## Resilient Infrastructure Delivery, Transparency and Governance in Santa Catarina, Brazil

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Santa Catarina in Brazil is affected by adverse climatic events such as floods, flash floods, landslides, windstorms, tornadoes and coastal erosions. Floods have caused fatalities and major damages to infrastructure and continue to do so routinely. Many people live in high-risk areas of coastal flooding and landslides and without a robust risk management, mitigation and adaption strategy, communities are prone to major disasters and displacement. Problems related to lack of city planning, lack of integrated urban drainage networks and lack of robust infrastructure networks are blamed for poor city resilience. Governments are known to react rather than plan and prevent. Lack of transparency, political interference, governance and institutional fragility of local administrations are blamed for not implementing long-term city-planning measures. This paper examines the policy framework and the governance structure that is in place to improve the resilience of the infrastructure projects. Literature review, case studies and action plans for the region provide an understanding of the current debate. It establishes the need for joined up integrated coastal and land zone management and governance solutions to be implemented by all stakeholders.

Keywords: governance, infrastructure, resilience, Santa Catarina– Brazil, transparency.

### INTRODUCTION

Climate Change has long been predicted to cause and increase extreme weather incidents and there are many instances that these predictions are coming true (Carrington, 2018). According to the Intergovernmental Panel on Climate Change (IPCC, 2012), ‘a changing climate leads to changes in the frequency, intensity, spatial extent, duration and timing of extreme weather and can result in unprecedented extreme weather and climate events’. Heat-waves, destructive hurricanes and typhoons, intensive rain and flooding have become the new norm and resilience, the capacity to cope, of the built environment and communities have become the major challenge and focus of many governments and communities.

Brazil is the world’s fifth largest country in terms of land size and has the world’s fifth largest population (FIESC, 2009). It is also home to the world’s largest river basin and has about 12% of the planet’s fresh water (The World Bank, 2016). The Atlantic coastline extends from the extreme south to the north of Brazil making it more vulnerable to coastal disasters. A number of extreme weather events and their devastating impacts in this decade have reignited the debate about how climate change is affecting Latin America’s largest country, home to most of the world’s biggest rain forests. In 2008, the costal areas of Santa Catarina in Southern Brazil, were severely affected by hurricane Catarina and had devastating effects on communities, housing and infrastructure. Subsequent analysis resulted in the knowledge that communities were living on land that were prone to river and coastal flooding, exposed to flood risk damages to assets. Researchers have estimated that one-third of the impact of landslides and half of flood damage could be avoided by altering human practices related to land occupation and improvements in the socioeconomic conditions of the population in areas at risk (Pivetta 2016). There is an urgent need to empower local governments and stakeholders to incorporate Disaster Risk Management (DRM) and socio ecological resilience systems to the decision making processes. While over the years, the state has shown significant progress in these practices there is still room to significantly improve its DRM strategy (The World Bank, 2016) that minimise disruption, displacement and improve resilience.

With this context, this paper aims to review the policies, legal framework and governance structure in place to deliver resilient infrastructure projects in Santa Catarina, Brazil and examine how governance, transparency and engaging communities influence the implementation of long-term city development solutions. The objectives include reviewing the policies and institutional and legal framework that governs the delivery of infra structure systems in Santa Catarina, identifying major challenges in delivering resilient infrastructure management systems and analysing how forces such as governance structure, lack of transparency, political interference and institutional fragility of local administrations influence the long-term city-planning measures. Methodological approach is based on broad-ranging literature reviews including government and stakeholder reports and action plans for the region as well as information gathered by interviews and case studies that provide evidence of practices. The paper will establish the need for all stakeholders to be involved and contribute to joined up integrated coastal and land zone management and governance solutions.

### Background & Context

The state of Santa Catarina in Southern Brazil has 3% of the Brazilian population (> 6 million) and in terms of land size, Brazil’s seventh smallest state (95,346km2) (The World Bank, 2016). In comparison to other states, Santa Catarina has outstanding socio-economic indicators and per capita income is fourth in Brazil. Levels of education and health are also among the highest in the country (FIESC, 2009). The state is affected by a great diversity of natural adverse events: droughts, floods, flash floods, hail, mass movements, windstorms, tornadoes, and coastal erosions and was adversely affected by Hurricane Catarina (2008), the only hurricane recorded in Brazil so far (The World Bank, 2016). The resulting flooding affected about 60 towns and over 1.5 million people. At least 135 people were killed, over 78,700 forced to evacuate their homes, 27,400 left homeless, 7,154 homes were completely destroyed (CEPED UFSC, 2016), and 186,000 left without electricity for weeks (BBC, 2008). Again in September 2011 the state was flooded, when 6 people died, 489,703 people were affected, 43,066 houses were damaged, and R$112 million of public losses was registered (CEPED UFSC, 2016). Between 1980 and 2011, there have been 11 major episodes of flooding (Garcia et. al., 2011), and the recent flood events in 2014 (Smithsonian 2014) and 2015 (Floodlist, 2015), suggest that flooding is a persistent and relevant hazard in the state.

