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Climate change action at the city level: tales from two megacities in Brazil

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Abstract

Purpose – The purpose of this paper is to analyze the factors shaping climate policies in two megacities in Brazil – São Paulo and Rio de Janeiro – through a multilevel perspective. The paper seeks to explore how climate change is being framed and how local governments are responding to it in terms of policy strategies.

Design/methodology/approach – Through empirical research based on two case studies, the authors discuss the governing of climate change action and analyze the factors that can constrain or undermine these actions based on information collected from reports, institutional web sites and academic and newspaper articles.

Findings – The participation in transnational municipal networks has been central for promoting and supporting climate change actions in both cities following the international experience. The organization and implementation of climate change measures rely on a landscape formed by multiple actors often spanning several sectors and levels of governance.

Originality/value – Most of the literature on climate change policy at the local level focuses on the context of developed countries. Analyses of advanced developing countries like Brazil are sparse as well as comparison in light of the international experience. The paper also draws attention for the lack of awareness for adaptation at the local level in these countries, building upon recent scientific findings on global climate change.

Keywords Climate change, Brazil, Governance, Public policy, Sustainable development

Paper type Research paper

1. Introduction

Climate change, as a global environmental problem, is being considered one of the most significant political challenges facing the international community (Giddens, 2009; Bulkeley and Newell, 2010). In this sense, the Intergovernmental Panel on Climate

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Change (IPCC) stated with high confidence on its Fourth Assessment Report (AR4) that changes in the global climate are now unequivocal and its impacts are underway with consequences for both urban and rural areas (Solomon *et al.*, 2007; Parry *et al.*, 2007). Climate change poses not only a local place-based problem, but also cross-scale challenge (Wilbanks and Kates, 1999). As a multi-dimensional problem, the conventional separation between global and national responses is highly inappropriate. Climate change requires actions at different levels of governance (multilevel) and interventions that range from international conventions and treaties at the global scale to climate protection and adaptation measures at the city level (Bulkeley and Betsill, 2003; Bulkeley and Betsill, 2005; Adger, 2005; Bulkeley and Kern, 2006; Gupta, 2007; Bulkeley and Newell, 2010).

The relationship between cities and climate change is usually based on a complex interaction between vulnerability and responsibility (Wilbanks and Kates, 1999; Robinson and Gore, 2005; Sanchez-Rodriguez *et al.*, 2005; Lankao, 2007; Bicknell *et al.*, 2009). Urban centers are home to a large proportion of the world's population, economic activity, and physical infrastructure that are at risk from floods, storms, landslides, heat waves, droughts and other climate-related phenomena. Climate change is expected to exacerbate these impacts on cities around the world (Wilbanks *et al.*, 2007; Satterthwaite *et al.*, 2007; Hunt and Watkiss, 2007). Cities are also source of most of the world's pollution and high consumers of non-renewable raw materials (Evans *et al.*, 2005). In addition, urban centers possess substantial ecological footprints and require vast areas to provide the food, energy, water and natural resources that keep them functioning as engines of the global economy (Sanchez-Rodriguez *et al.*, 2005; Evans *et al.*, 2005). At the same time, local governments and their legal responsibility and jurisdiction provide opportunities to influence many of the activities that contribute to climate change and respond to it in terms of both mitigation and adaptation policies (Bulkeley and Betsill, 2003; Robinson and Gore, 2005; Satterthwaite, 2008; Puppim de Oliveira, 2009; Bulkeley *et al.*, 2009; Bulkeley, 2010).

By mitigation cities can substantially reduce their environmental impact and consequently transform their infrastructure and consumption patterns improving the global environment. By adaptation cities become resilient to climatic impacts and reduce risks from climate change and variability (Dawson, 2007; Satterthwaite *et al.*, 2007). Although these urban transformations will take decades and are probably reliant on significant developments in how cities are governed and planned, cities have a very direct interest in both mitigating and adapting to environmental and climatic change (Satterthwaite *et al.*, 2007; Bicknell *et al.*, 2009).

