverse scenario may be further aggravated, since the city is subject to rising sea levels, increased precipitation and higher temperatures, with the possibility of a greater occurrence of floods, heat waves, landslides and erosion along the coastal region.

The city's adaptation to climate change is therefore imperative, although there is still no consensus on how this issue should be addressed in urban planning, given the magnitude and intersectorality of the problem. This article discusses the concern of public authorities and society regarding the climate agenda in the sixteenth most vulnerable city on the planet, as classified by the Intergovernmental Panel on Climate Change (IPCC), and the limitations of urban planning, given the increasingly pessimistic climatic scenarios, the threats of which still remain invisible to the majority of the population.

Based on the assumption that it is necessary to think globally and act locally, there has been a consensus that the challenge of confronting climate change is the responsibility of the entire society, and cannot be achieved without the cooperation

and mutual effort of the international community. The manner in which it is conducted, however, would be up to national and subnational governments, including all the actors that play some role in elaborating the form and function of human settlements (UN-HABITAT, 2015). Accordingly, there is in the literature a rich interaction of this theme with urban planning to establish ways in which to overcome the disturbances of social life, which are strongly expressed in the threat of climate change (ARANTES, 2012).

In the Brazilian case, where around 85% of the population live in urban areas, despite the difficulties in remedying the infrastructure investment deficit of cities, the instruments of urban management in the City Statute, established by Law No. 10,257, on July 10, 2001 (BRASIL, 2001), are identified as being fundamental for putting mitigation and adaptation strategies into practice to tackle the effects of climate change, in order to make cities more resilient (BRAGA, 2012). The master plan, in particular, mandatory for cities with a population of more than 20,000, with a view to implementing an urban development and expansion policy, has also been considered an important environmental planning instrument (SANTOS, 2004), for addressing the socio-environmental challenges of a historical process of exclusionary urbanization, as well as promoting environmental sustainability.

After studies conducted both by the academy and the municipal government indicated that the city of Recife needed to prepare itself for extreme environmental events, a set of actions related to the climate agenda gained international recognition, thereby demonstrating an effort by municipal management to develop a low-carbon policy. However, they also highlighted the need to move forward in adopting measures so as to make the city resilient and more able to face the heightened problems such as floods, sea level rises and landslides. Hence, this makes a revision of the master plan, a priori, an opportunity to integrate adaptation and mitigation actions into the guidelines in order to promote more effective sustainable management and development of the territory.

Considering the magnitude of the potential impacts of climate and the socio-environmental problems identified across the territory of the city, we have therefore sought to answer the following question: To what extent do the public authorities and society 1) understand the degree of the city's vulnerability, and 2) expect to make the master plan revision process the moment for establishing commitments and implementing specific programs capable of guaranteeing a new paradigm for the environmental sustainability of Recife, given the challenges of climate change? Hence, we have focused on analyzing the 2008 Master Plan and on the actions of the ICLEI – Local Governments for Sustainability in the Urban-LEDS (Promoting Low Emission Development Strategies) program, among other investigations.

1. The evolution of urban planning in Recife

The center of a metropolitan region that concentrates 3.7 million people and 65.1% of the entire GDP of the state of Pernambuco, Recife is considered the most important industrial center in the Northeast region, producing goods and services such as sugarcane, ships, oil rigs and electronics. The Recife Metropolitan Region (RMR)¹ has undergone a rapid process of urbanization and is currently home to 42% of the state's population, which occupies only 2.8% of the territory of Pernambuco.

The ninth largest city in Brazil, with a population of almost 1.6 million spread across an area of just 218 km², Recife is subject to a mean rise in sea level, an increase in precipitation and a higher mean temperature (RECIFE, 2016). In addition to the climatic aspects, the city sits on a low-lying coastal plain, with extensive urbanization along the beachfront and a high population density, of around 7,300 inhabitants/km², plus irregular occupation of the hillsides and wetlands, a growing increase in soil impermeability and risks arising from the phenomenon of subsidence – in which the levels of aquifers and urban soil are lowered. Recife is also located on the delta of three rivers – the Capibaribe, Beberibe and Tejipió – and has an extensive water network involving 95 canals, with a total length of more than 100 km. All of this has led the city to occupy the 16th position in the world ranking of vulnerability to the effects of climate change.

