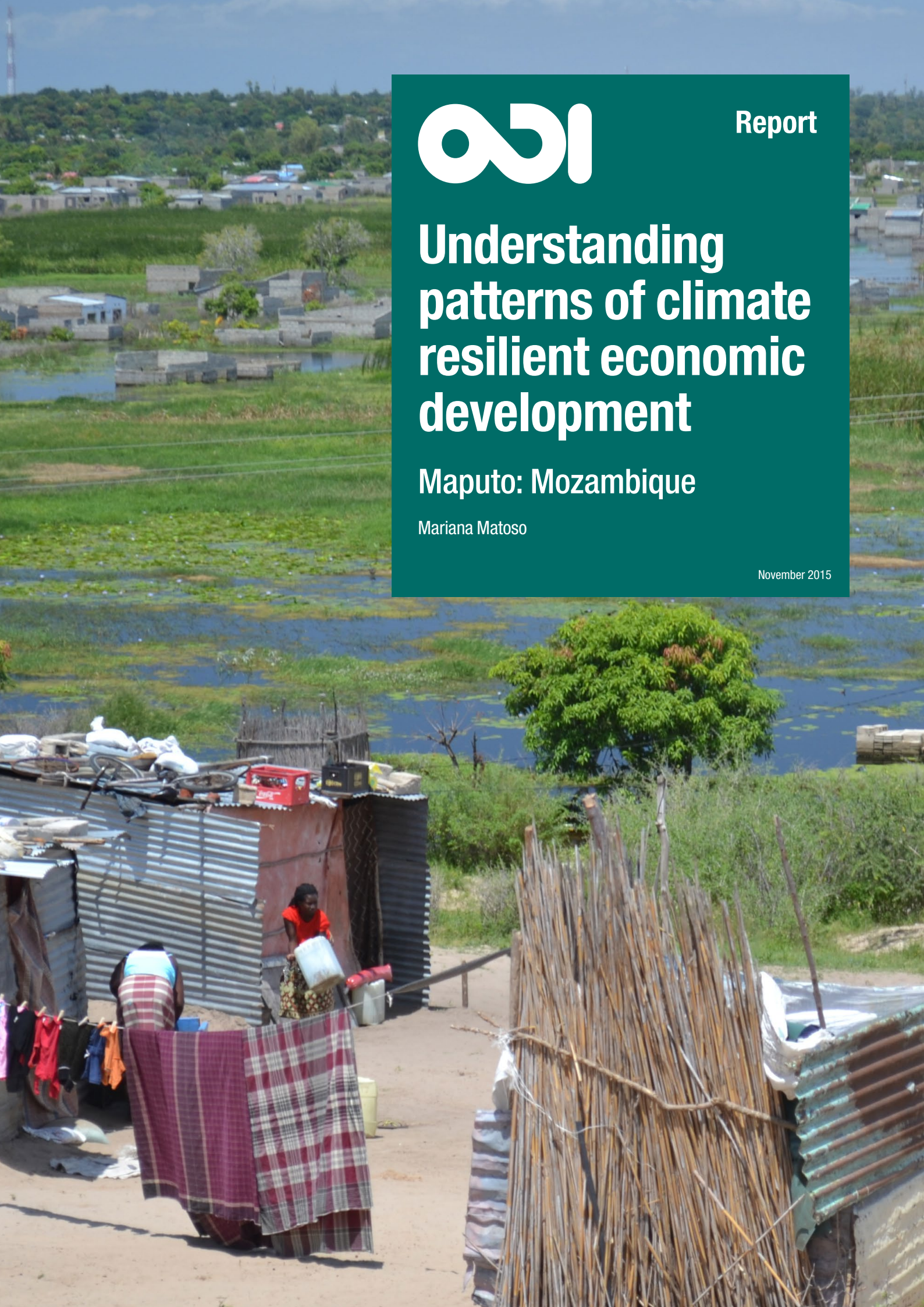

Report

Understanding patterns of climate resilient economic development

Maputo: Mozambique

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November 2015

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Key messages

- We examined the capital city of Mozambique, Maputo, over the last decade, to understand how patterns of economic development affect vulnerability and exposure to the impacts of climate change;
- Over the last decade, **Maputo remained the main economic hub in the country,** currently producing over 20% of the entire national GDP;
- **The city is more resilient to climate extremes like inland flooding and sea-level rise now than it was a decade ago,** as governmental initiatives have increased people's and assets adaptive capacity.
- **But economic growth was not the key factor in this process** and in some cases ultimately contributed to exacerbate uneven distribution of adaptive measures, with key economic infrastructure taking precedence over the poorest living in the most flood prone areas.
- The ultimate lesson being that **unless sustained economic growth is captured, channelled and translated into suitable pro-poor programmes**, it, alone, **will not automatically contribute towards increasing poor people's adaptive capacity**.