Besides the important role in formulating and implementing climate policies, local governments also participate in the international arena through transnational networks of local (and subnational) governments. These transnational actors have been attracting increasing attention since the early 1990s and are commonly seen as a concrete result of the Rio Summit in 1992. Bulkeley and Betsill (2003) have argued that such networks of transnational local authorities do not fall easily into existing conceptual frameworks for climate change responses as it is difficult to analyze if they are governmental or non-governmental organizations.

This discussion is particularly relevant for developing countries, which have no binding commitments for reducing greenhouse gases (GHG) emissions under the Kyoto Protocol and are more vulnerable to climate change impacts due to their geographical location and low adaptive capacity that usually result from historical

development deficits (Wilbanks *et al.*, 2007; Bicknell *et al.*, 2009). It is also mostly important to focus on megacities that are engines of the world's economy, centers of innovation and important areas of population growth and concentration as it has been argued elsewhere (Sanchez-Rodriguez *et al.*, 2005; De Sherbinin *et al.*, 2007).

Building on that, this paper analyzes the factors shaping climate policies in two megacities in Brazil through a multilevel perspective: São Paulo and Rio de Janeiro. It explores how climate change is being framed and how local governments are responding to it in terms of policy strategies and instruments. By doing so, it is expected to deepen the understanding on how these cities in Brazil are responding to these challenges and uncover the strategies that are being deployed by these local governments. The paper argues that the participation in transnational municipal networks has been central for initiating and supporting climate change actions in both cities following the international experience, with considerable attention being devoted to mitigation of GHG. On the other hand, there is critical lack of attention to adaptation measures on a comprehensive manner. Although there is the need for more research to assess the effect of human-induced climate change (global warming) in both cities, they have been already suffering the impacts of current climatic conditions and variability on a regular basis due to its social vulnerability resulting from poor infrastructures and policies in areas such as housing and sanitation.

The organization, steering and implementation of current and future climate change measures rely heavily on a landscape formed by multiple actors with a variety of interests, capacities, and challenges often spanning several sectors as the two case studies will illustrate. This fragmented landscape of actors, interests and sectors combined with structural governance problems in both Brazilian cities poses significant challenges for the advancement of these efforts in the two cities as they seem to have limited capacity to address the climate change challenge alone. Through an empirical research, the paper discusses the governing of climate change at the city level and analyzes the factors that can constrain or undermine these actions.

2. Local governments and climate change

Local governments have taken the lead in responding to climate change in diverse contexts, including developing, developed and countries that have been reluctant in supporting international action towards the mitigation of GHG emissions (e.g. USA). In this direction, there is a growing body of literature that provides robust arguments for the engagement of local governments in climate policy making (Kousky and Schneider, 2003; Bulkeley and Betsill, 2003; Bulkeley and Betsill, 2005; Puppim de Oliveira, 2009; Bulkeley *et al.*, 2009; Bulkeley, 2010), although these non-state actors, as referred by constructivist approaches in international relations (Bulkeley and Betsill, 2003), do not have direct nor binding commitments under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (Bulkeley and Betsill, 2003; Betsill and Bulkeley, 2007). These arguments are usually based on the recognition that cities and its local authorities have the legal jurisdiction and control over areas and sectors that can influence many activities that are not only critical sources of GHG emissions such as transportation and energy use, but also key instruments for managing and reducing urban climate risks such as land use regulation, zoning, civil defense and disaster response and mitigation (Wilbanks and Kates, 1999; Robinson and Gore, 2005; Dawson, 2007; Satterthwaite *et al.*, 2007; Bulkeley *et al.*, 2009).