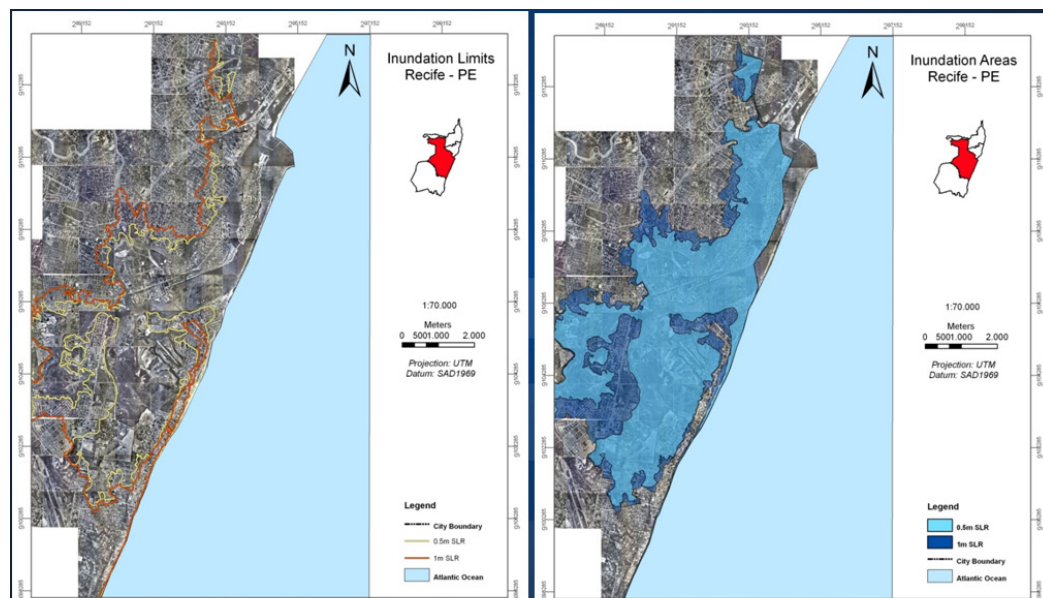


Figure 1. The vulnerability of Recife to climate change in 2016

Source: Araújo (2016).

1. Throughout the article, while the names of Brazilian institutions, government departments, strategies, plans etc. have been translated into English, their acronyms have remained in Portuguese.

Araújo (2016) warned about the impacts of climate change on the city's territory and has referred to 33.7 km² of floodplains (Figure 1), in a simulation of what could happen in Recife, where a rise in the sea level is predicted due to an increase in global temperature of 2° C, and, in a more pessimistic scenario, 4° C. The author has also argued that a rise in the sea level has already occurred, primarily in the tropics, and a change in wind speed has caused more precipitation, in a trend whereby heavy rains have become more and more frequent.

Gusmão (2017, s.p.), when addressing the phenomenon of subsidence, reinforced concerns stating that Recife has grown on top of landfills located on soft soil. The weight of these landfills has caused the soil to sink in various regions of the city, making them more susceptible to flooding. The author stated that: "If we imagine that the sea level will rise over the coming decades, alongside the sinking of these areas of land, we will have an extremely hazardous situation in terms of loss, both human and of the city's infrastructure"² (GUSMÃO, 2017).

Continuing in relation to climate vulnerability in the city of Recife, in a study on vulnerability to disasters caused by rain, Souza et al. (2014) identified that there has been a significant increase in the occurrence of disasters, affecting the social, political and economic system of the city. Based on the results encountered, it was evident that the largest number of deaths resulting from the rains in Recife, calculated by a risk equation, occurred in the areas of hills and population density, in conjunction with the poor social and economic conditions presented.

According to a case study of medium and large coastal cities in different regions of Brazil, published in the international report *Impact, vulnerability and adaptation to Climate Change in Brazilian Coastal Cities* (IPCC, 2015), between 1946 and 1988 the sea level - in Recife increased by 5.6 mm/year, which corresponds to an increase of 0.24 m in 42 years. Coastal erosion and occupation of the backshore areas reduced the beach line by more than 20m at Boa Viagem Beach, the city's most valorized beachfront area. There was a frequent occurrence of landslides and flooding as a result of the rains, associated with a lack of infrastructure and, in particular, the social and economic conditions of the population. The report also indicated the possibility that by 2050 the sea level would have risen by 40 cm, thereby substantially increasing the risk of the occurrence of rough seas, floods, flash floods and landslides.

Corroborating the signs of Recife's considerable vulnerability to the prospect of rising sea levels, the National Aeronautics and Space Administration (NASA) announced in November 2017 that a new tool developed by engineers at the

2. This and all non-English citations hereafter have been translated by the author.

Jet Propulsion Laboratory was able to predict how port cities will be hit by the melting glaciers in Antarctica, Greenland and thirteen other ice masses. In Brazil, Rio de Janeiro, Recife and Belém were among the 293 cities studied, and will be the most affected. The study was able to calculate the city's exact sensitivity to the melting of each ice mass based on images generated by a gradient fingerprint mapping model. The tool aims to contribute to the planning of the world's main cities over the next hundred years (BBC, 2017).