Abbreviations

Abbreviation	Description
CONDES	National Council for Sustainable Development *(Conselho Nacional de Desenvolvimento Sustentável)*
CRA	Water Regulatory Council *(Conselho Regulatório da Água)*
CT-CONDES	CONDES Technical Council *(Conselho Técnico do CONDES)*
FIPAG	Water sector asset-holding agency *(Fundo de Investimento e Património de Abastecimento de Água)*
INGC	National Disaster Management Institute *(Instituto Nacional de Gestao de Calamidades)*
GIIMC	Inter- Institutional Group on Climate Change *(Grupo Inter-Institucional para as Mudanças Climáticas)*
MICOA	Ministry for Coordination of Environmental Affairs *(Ministério para a Coordenação da Acção Ambiental*
MD	Municipal District (*Distrito Municipal)*
SDIP	Spatial Development Initiatives Programmes
UMC	Climate Change Unit *(Unidade das Mudanças Climáticas)*

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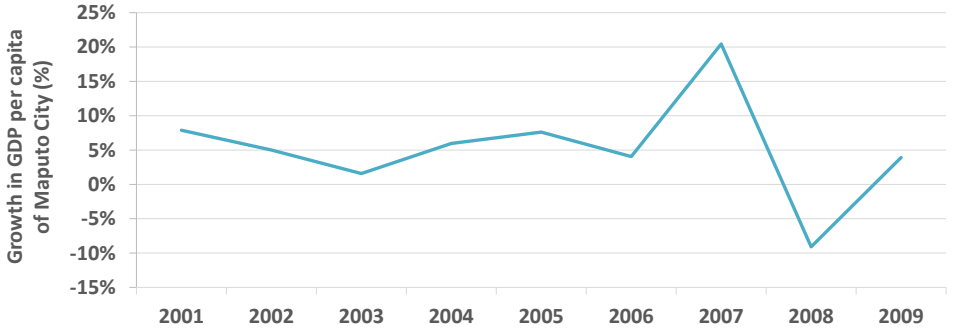
Executive summary

Maputo's high, albeit variable, economic development has continued to improve the climate resilience of the most developed and central parts of the city while providing little benefit to overcrowded, informal settlements in flood-prone marshlands. The high cost of living in low-risk areas has forced the poorest in Maputo to settle in areas exposed to flood risk and offering little infrastructure, public service provision or economic opportunity. As growth continued, this divide worsened and a higher population density has amplified the poor's vulnerabilities. Public efforts to address this have begun to improve sensitivity and adaptive capacity yet remain small-scale.



Maputo's GDP per capita grew at a relatively high rate to 2007 driven by external aid and FDI, increases in social infrastructure investment and liberalisation of the economy. Following a sharp 9 per cent contraction in 2008, economic growth quickly rebounded.

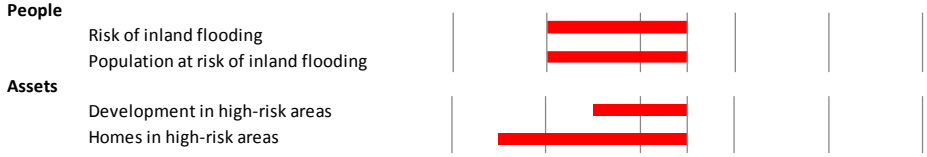
The case study addresses the question: '*To what extent has Maputo's traditional role as the epicentre of the Mozambican economy and hub of economic investment contributed to increases in the city's climate resilience, in particular of those living in the informal settlements?'* over the 2000-2015 period. It drew from desk-based research and fieldwork including the review of technical reports, policy and legal documents, municipal and international databases and interviews.

The direction and relative scale of the impacts presented in the scorecard below are subjective judgements based on quantitative data wherever possible. Due to the availability of credible and accurate data, approximations are used for each indicator which may vary by geographical focus or time period and others may draw from qualitative research. A full discussion of analytical constraints is given in the synthesis presentation.

Change in resilience
due to change in indicator

EXPOSURE

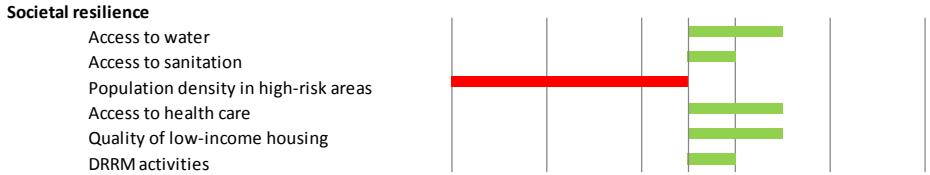
The presence of people and assets in places that could be adversely affected by climate change.



Informal settlements built in the marshlands experienced rapid population growth, construction of houses and informal infrastructure. As a result, these communities and structures are highly exposed to the risk of inland flooding. Average annual rainfall rose increasing the risk of inland flooding, though this is not attributable to economic development.

SENSITIVITY

The degree to which a system is affected by or responsive to a climate stimuli.