There are also many reasons for acknowledging local governments as one of the critical actors in climate policy, and urban centers as the fundamental arena where climate governance is taking place (Bulkeley and Betsill, 2003; Lankao, 2007; Bulkeley and Newell, 2010; Bulkeley, 2010). In the same direction, the city is also the level of governance closest to the people (Wilbanks and Kates, 1999; Evans *et al.*, 2005; Adger, 2005; Satterthwaite, 2008; Puppim de Oliveira, 2009). This recognition builds on the assumption that local governments are more flexible and more accountable to their citizens than other levels of governance. In theory, they tend to be smaller and decisions can be taken faster than those at the national level. This flexibility and readiness in response and action can shape governmental structures to be more adaptive to new situations and agendas so that these governments become less bureaucratic to implement policies as local governments are closer to their constituencies and local officials suffer the pressure from interest groups such as civil society, community-based organizations and environmentalist groups on a daily basis (Puppim de Oliveira, 2009; Birkmann *et al.*, 2010).

On the other hand, local governments also face many barriers in developing climate policy at the city level. Some barriers are well described and analyzed by the policy and public administration literature such as the presence of short mandates for local authorities, the lack of financial and human resources available at the local and the lack of autonomy to regulate specific sectors and economic agents (Ligeti *et al.*, 2007; Parzen, 2008; Puppim de Oliveira, 2009; Martins and Ferreira, 2010). Table I provides a summary of key factors that can support or inhibit local governments to engage in climate policy making.

Key factors	Enabling environment	Obstacles and constraints
Resource and capacity	Institutional and financial capacity to undertake climate change actions	Lack of financial, human and technological resources
	Presence of a local champion	Lack of commitment from political leaders
	Allocation of financial and human resources	Lack of attention to environmental issues
	Long-term urban planning	Short-term view
Knowledge and information	Strong communication and outreach	Business as usual approach
	Vulnerability perception and strong risk management approach	Lack of vulnerability assessment and poor understanding in terms of impacts and extend of climate change
	Strong science-policy interface	Mismatch between policy makers and scientific community
Institutions and governance	Authority to coordinate and regulate climate change actions	Lack of authority and jurisdiction
	National programs to support local initiatives	Lack of national and international support
	Participation in transnational city networks	Poor vertical and horizontal coordination across levels and policies
	Good governance stakeholder involvement and participation strategy	Poor governance structures and difficulties in getting key sectors involved

Source: The authors

Table I.
Key factors that support or constraint climate change action at the city level

One of the major barriers, however, is poorly approached and understood by most climate change governance research. It draws upon the fact that climate change is considered a "wicked problem" in policy circles (Brown, 2009). Climate change illustrates the dynamic complexity of many modern public problems as it is unstructured making the causes and effects of a changing climate extremely difficult to be identified and addressed by local authorities (Brown, 2009; Giddens, 2009). Furthermore, "wicked problems", as coined and defined by Rittel and Webber (1973), involve multiple and intertwined sets of public and private actors and challenges that cut across interconnecting policy domains and levels of government (Brown, 2009).