In view of the various warnings given out on the risks of climatic effects, a set of actions developed by the government has received international recognition, and is a demonstration of the efforts on the part of the municipal management to confront the climatic effects. This recognition is due to the fact that, in 2013, Recife was selected by the ICLEI to be one of the model cities of the Urban-LEDS project, a global project implemented by ICLEI in partnership with UN-Habitat, funded by the European Commission. Its objective is to provide a series of tools and solutions in order to guide cities in South Africa, India, Indonesia and Brazil with regard to implementing low-carbon development policies. Since then, Recife City Hall has joined the global climate agenda and has gained access to specialized consultancy and technical training, and has participated in several international seminars and events.

To meet the need for links between the municipal government and the representatives of organized civil society, the Committee for Sustainability and Climate Change in Recife (*Comitê de Sustentabilidade e Mudanças Climáticas do Recife – COMCLIMA*) and the Sustainability and Climate Change Group (*Grupo de Sustentabilidade e Mudanças Climáticas - GECLIMA*) were also created through Decree No. 27, on September 6, 2013.

In 2014, Law No. 18,011 (RECIFE, 2014) was enacted, which instituted the Policy for Sustainability and Confronting Climate Change in Recife and provides the principles, guidelines and objectives to combat the impacts of climate on the city. Among the issues highlighted in the legislation, the guidelines for increasing soil permeability and extending green areas are of particular note, in order to avoid the formation of heat islands resulting from urbanization. This law, which requires undertakings with a large environmental impact to form an inventory of greenhouse gases (GHG), created the Environmental Sustainability Certification Program, with a view to encouraging sustainable construction. It also establishes the presentation and disclosure of the GHG emissions inventory prepared by Recife City Hall every two years.

The goals and actions to steer Recife towards low-emission urban development constitute the Low Carbon Plan, and were discussed with the participation of civil

society and the private sector, as well as the different spheres of municipal and state government, seeking to bring greater consistency and legitimacy to the proposal. This plan includes actions to reduce emissions in the areas of waste and sanitation, energy and transport, and to promote the city's sustainable development, such as valorizing green areas and expanding afforestation and environmental education.

Another initiative worthy of mention, of a participatory nature, and which reinforces actions to combat climate change, is the *Projeto Recife 500 anos* [Project Recife 500 years], which is defining medium and long-term planning, with the aim of making the city's transition toward a new pattern of development.

This set of actions has placed Recife in a privileged situation in relation to other capitals in the Northeast, with the setting up of an entire institutional arrangement of the Policy for Sustainability and Combating Climate Change. The theme was introduced onto the municipal urban agenda and the actors are beginning to understand its importance. With the regulation, the definition of guidelines, the preparation of GHG emission inventories and the low carbon plan and the regular functioning of the Committee, the city is moving towards consolidating its planning structure. However, the sectorial actions foreseen in the areas of transport and urban mobility, waste and sanitation, energy and sustainable urban development to reduce GHG emissions lack implementation and monitoring.

With regard to adaptation, the IX COMCLIMA, held in July 2016, presented studies on the impacts of climate change across the territory of Recife. Despite the disturbing warnings that were delivered, tougher and more restrictive measures regarding the use and occupation of land remain a major challenge, and needs to be met in order to reduce the vulnerability of the city. In December 2018, at the XV COMCLIMA, Recife City Hall announced that development would begin on a Climate Change Adaptation Plan, tackling ways to adapt the state capital of Pernambuco to scenarios of gradual and extreme climate change and climate variability. The forecast is that the work, financed by CAF (Latin American Development Bank) and prepared by WayCarbon and ICLEI-SAMS, will present Recife's vulnerability index after nine months, with the territorial mapping of vulnerability points and a plan of actions that need to be implemented in order to reduce the impacts.

In conjunction with the achievements of the urban policy, the objective of which begins to organize the full development of the social functions of the city and urban property, the decentralization and strengthening of the municipality as an entity of the federation takes place, which enables democratic experiences in the planning and municipal management to be broadened. Several cities, including São Paulo, Rio de Janeiro, Natal, Santo André, Diadema, Belo Horizonte and Recife itself, created master plans in the 1990s, using the principles of the Constitution

in order to reformulate the framework of municipal urban policy (CYMBALISTA; CARDOSO; SANTORO, 2011). However, it is in the preparation and approval of master plans after the City Statute (BRASIL, 2001) that the rules of the democratic regime become clearer, with new spaces for participation.

2. Between the law and the marks of exclusionary urbanization

From a planning point of view, urban growth in Recife throughout the twentieth century until the present day has been accompanied by a sequence of plans, laws and decrees most markedly from 1919, with revisions or replacements, until arriving at the 2008 Master Plan, which is still in force. These laws have generally relegated social and environmental issues to the background, by allowing urbanization to occur in a disorganized manner, generating what is conventionally termed an “urban problem”, i.e., lacking in infrastructure and in meeting urban social demands (CANO, 1989). The patterns of land use and occupation have invariably obeyed a social hierarchy, with the due distancing from the social classes and activities, increasing socio-spatial segregation and the monetization of land through the capacity of its use (RECIFE, 2018).