Among the effects of climate change that are of greatest relevance to cities are the increase in Earth’s average surface temperatures, forecasted to rise between 2 and 4°C in some regions of Brazil by the end of the 21st century. Such increases in temperature may modify moisture flows and create atmospheric conditions that are more susceptible to extreme events (Ministry of Environment, 2016). There is thus increased risk of a rise in the frequency and intensity of extreme rainfall events in the more urbanized and populated regions of Brazil, especially the South, Southeast and along the Brazilian coast (Riebeek, 2010). This, combined with other evidence from studies on a global scale (IPCC 2012 & 2016, World Bank 2016 & 2018) indicate that climate variability already poses a significant challenge and that future climate change effects seem inevitable. This makes it vital to develop strategies for adaptation, in view of the issues of ethical and social justice these entail.

Climate change impacts heavily on the poor, especially communities and settlements that are situated in high-risk areas with limited access to services and resources (Marengo, 2009) and particularly vulnerable to extreme events. Analysis of the impact of climate change on coastal ecosystems illustrates the importance of maintaining and restoring areas for displacement or mobility of such ecosystems. With the increase in average temperatures it is expected that mangrove ecosystems migrate to south regions of Brazil, beyond their current climatic limits that nowadays extend down to State of Santa Catarina (World Bank, 2012). Addressing such challenges requires inter-institutional and joint collaboration, social-policy formulation strategies, and effective long-term integrated nationwide adaptation programmes (Marengo, 2009).

Urban development policies are known to be effective in bringing about adaptation to climate change in cities. These means of systemic approaches will address current issues such as frequent flooding and anticipated problems such as displacement. In Santa Catarina there is a need for such integrated approaches that are viable to be implemented as scientific knowledge and research in relation to disasters advances.

Over the years, there have been instances where transparency and governance has been brought to question in relation to Brazil’s infrastructure development projects. Overpricing and bid rigging have resulted in steep price escalations (Martini 2017). In Santa Catarina the problem is focused more on non engagement of communities and stakeholders in the decision making process which has resulted in the displaced returning to the disaster prone areas many times over. This failed relocation process has illustrated the need for resilient Social Ecological Systems to achieve long-term sustainability. Local Community participation, their perception of the value of long term solutions, life long education measures that inform and transparent governance systems with accountability, have been identified as key factors in this process.

**Current Policy and legal framework**

In Brazil, The National Policy for Civil Protection and Defense brought into effect by Law 12608 of 10th April 2012, states that it is the duty of the Union states, Federal Districts and Municipalities to adopt measures necessary for reducing disaster risks, and that these may be applied in collaboration with public, private or civil society bodies (MMA, 2016b). This policy encompasses actions for prevention, mitigation, preparation, response and recovery, targeted at promoting civil defense. It provides for the National Protection and Civil Defense System, comprised of federal, state and municipal administrations, and of public and private organisations with significant engagement in the field of protection and civil defense (Figure 1).



Figure 1- Overall organisation of National Protection and Civil Defense System (MMA, 2016b)

The National Secretariat for Protection and Civil Defense (SEDEC) is the focal point for its implementation, in coordination with the Secretariat for Climate Change and Environmental Quality of the Ministry of Environment (MMA). Other collaborators include the Ministry of National Integration, the National Centre for Monitoring and Early Warning of Natural Disasters, the Brazilian Geological Service, the Ministry of Planning, Budget and Management, the Ministry of Cities (MCid) and the National Institute for Space Research.

The MMA in Brazil adapted ‘The National Adaptation Plan’ (NAP) in May 2016 to promote reduction and management of climate risk considering the effects of climate change, by taking full advantage of emerging opportunities, avoiding losses and damages, and building instruments to enable adaptation of natural, human, productive and infrastructure systems (MMA, 2016a). According to this vision all government-policy sectors considered vulnerable to the impacts of climate change was to have strategies in place for climate-risk management. Measures for adaptation were to be aligned with national socioeconomic development goals, and with coordinated federal, state and municipal public policies for reduction of inequalities. The NAP acquires importance not merely as a tool for directing guidelines and actions, but also as the connection for inter-sectoral and inter-governmental coordination. A crucial aspect for implementation of national urban development policy relates to consonance of the actions of federal authorities with those of the states and municipalities, other branches of government (legislatures and judiciary), and participation of civil-society in coordination and integration of investments and actions for Brazilian cities, targeted at reducing social inequality and strengthening environmental sustainability (MMA 2016b).