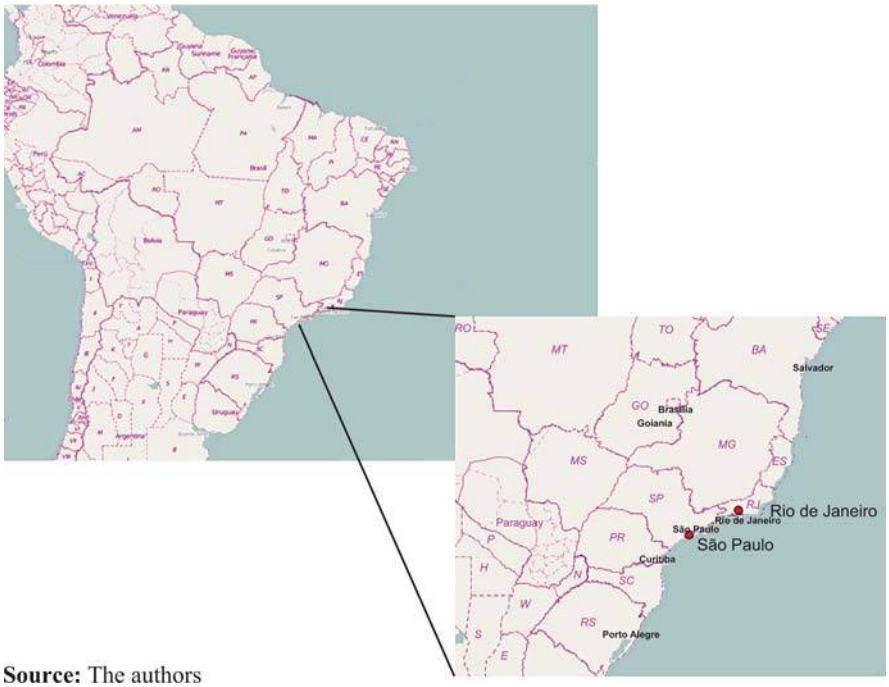
This fundamental barrier may hide the chain and scale of causes and consequences of climate change in all levels and thus make climate change action at the local level ineffective or only palliative (Puppim de Oliveira, 2009). According to Brown (2009), a network approach has been argued to best tackle a wicked problem where diverse actors from government and differing sectors and stakeholders get together to share resources and knowledge. In this direction, the analysis of the modes of governing these actions is crucial for understanding how local governments from two megacities in Brazil are addressing climate change, engaging with other local governments and collaborating in other levels of governance.

3. Addressing climate change at the local level: tales from two megacities in Brazil

In order to understand how local governments from the largest Brazilian cities are responding to the challenge posed by climate change, climate action was analyzed in São Paulo and Rio de Janeiro (Figure 1). In this context, climate change action is understood in terms of policy responses, measures, and different instruments deployed to explicitly address the climate change issue in the two cities (e.g. laws, policies, programs, and plans).

Brazil has ratified the Kyoto Protocol and was one of its stronger supporters. Today, it is also one of the five major emerging economies in the world and presents comparative advantages in dealing with climate change when compared to other advanced developing economies. As a non-annex 1 country, Brazil does not have emission targets under the Kyoto protocol. In terms of energy, the country relies mostly on electricity generated by hydroelectric plants that contributes significantly with mitigation efforts (Setzer, 2009) providing several comparative advantages in terms of sustainable development. It is also home of one of the greatest ecosystems and forests of the planet, including the Amazon and the Atlantic rainforests (MEA, 2005). On the other hand, deforestation and burning of biomass, particularly in the Amazon region, constitutes a major source of GHG emissions in Brazil (Joly, 2009; BRASIL, 2010). Puppim de Oliveira (2009) highlights that Brazil is also one of the leading countries in the number of projects within the Clean Development Mechanism (CDM) and one of the largest receiver of resources from the Global Environment Facility (GEF), a program led by the main funding organizations for the implementation of the UNFCCC and other international conventions.

In recent years, there are a number of ongoing climate change initiatives at the local, subnational and national levels. However, Brazil has not been able to design and implement a comprehensive climate change strategy even though a National Plan on Climate Change was approved by the Congress and by the President in December 2009



Source: The authors

Figure 1.
The cities of São Paulo and Rio de Janeiro in Brazil

(National Law 12.187). In the same direction, some local regulations are taking place in different parts of the country particularly at the subnational level. The analysis of two of these efforts, namely in the cities of São Paulo and Rio de Janeiro, provides interesting insights on the way these actions are being framed and how these local governments are acting in different policy domains and contexts.

Case studies are frequently applied in social science research and provide an in-depth investigation and a systematic way of looking at different policies and actions (Yin, 2009). For the purpose of this paper, information was collected from reports, institutional web sites and academic and newspaper articles (Puppim de Oliveira, 2009). The main findings of the case studies are presented below followed by a discussion of the key factors shaping climate change policy making.