Thus, the 2008 Master Plan conceptually advanced, bringing the agenda of new environmental awareness and including the main urbanistic instruments of the City Statute (BRASIL, 2001). However, following the trend of what has been confirmed at a national level, of not foreseeing the self-application of these instruments in the body of the law itself and by not being able later to promote their regulation in specific laws, the Recife Master Plan was unable achieve viability for the urban development strategies and territorial ordering, or to achieve practical effects in the sense of carrying out the social function of the city and property (RECIFE, 2018), which thereby led to new conflicts and the emergence of various movements related to the right to the city.

Institutionally, urban planning in Recife is under the responsibility of the Instituto da Cidade Pelopidas da Silveira (ICPS), a technical department linked to the Secretariat of Urban Planning (Seplan), which has a deliberative, consultative and purposeful collegiate body, the Recife City Council (ConCidade), created by Municipal Law No. 18,013/2014, whose composition represents the government and civil society. Therefore, ConCidade is part of the administrative structure of the municipal executive power and the national urban development system, in order to exercise social control over the municipality’s urban and environmental management.

According to the deadline established for the revision of the Master Plan - which, according to the City Statute and the Organic Law of the Municipality, needs to take place at least every ten years - Recife conducted, throughout 2018, a process of discussions on the creation and revision of the urban legislation, called the Territorial Ordering Plan (*Plano de Ordenamento Territorial - POT*).

Over the span of a decade, profound changes have taken place and have shaped the political, social and economic context of the revision of the Master Plan, starting with the economic crisis that erupted in 2008, leading the globalization process to send out signs of diminishing economic dynamism and the advance of neoliberal policies, with serious repercussions in Brazil.

3. The revision process of the Recife Master Plan

The development strategy for the Territorial Ordering Plan was presented in December 2017 at a regular meeting of ConCidade, when the consultancy company was announced, contracted after a long bidding process financed by the World Bank, thus triggering the Master Plan revision. In addition to being compatible with several sectoral plans and with legislation on the environment and the protection of historical and cultural heritage, the proposal concerned the revision, updating and/or regulation of a set of legal diplomas and urban planning instruments, under the coordination of the ICPS and with the technical support of the Consortium Diagonal Empreendimentos e Gestão de Negócios Ltda. and Jorge Wilhelm Consultores Associados (Figure 2).

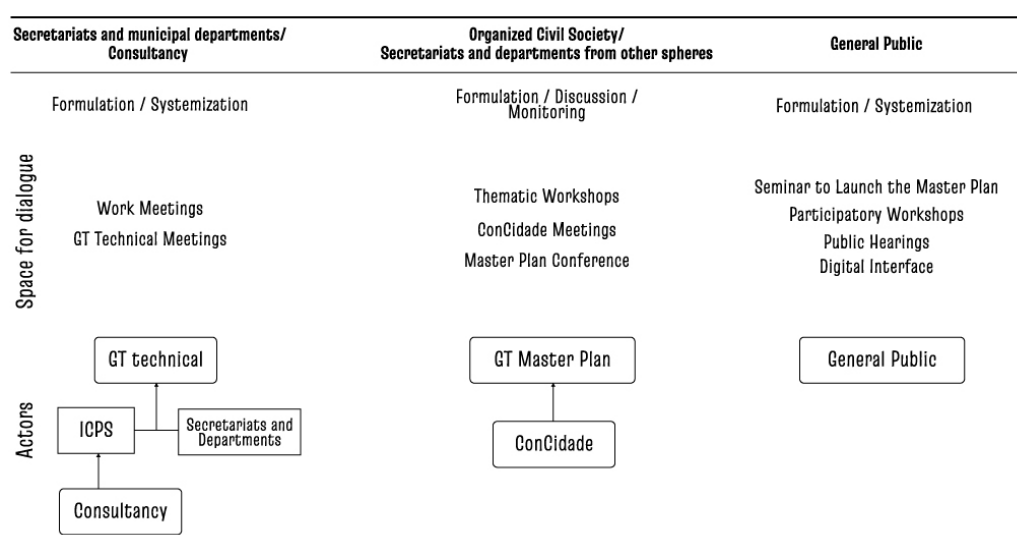


Figure 2. The participatory management structure adopted

Source: Based on information from Recife (2018).

Initially, the work plan for the Territorial Ordering Plan established a period of six months for holding seminars, workshops and public hearings and a conference at which the proposal for the new master plan would be approved, scheduled to take place in June 2018, plus a further seven months for the discussion and construction of other proposals, totaling 34 moments of social listening and of composing what was termed the Collective Construction Strategy (*Estratégia de Construção Coletiva - ECC*), in order to update and make all municipal urban legislation compatible by January 2019. Figure 3 presents the relationship between the Territorial Ordering Plan and other plans and norms.