### Major challenges in delivering resilient infrastructure management systems

Most Brazilian cities already face socio environmental problems associated with accelerated growth and transformations of urban space. Climate change tends to exacerbate the effects of existing hazards, such as flooding, landslides, heat waves and water shortages. Historically, issues relating to changes in climate patterns and extreme weather events have generally been overlooked by governments and, consequently, themes such as urban development, risk management and adaptation to climate change have been treated separately. In recent years, Brazil has advanced in the implementation of public policies for urban development that combine urban planning and risk management within a prevention perspective.

####  Economic losses due to disasters

An assessment carried out by the World Bank, State Governments, and the National Secretariat of Civil Defense, found out that as a result of four natural disasters that occurred in Brazil between 2008 and 2011 the country lost as much as US$9 billion and the housing sector was the most affected, with losses above US$4 billion (Cruz, 2012). In Rio de Janeiro, reconstruction works for roads and highways took US$373 million (MMA, 2016a). Such damages in the transport infrastructure cause interruption of economic activities with hard-to-measure losses and would only be realised in the long term thus making it difficult to invest further. As a result, most projects will be to reconstruct and attain the previous state rather than improve and be resilient. The impacts of the disasters were felt more by low-income segments of the population, who lived in hills, river shores, and other vulnerable areas (MMA 2016b). Besides delivering emergency cash transfers, local governments helped people resettle and financed housing reconstruction. Impacts on infrastructure services, education, health, agriculture, and commerce can also be significant. Hence the solutions could be short term to address the recovery phase rather than investments in long-term solutions (Viana, 2011).

#### Cultural change of organisational processes

With the devastations due to a number of flooding incidences, it is hoped that the economic effects and losses for the built assets, infrastructure and communities will drive a cultural change in organisations that deliver urban city planning solutions. Federico Pedroso, World Bank Consultant cited in Cruz (2012) states ‘Only recently has the importance of disaster risk management gained visibility in Brazil. Setting preventive measures takes urban and financial planning, and a long-term commitment’. A first step towards the implementation of public policies was taken in August 2014, when Brazil’s government launched the National Plan for Disaster Risk Management (2012-2014). US$11 billion were earmarked for the initiative, of which 83% will fund construction works aimed at avoiding and mitigating the effects of natural disasters (Cruz, 2012). It is now acknowledged that these processes are essential, urgent and must be embedded in urban development projects to achieve long-term resilience of the cities.

#### Long term Disaster Risk Management

The impact of climate change is regarded as one of the contributing factors to increased disaster risk. Risks stem from the intersection of three factors. Firstly, threat stemming from extreme weather conditions, exacerbated by current climate-change trends. Secondly, vulnerability of populations to disasters, i.e., their capacity to prepare and recover effectively in the aftermath of a disaster. Thirdly, exposure of human systems and settlements in areas susceptible to phenomena such as flooding and landslides, referred to as “risk areas” (MMA, 2016b). Widespread unplanned urban expansion over the past 60 years in Brazil and Santa Catarina has resulted in concentration of vulnerable populations in risk-prone areas. Such populations are thus exposed, both to sudden disasters, such as landslides, floodwaters, etc., and to gradual natural processes, such as drought and flooding. Substandard housing in ill-suited locations near hillsides or flood-prone areas; poor infrastructure, such as roads or paths that hinder easy access to highly vulnerable areas; lack of a functioning civil defence; overcrowded, impermeable cities that do not channel away rainwater—all of these unnatural factors related to human culture can influence the final outcome of a risk situation (MMA, 2016a).

#### Innovation and new knowledge

In setting sectoral and thematic strategies of the NAP (2016), the major bottlenecks identified for climate-risk management are: information and knowledge gaps relating to exposure and sensitivity of human, productive and infrastructure systems to climate change; identification and spacing of the potential impacts of climate change on Brazilian national territory; and decentralized dissemination of climate data and information in plainly understandable language (MMA, 2016b). In this respect, initiatives that prioritise knowledge management, targeted at generating new knowledge and technologies, management and access to information are essential for fostering Brazil’s sustainable development and economic competitiveness, within the context of climate change, mitigation and adaptation.