3.1 The city of São Paulo

The city of São Paulo is the largest urban agglomeration in South America and is among the top-10 cities in the world with a population of over 11 million people (City Mayors Statistics, 2010). The city is an important financial and commercial hub for the region and responds to up 10 percent of Brazil's total GHG emissions when the deforestation of the Amazon rainforest is excluded. Over the last decade, the city has developed a series of local initiatives to address climate change, environmental degradation and air pollution due to high industrial and automotive emissions (Lucon and Goldemberg, 2010). It included increasing regulatory standards, law enforcement for industrial plants and the restriction of 20 percent of the city's automobiles during peak hours in the central area (Puppim de Oliveira, 2009).

In 2003, São Paulo joined the Cities for Climate Protection (CCP), a campaign of the International Council for Local Environmental Initiatives (ICLEI). ICLEI is one of the major transnational municipal networks worldwide and it has been supporting climate action at the municipal level for almost two decades focusing, in the beginning, only on mitigation and more recently also on adaptation measures. Local governments join the CCP campaign by passing a resolution pledging to reduce GHG emissions through five milestones, basically elaborating a baseline emissions inventory, adopting emission targets, developing local action plan and implementing specific policies and measures (ICLEI, 1993).

São Paulo elaborated an emission inventory in partnership with research centers to set priorities for climate action (Puppim de Oliveira, 2009). The city has also joined the Energy Efficiency Program of the State of São Paulo, a subnational champion for environmental and climate change policies in Brazil (Cunha *et al.*, 2009; Lucon and Goldemberg, 2010). In parallel with the state initiatives, the city of São Paulo has also developed a specific policy to address climate change as a result of the partnership between a research center, ICLEI, the municipal secretary for the environment and committed individuals and policy entrepreneurs. This policy was approved by the City Council and became a municipal law in June 2009 (Municipal Law 14.933). Although general in its lines as the law still waits for specific regulations, it established a concrete target of 30 percent reduction in GHG emissions by 2012 through initiatives that are aimed to improve the public transport, energy efficiency, green building, land use and solid waste management. In doing so, São Paulo was a pioneer municipal government in approving such law in the country. It is also important to acknowledge that these measures were an important milestone due to the importance of the city of São Paulo for Brazil and South America.

In this direction, the city has also implemented a CDM project in the Bandeirantes landfill, one of the largest in the country, where the CH_4 (methane) released by the solid waste is being used for power generation and the revenues invested for the benefit of poor communities located in the surrounding area of the landfill. Puppim de Oliveira (2009) shows that this action alone was estimated to have reduced GHG emissions by 11 percent in the city. Since 2007, another law has been approved obligating buildings with more than three bathrooms to use solar water heating systems (Bulkeley *et al.*, 2009).

Climate change policy making in the city of São Paulo shows synergies and interaction with other policies (e.g. transport, solid waste management, air pollution control) and actors (e.g. ICLEI, The World Bank, research centers and the State of São Paulo government) trying to combine climate security with economic benefits arising from air pollution (avoiding health effects), better urban planning, land use, and revenues from carbon credits. Climate change measures in São Paulo, however, still devotes very little attention to adaptation policies and planning although the city often suffers from several climate-related events such as floods, landslides and water scarcity (Puppim de Oliveira, 2009; Nobre *et al.*, 2010).

3.2 The city of Rio de Janeiro

The city of Rio de Janeiro is the largest and most complex urban center in the Brazilian coastline with around ten million people. It is also the second most populous city in the country with great economic, political, cultural and historical importance (Egler, 2007; De Sherbinin *et al.*, 2007). Although well known for its beaches and beautiful

landscapes, the city of Rio de Janeiro faces many social problems and environmental challenges such as urban violence, informal and illegal settlements in hazardous areas (e.g. *favelas*), sewage treatment, disposal, and industrial waste among many others. De Sherbinin *et al.* (2007) analyzed the vulnerability of Rio de Janeiro to climate change and highlighted that the socioeconomic problems can be highly exacerbated by climate change in the near future.