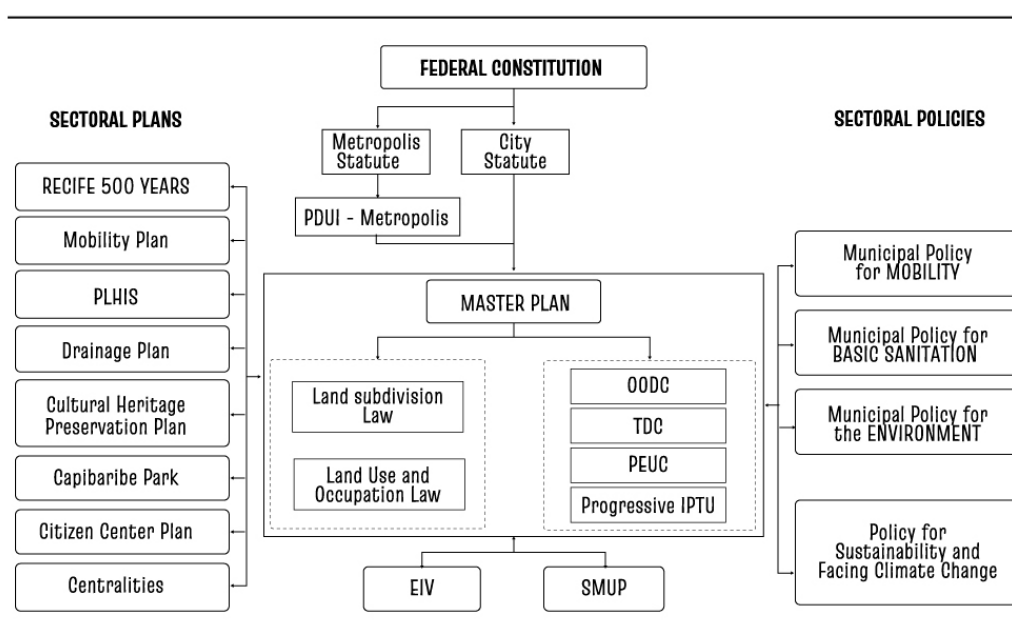


Figure 3. The relationship between the Territorial Ordering Plan and other plans and norms

Legends: EIV: Neighborhood Impact Study; IPTU: Urban Territorial Property Tax; OODC: Onerous Grant for the Right to Build; PDUI: Integrated Urban Development Plan; PEUC: Compulsory Installment, Building or Use; PLHIS: Place for Social Housing; SMUP: Municipal System of Protected Units; TDC: Transfer of Development Rights.

Source: Based on information from Recife (2018).

The ECC and the respective schedule were presented within the scope of ConCidade, with the detailed proposal agreed upon by the Working Group (GT-POT) established by resolution No. 001, of May 4, 2018, in order to observe, monitor and assess the participatory process of the POT. This working group held fifteen meetings until December 2018 and was made up of sixteen members of ConCidade, representatives from the segments that comprise the collegiate.

Since the beginning of the process, the period of six months proposed by the public authorities for the revision of the Master Plan was harshly criticized by social movements, organized in the *Articulação Recife de Luta* (Recife Coalition for Struggle). Several months passed amid tense debate with requests being made for an adjournment, for the Public Ministry to open a civil public inquiry, and with several protests against the installed process alleging that there had been no effective popular participation and that, pressed by the tight deadline, the process allowed for no further discussion on relevant issues for the development of the city. As a result, the public debate only began in June.

Even so, the process included six public consultations in the Political-Administrative Regions (RPAs), nine thematic workshops, a public hearing on the propositional diagnosis, six public feedback hearings in the RPAs, four workshops per segment for the election of conference delegates, two training courses for the delegates and the Master Plan Conference itself, which ended with the Complementary Bill being submitted to the City Council in December 2018. Recife City Hall considered (Figure 4) that there had been an increase in the number of events and in the time period initially established in the Terms of Reference, from the time of the launching event for the revision of the Master Plan and comprising a period of thirteen months, the decision for which came from the GT-POT at the ECC.