#### Governance and transparency

According to UNISDR (2015), DRM requires shared responsibilities by central governments, local authorities and other sectors and stakeholders, and must protect people and their property, their livelihoods and productive assets, including the right to development (Eyerkaufer et al 2016). Thus, the process requires the whole society’s commitment and partnership, in a clear designation of responsibilities between public and private stakeholders. It is said that the expression ‘long-term planning’ is rarely found in Brazil's political dictionary and short-term, eye-catching public works and winning elections are the aim, focus and the main driver of cities' growth (Viana, 2011). Profit is understood to be the main concern (Martini, 2017) and there have been instances where governance, transparency and accountability of decisions and actions have been clouded. Corruption and bid rigging in construction procurement have been highlighted and there is evidence of over-billing in the 15 Brazilian infrastructure projects that have already been subject to technical reviews and audits by the courts and federal police (Martini, 2017).

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### Transparency and governance in delivering resilient infrastructure systems

Brazil’s territory represents an array of economic, social and urban-development issues among municipalities and reflects the diversity of its urban settlements. (MMA, 2016b). Such heterogeneity has repercussions on the affordability, capability, transparency of municipalities and their ability to adapt to climate change, which also relates closely to aspects of governance and democratic management (Oliviera et al, 2006). From an urban standpoint, local administrations are better able to deal efficiently with issues of infrastructure and essential public services for public well-being, and more capable of regulating and exercising control over the local-level actions of individuals and companies (Satterthwaite, 2008). In practice, there seems to be many external factors including political pressures, unfair procurement of contracts and other corruption measures that influence the delivery of infrastructure projects.

Intensive rains and severe floods are becoming a routine in most part of Brazil and cities do not have the capacity or the infrastructure systems that can cope with such extreme events. Long term integrated urban planning has not been a part of the political agenda in Brazil and governments react, rather than plan and prevent (Martini, 2017). The ministry in charge of monitoring urban planning, the Ministry of Cities, was created in 2003 and The Supreme Court is still deciding if all cities will have to set out and follow an urban plan as defined in 1988 in new federal constitution. The national ‘Plan of Growth Acceleration’ (2009), the major project for infrastructure works, earmarked £4.4bn for disaster containment and will be used for drainage and containment caps for hills. According to the National Secretary of Urban programmes, these are short-term emergency works purely to reduce the repetition of tragedies and fail to address the long-term urban planning issues (Viana, 2011).

In Brazil and Santa Catarina, many communities live in high-risk areas, such as the slopes of mountains. Land in the city centres is too valuable for social housing and often governments do not compel the efficient use of urban land nor influence the private sector to do so. Social inequality and the stimulus to maximize property gains during recent decades have greatly worsened the exposure of poor communities, lacking resources and other alternatives, who have been forced to settle in high-risk areas (MMA, 2016b). The Brazilian cities have put forward measures to avoid this problem, such as the creation of social interest zones and progressive taxing of unoccupied or sub-utilised buildings. The problem is seen to be excessive pressure from estate agents and private property developers with the Governments tending to yield (Bonduki, 2011 cited in Viana, 2011). Building Contractors and estate agents are known to donate large amounts of money to political campaigns (Martini, 2017) to exert influence over local government decisions.

The development of risk prone areas and subsequent disasters are not only affecting the poor but the other social classes as well. In many cities the houses that came down in the landslides belonged to middle class families and were built due to beautiful locations, good views and the authorities not being able to stop the development. This institutional fragility of local administrations has led to fragile eco-systems that have adverse effects on the community.

### Conclusions

Societies looking for sustainable, long term, developments are characterised as being resilient, responding in an organized manner and recovering more efficiently from a disaster. Incorporating risk management into an integrated urban planning process, having clear hierarchical accountability for all stakeholders allow authorities and governments to have better chance of achieving mitigation and adaptation goals in resilience with a short recovery phase with minimum damage and long-term investment plan that can provide balanced socio-ecological systems. This new form of governance, planning and implementation presents several challenges. One being the inter-institutional, inter-community and intra institutional and community coordination that need to clearly define the risk-management roles and responsibilities of the different participating entities. The second is engaging all stakeholders, including the affected communities in the decision making process so that their voices are heard and incorporated in to the solutions that are provided. This type of open inclusive governance strategies can improve the transparency of authoritative decision-making and improve the citizenship of city dwellers resulting in many positive socio-economic and environmental actions.

A major re-think of organisational culture and hierarchy and mind change is necessary to achieve social ecological systems that are resilient in the long term. This will only be achieved by community and local participation at grass root levels, learning and education, governance systems that are not driven by political gains and influences, and complex eco-system services supported by legislation that can be truly implemented.

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