Climate policy making in Rio de Janeiro began in 1998 when the city government joined CCP. As in the case of São Paulo, the city of Rio de Janeiro elaborated an inventory of GHG emissions for the period of 1990-1998 in partnership with a local university in 2003 (Dubeux and La Rovere, 2007). After some years of silence and no political action, climate change was brought back in the municipal agenda in early 2007 when the Mayor signed a Protocol of Action in February 2007, namely the Rio Protocol (Municipal Decree 27.595). This protocol encompasses both mitigation and adaptation measures and tries to integrate key sectors within the municipal administration towards an action plan to address both causes and risks associated with climate change. It mainstreams climate change across different municipal sectors. For instance, it demands the inclusion of climate change into the city's masterplan as well as improvements in the local regulations for urban planning. It also introduces the development of CDM projects within municipal activities.

In order to raise public and internal awareness to the climate change issue, the local government commissioned scientific assessments in key specific sectors such as ecosystems' vulnerability, climate change projections and health impacts, coastal zone management and possible effects on urban infrastructure and human settlements. This was followed by the organization a series of events bringing together civil servants, government officials, scholars and community organizations to discuss the results of these assessments in light with the city's current and future reality. These seminars named "Rio in the next 100 years" (or Rio + 100) have also called attention to the city's high vulnerability to climate change in terms of its physical exposure, sensitivity and low adaptive capacity (De Sherbinin *et al.*, 2007; Nacaratti, 2008). These seminars, as well as a number of field visits to learn from best practices in different contexts including Canada and the USA, had the support of C40 – Cities Climate Leadership Group, a group of large cities committed to tackling climate change that work in partnership with the Clinton Climate Initiative (CCI) from The William J. Clinton Foundation.

4. Governing climate change in Brazil: key messages

The cities of São Paulo and Rio de Janeiro provide examples of two megacities, urban areas with more than ten million people that are important centers of economic growth not only for Brazil but also for South America through their long-standing relationships with the rest of the world as important hubs for trade, financial activities and industrial innovations (De Sherbinin *et al.*, 2007). The case studies showed that the new governance arrangements such as the participation in transnational municipal networks has been crucial for initiating and supporting climate change activities in both cities not only in Brazil, but also worldwide (Bulkeley *et al.*, 2009; Bulkeley and Newell, 2010; Bulkeley, 2010). Building on the experience from developed countries, Schreurs (2008) argues that these networks, particularly the ICLEI CCP, may be most important in the earliest stages of climate policy making as local actors are usually seeking ideas from cities that share similar politics or urban characteristics.

The case studies of São Paulo and Rio de Janeiro bring evidence on the factors that are shaping climate policy at the local level at these early stages in Brazil. These findings highlight factors that have been raised elsewhere (Bulkeley and Betsill, 2003) when analyzing climate change action in the UK, USA and Australia. These factors include the presence of committed individuals and political will to address climate change within the local government agenda, the availability of funding for assessments and GHG inventories, local power and jurisdiction over key sectors, and the existence of informal networks to support policy design and implementation engaging with a range of different actors, such as research institutions, governmental bodies, political champions and community organizations (Sanchez-Rodríguez *et al.*, 2005; Bulkeley, 2010; Martins and Ferreira, 2010).

Although with slightly distinctive interpretations, Setzer (2009) had already argued in the same direction when analyzing climate policies in the city and the state of São Paulo. In this sense, although this paper argues that São Paulo and Rio de Janeiro follow some common patterns of climate change action at the local level, previous works such as Bulkeley and Kern (2006) and Bulkeley *et al.* (2009) identified contrasting modes of governing these initiatives. These modes of governing climate change at the local level include the deployment of different strategies such as networking and partnerships, exercising regulation and authority, self-governing, and enabling an environment for private investments and action. Table II summarizes climate change action and policy making in both São Paulo and Rio de Janeiro.