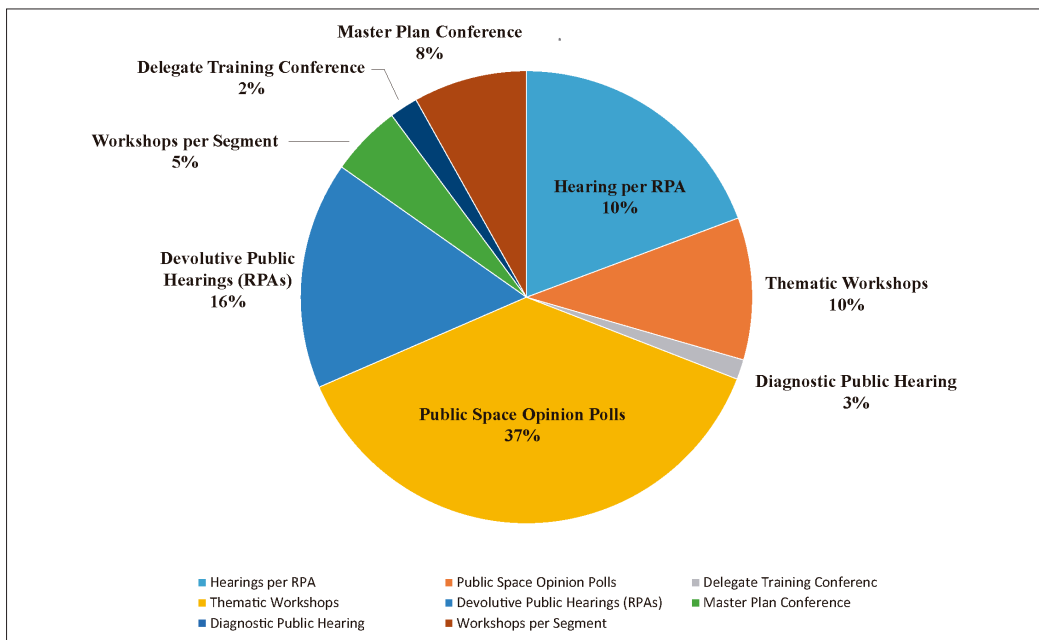


Figure 4. Contribution to the Recife Master Plan received by event type

Source: Based on information from Recife (2018).

According to data provided by Recife City Hall, the revision process of the Recife Master Plan registered the participation of 6,991 people, 5,288 of which were face-to-face and 1,703 virtual, through the digital platform www.planodirtor.recife.pe.gov.br, and the opinion polls on topics relating to the Master Plan (RECIFE, 2018). This portal provided a set of information related to the POT creation process, as well as instruments for popular participation and contribution in the diagnosis and proposal stages.

With regard to the contributions and proposals for the Master Plan, Recife City Hall reported that they received a total of 16,490 contributions, 4,476 made in person, for which, the percentages by type of event is detailed in Figure 4. Of these, 250 were delivered in documents filed at the headquarters of Recife City Hall. There were also 12,014 virtual contributions during the Master Plan revision period.

The content of these face-to-face and virtual public meetings and consultations was added to the set of studies and data analysis of official and academic studies, plans and projects from various spheres developed by Recife City Hall.

For the debates at the 2018 Master Plan Conference, the Proposal Booklet was made available on the portal and distributed to the conference participants, having been submitted for approval to the 348 delegates and 82 observers who signed up for two days of discussions. Although the beginning of this conference was marked with another protest by the *Articulação Recife de Luta* and by the withdrawal of its members, official data revealed that by the end of the meeting, 84% of the delegates had remained present, so as to bring legitimacy to the vote on the 103 proposals prepared by the Working Groups.

It is on this set of information, related to the revision process of the Recife Master Plan, that considerations are made with a focus on the climate issue, particularly toward to the adaptation measures.

4. Incorporating the climate issue into urban planning

In all thematic documents and presentations made available throughout the Master Plan revision process, the issue of climate was always highlighted as one of the essential topics for the debate on city planning, starting with the Terms of Reference for contracting consultancy services, demonstrating the maturity reached by the Climate Policy worked upon by the municipal government until that moment. The most important of these documents for the presentation of the concepts is undoubtedly the *Diagnóstico propositivo do Plano de Ordenamento Territorial do Recife - leitura técnica e comunitária* [The Purposeful Diagnosis of the Territorial Ordering Plan of Recife: a technical and community reading], in which, 816 pages contain the systematization and analysis of official and academic studies, together with content resulting from the face-to-face and virtual public consultations.

This diagnosis details the context, the conceptual approach and trends in climate change, including the hazards to Recife that will result from these changes, such as rising mean sea levels, coastal erosion, heat islands and waves, and a propensity towards flooding. It brings together a significant overview of available information, ranging from IPCC data, which, as previously mentioned, qualifies Recife as the sixteenth most vulnerable city on the planet, to studies carried out locally and validated by public administration, particularly by the municipal environmental agency. The document textually recognizes the vulnerabilities to climate change and highlights the need to promote mitigation and adaptation measures.

Climate change also figured among the themes that guided the thematic workshops in the search for a broader dialogue with society, comprising a total of nine axes: i) sustainable economic development and social inclusion; ii) socio-territorial equity, housing and land tenure regularization; iii) environment, sustainability, climate change and environmental sanitation; iv) cultural heritage; v) real estate property, social function and urban financing; vi) democratic management system, control and social participation; vii) land use, drainage and accessibility/mobility; viii) territorial ordering and ix) urban planning instruments.

Emphasis should be given to the importance, for the debate, of the studies and legislation that preceded the Recife Master Plan revision process. In previous years, Recife City Hall had carried out the infrastructure mapping of the city's critical areas, and in 2014, had established both the Municipal System of Protected Units (SMU) and the Policy for Sustainability and Combating Climate Change. In 2016, it was the turn of the Municipal Environmental Policy and, in 2017, the Municipal Basic Sanitation Plan, among other legislation.

All of this work resulted in the Complementary Bill (PLC) sent to the City Council Chambers in December 2018, whose text is still a matter of debate in the Legislative, in the final phase of the Recife Master Plan revision. Several excerpts from the PLC that instituted the Recife Master Plan illustrate the visibility given to environmental issues, as well as to the principles of sustainability, land use and occupation and, in particular, to the theme of climate change.

The zoning provided for in the PLC defines in its Article 29 the Macrozone of the Natural and Cultural Environment (MANC). This encompasses the preserved vegetation masses, the main and secondary water network and the city's cultural heritage, a territory of special interest for the policies of adaptation, in view of the strong presence of waters in Recife, from its maritime coastline to rivers and canals.

In Article 31, the MANC guideline is "to develop the territory in a sustainable manner and to expand the Municipality's resilience in order to confront climate

change”. According to the proposal, the MANC is compartmentalized into a Natural Environment Zone (ZAN) and a Sustainable Development Zone (ZDS), and its basic proposal is to preserve permeable areas by contributing to the adoption of green infrastructure solutions for climate adaptation.

5. The vision of actors and civil society in urban planning

An analysis of the interviews conducted during the revision process of the Recife Master Plan plus the understanding of different actors regarding the measures to combat climate change have revealed that Recife’s vulnerability goes beyond the fact that it is a densely populated, low-lying, coastal city with precarious infrastructure and subject to climate effects, such as rising sea levels and increased temperature and rainfall. Within this context, conducting the debate on climate risks and seeking to insert it into a participatory planning process proved to be a complex reality and thus, a methodological challenge.

It was identified that the available studies and data were insufficient to build scenarios resulting from climate change and, consequently, to prioritize government actions. Even recognizing that, in the diagnosis drawn up for the Recife Master Plan revision and in other official documents, the city of Recife is located where the impacts caused by global warming are most observed (it is one of the world hotspots mentioned in the list of IPCC), technicians and consultants raised doubts regarding the adequacy of the available studies for decision-making and the pertinence of more detailed responses to the effects of climate in the text of the Recife Master Plan.

The occurrence of flash flooding, which is already part of the city’s routine, appears recurrently as a concern, together with landslides. However, on the other hand, it is difficult to specify how the impacts arising from climate change will be intensified and when measures to prevent the occupation of vulnerable areas should be adopted.

The diversity of interests, visions and proposals on urban planning presented by the segments that worked on the revision of the Recife Master Plan may be observed in the conducted interviews. Criticisms in relation to the diagnosis produced to support the debate on the revision of the Master Plan were recurrent in the speeches of the interviewees, both by government and civil society representatives, in reference to the debated content and specific themes.

The most representative topics highlighted in interviews with government representatives, managers and members of civil society are listed below.

1. The phenomenon of climate change is treated as an abstraction, something unperceived in the daily life of the city;
2. A lack of consensus on what to do in areas that are already occupied and potentially vulnerable to flooding;
3. The municipality's low response capacity and fragility in dealing with climate risks and the effects of deficient infrastructure systems, with an emphasis on urban drainage;
4. Few links between the studies and existing thematic plans;
5. The need for multilevel governance action, with greater links between federative entities and defining the prioritization of measures;
6. The need to adapt the standardization to the execution of works and infrastructures;
7. The importance of environmental education regarding social participation in planning;
8. The complexity of urban and environmental themes;
9. A lack of long-term planning and the discontinuity of management processes; and
10. Failure to set deadlines and financial resources for implementing the proposed measures.

6. The challenges of implementing climate change adaptation

Within the strategies and instruments related to inducing urban-environmental development in the city of Recife, presented in the 2018 Master Plan, deadlines and details of the implementation process generally remain undefined. Issues such as rewilding the canals, reducing coastal vulnerability, expanding the percentage of natural land, the urbanization of slums and containment of risk areas, among other issues pertaining to the expansion of the city's adaptive capacity, are among the most relevant proposals in the 2018 Master Plan.

However, the normative rules present in the Recife Master Plan are insufficient to effectively intervene in the urban licensing of private enterprises or in the planning and execution of public interventions from the perspective of preparing the city to face the effects of the climate. Indicating, for example, among the guidelines, that it is necessary "to control informal urban expansion across areas of environmental fragility and protected units" or "to rewild the margins of waterways, valorizing their relationship with the city's landscape" does not imply stating how, when and with what resources this will be achieved.