These different approaches applied to address climate change illustrate that it is not only a place-based problem but also a cross-scale and multilevel challenge (Wilbanks and Kates, 1999; Gupta, 2007; Bulkeley and Newell, 2010). The first generation of local government efforts is important to raise public and government awareness and mitigate partially some causes of the problem, especially in developing countries like Brazil. However, recent research on the magnitude and scale of the global changes (Füssel, 2008; Parry *et al.*, 2008; Rockström *et al.*, 2009) suggests that local governments alone may have limited capacity to address the causes and cope with the unavoidable impacts of climate change without strong commitment and leadership from national governments and the international community. It is urgent to reduce inequalities and enhance the capacities of individuals, communities and institutions in order to build resilient cities.

In Brazil, as in many other developing countries, although the national government has been acting by designing integrated plans and programs to address mitigation and adaptation in specific sectors such as agriculture, energy and industry, these measures have been patchy and tentative with most attention being given to mitigation. The need for strong adaptation interventions is constrained by social inequality, lack of institutional capacity and pathways of unsustainable development that have been permeating the Brazilian history for many decades (Ferreira, 1998; Ribeiro, 2008).

In the light of the challenge ahead, governance emerges as a key concept to bridge different efforts and provide the pathway for the development of appropriate strategies (Moser, 2009b; Bulkeley and Newell, 2010). In the Brazilian context, where the 1988 Federal Constitution divided responsibilities for environmental and social policies among the three levels of government (federal, state and municipal), the governance of climate change responses will require the organization, steering and implementation of policies and measures with the participation of multiple actors that span several sectors, not only the environmental area (Moser, 2009a). It is not an easy task in a

Cities	Focus	Stage	Municipal governments Transnational networks	Emission targets	CDM projects	Strategy	Infrastructure
São Paulo	Mitigation and adaptation	Implementation (particularly in terms of mitigation)	Yes (CCP ICLEI and C40)	Yes (30%)	Yes	Governing by authority (municipal laws and specific regulations) Raise awareness Scientific assessment and scenario modeling Environmental education	Public transport, cycling lanes, landfills, solid waste management, energy efficiency, green building
Rio de Janeiro	Mitigation	Implementation (particularly in terms of mitigation)	Yes (CCP ICLEI and C40)	No	Yes	Governing by authority (municipal decree and specific regulations) Basic scientific assessment Environmental education	Public transport, cycling lanes, landfills, solid waste management, green building

Source: The authors

Table II.
Summary of climate change activities and policy making in São Paulo and Rio de Janeiro

country with 27 states, one federal district, and more than 5500 municipalities as highlighted by Puppim de Oliveira (2009).

The roles of the three levels of government combined with the specific interests of the different regions of the country, economic groups and political contexts may often conflict with each other and undermine climate change efforts in the long run.

5. Conclusion

This paper has investigated climate change activities and policy making in two megacities in Brazil, São Paulo and Rio de Janeiro, considered to be the most important in the country in terms of population concentration and economic and political relevance. Through a multilevel perspective, the analysis has shown that these cities have followed the international experience building on the factors that have shaped these initiatives at the local level. The participation in transnational municipal networks has fostered political action and policy making at the city level particularly in mitigating GHG emissions. It has also raised public and governmental awareness in terms of the challenge posed by human-induced climate change and climate variability.

Despite of these developments, there is still an important gap in terms of the adaptation needs, mainly in terms of better urban planning and improved city infrastructure to be able to cope with the unavoidable effects of increasing global temperatures and its consequences for the global and regional climate systems.

Although being considered a significant step towards addressing the climate change issue, recent research on global climate change and its impacts suggests that local government action may not be enough to cope with the magnitude and frequency of the predicted changes as they might have limited capacity to respond and adapt effectively to the climate change problem. Even though local governments are closer to the people, they rely on measures taken and supported by higher levels of government intervention as their responsibility and jurisdiction is constrained by legal and institutional aspects such as lack of financial and technical resources. However, understanding and approaching the governance challenge through the local level perspective is crucial for securing a safe and sustainable pathway for megacities and countries worldwide.

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