Within this context, there is a set of conditions and recommendations with a view to preventing the Recife Master Plan from being a utopian construction plan for a sustainable city and making its guidelines effective, and indeed incorporated into urban policies. Such guidelines may be summarized as follows:

1. Publicize the law, discursively linking the debate on the city to the climate agenda and the Sustainable Development Goals to be incorporated into the city's daily life;
2. Validate the Climate Change Adaptation Plan in a participatory manner;
3. Strengthen the planning instances, incorporating the metropolitan character;
4. Establish multilevel governance in order to reorient climate policies and overcome the inability to provide the necessary resources for an appropriate infrastructure for adaptation; and
5. Promote social awareness that exclusion increases vulnerabilities and that advances require macroeconomic changes and greater investment in urban infrastructure.

In order to overcome these challenges, it is up to the public administration to be incisive in promoting a systemic view that urban sustainability depends on the cooperation of all.

Final considerations

It is possible to affirm that the proposed text produced for the Recife Master Plan has objectives, principles and guidelines fully convergent with the climate change agenda, whether from the perspective of mitigation, or from the adaptation of Recife to the global effects of climate. Paradoxically, the available studies, the political process of social participation and the degree of broadening the debates proved to be insufficient and unable to guide decisions adjusted to the needs of the city, which may reduce the practical effects of the proposal and thereby interfere in the effective implementation of adaptation measures.

The climate agenda gained visibility in Recife in 2013, when it became part of the Urban-LEDS project, an ICLEI initiative. Conducted by the Secretariat of Environment and Sustainability, the climate policy was established by law and was structured by conducting GHG emission inventories, creating GECLIMA and COMCLIMA and publishing *Recife sustentável e de baixo carbono – Plano de Redução de Emissões de Gases de Efeito Estufa* [Sustainable and Low Carbon Recife – A Reduction Plan of Greenhouse Gas Emissions], in addition to other initiatives.

As the team was trained, studies characterizing Recife as a global hotspot began to receive greater publicity, demonstrating the city's degree of vulnerability to climate threats.

The Municipal Policy on Sustainability and Combating Climate Change, was enacted in 2014, and the Low Carbon Plan, published in 2016. These established objectives, guidelines and targets directed toward sectorial policies in the areas of transport, energy, sanitation, civil construction, solid waste and sustainable urban development, with a focus on mitigation measures. However, the means and resources for the effective reduction of GHG emissions were still to be built in.

In view of the relevant factor in inducing changes in urban systems, the Recife Master Plan was revised throughout 2018, and was translated into an opportunity to insert the climate agenda into urban planning. Indeed, the Complimentary Bill under consideration by the Recife City Council brings several references and concepts related to the concern for the effects of climate and incorporates the Climate Change Policy in its objectives, guidelines and principles, indicating the municipality's desire to face these effects. Issues such as heat islands, impermeability, vulnerability, and the risk of landslides are dealt with at various moments throughout the text, which highlights the intention to move forward in adopting measures to make the city resilient and capable of facing the aggravation of problems such as flooding, rising sea levels, coastal erosion and landslides.

Incorporating the theme of climate change in urban planning is reflected in the PLC text in order to align Recife's urban legislation with the concerns of contemporary urbanism in the international context, considering the global environment. The question is whether this incorporation is sufficient to reverse the main causes that have generated social and environmental vulnerabilities and risks and promoted changes in the city's environment, so as to move towards sustainable development.

This article has identified the limits of the Recife Master Plan in broadening the issues related to adaptation measures and in configuring itself as the result of a social pact for the management of the territory. The proposals present in the body of the PLC are not associated with the debate undertaken throughout the revision process, and have come from the technical department of the municipal management, since the issue of climate change is still poorly understood by the population. The interviews with the planning actors revealed a concern for the discontinuity of public management and the understanding that defining priorities takes place as a result of a culture of immediatism.

As seen, the Recife Master Plan mentions the need to "adopt measures that promote urban resilience and an adaptive capacity to climate change, through

investments, support and incentives for organizing, structuring and strengthening public departments and civil society entities, and to the articulation and systematic integration between them”. But how may the Master Plan’s ability to transfer theory to practice be assessed? Is it really possible for the municipality to guarantee equity and socio-territorial inclusion over the next ten years, as these concepts are described in the proposed law?

It is true that planners have incorporated sustainability concepts into the revision of the Recife Master Plan. However, what we sought to analyze was whether these concepts, when incorporated, were somehow accompanied by instruments that indicated the obligation to make them an effective public policy. The answer is: the overwhelming majority of them do not.

In any case, what may be called a paradigm shift has taken place. The novelty of the law is real. The city’s legal system is more closely aligned with the 2030 Agenda for Sustainable Development, by proposing that it should be guided by the principles of the social function of the city; the social function of property; sustainability; socio-territorial equity; metropolitan and intra-urban integration; democratic management and gender equity. The urban development agenda for Recife now officially goes hand in hand with the climate agenda, constituting an integrated policy.

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