City-wide access to public amenities such as water, sanitation and health slightly improved alongisde the quality of low-income housing, as indicated by a decrease in the percentage of informal structures. However, this was not true for the most vulnerable bairros which experienced rapid increases in population density. This worsened sensitivity to floods both in terms of the number of people affected and the severity of the damage due to the additional strain on public services and the spread of disease. Disaster risk reducation and management (DRRM) activities included the distribution of emergency readiness kits though only to a small number of bairros and not those at the highest risk of flooding.

ADAPTIVE CAPACITY

The potential or capability of a system to adapt to, or alter to better suit, climatic stimuli or their effects or impacts.

Wealth rose across the period, as reflected by an increase in the home ownership rate, while the high level of inequality remained relatively constant suggesting the rich benefitted the most from GDP growth. That said, both the poverty rate and the average income gap to the poverty line fell indicating a moderate increase in adaptive capacity across the city. Education and training improved as the secondary enrolment rate rose and climate change awareness programmes were established. DRRM committees in vulnerable bairros were also established to provide structure to DRRM activities.

Are impacts different for the poorest?

The emergence of informal settlements was partly due to the high cost of living in the 'cement city', the well-developed and central parts of Maputo. Financially constrained new migrants were forced to settle in 'bairros' where living conditions were cheaper but the risk of climatic impacts such as floods was higher leading to **increased levels of exposure**.

Bairros are characterised by a lack of social infrastructure and poor provision of public services **worsening sensitivity to climatic impacts**. As there are few local medical centres, the cost of health care is heightened by transport and water prices are among the highest in the city due to poor distribution links.

Most bairro residents work in the informal sector and have not benefitted from the spur of economic growth as it is associated with sectors that require skilled labour such as manufacturing and finance. Moreover, entry opportunities for these industries are slim as local education suffers from insufficient resources **limiting the poor's ability to build adaptive capacity**.

Gender disparities persist: rates of illiteracy, unemployment and dropping out of school are all higher among women. Women also tend to start work in the informal sector earlier than men. Together, **these factors severely hamper women's ability to attain skilled, well-paid jobs, which in turn limits their access to finance and adaptive capacity**.

Are impacts locked in?

The Port of Maputo, its rail links and oil facilities are situated on an estuary while the tourism industry and high-end dwellings are also concentrated close to the sea. Even in low sea level rise scenarios, these areas will be under threat from extreme weather events by 2030. **Assets in these areas have locked in exposure due to high fixed capital costs and long asset lifetimes.** The sensitivity of these assets could be reduced through protective infrastructure such as fortified seawalls, beach nourishment, or steep barriers along the coast though these measures are likely to be costly.

Despite steady economic growth, properties within the 'cement city' substantially supersede the financial capacity of the average Maputo dweller, let alone those in bairros; poverty incidence across the city is 51 per cent whereas average monthly rent in Municipal District (MD) I is US $3,000. Land is also becoming scarcer in MDs II and III and population density in their bairros are at alarming levels. Due to these factors, **the poor in flood-prone bairros are subject to social lock-in of worsened exposure, sensitivity and adaptive capacity**. Government relocation programmes have moved residents to remote and underdeveloped MDs where exposure may be reduced but limited job prospects, access to key markets and basic services do little to improve sensitivity or adaptive capacity. A resettlement plan including compensation combined with key infrastructure investments would be needed to reverse this trend.

What are the policy implications?

Sustained economic growth does not necessarily translate into increased adaptive capacity, particularly for women and the poorest. While the incomes of these communities slightly rose in Maputo, they did not see significant benefits from the expansion of highly skilled sectors, such as finance and manufacturing, in which they do not participate. To help address this, income rises could be channelled into programmes that reduce reliance on informal livelihoods by supporting the development of new economic hubs across the city, or by improving transport linkages to existing hubs. This requires no change from standard economic development policy though it is important to account for the additional benefit of increased adaptive capacity.

Focussing on just one component of climate resilience can lead to unintended consequences and negative lock-in. The limited success of resettlement strategies in Maputo is likely due to the narrow focus on exposure when selecting resettlement locations. Considering all components of resilience together may have suggested that the lack of social infrastructure in, and remote location of, resettlement destinations would have detrimental impacts on residents' sensitivity and adaptive capacity. Moreover, this could help identify steps to avoid negative lock-in; for example, if the strategy had been accompanied by investments in local infrastructure, transport links and public services, residents would have had better access to finance and the resources that they require to build their own resilience.

1. Introduction

Background to & context of the study

Project background

The physical effects of climate change will have direct and indirect impacts on economic and social structures and natural systems, and these impacts will have high costs (IPCC, 2001; IPCC, 2014; Stern, 2006). Although the manifestation of climate change will vary across regions, at the global level the Intergovernmental Panel on Climate Change (IPCC) projects an increase in temperatures, melting ice sheets and rising sea levels, and changing climatic variability potentially leading to more extreme events such as flooding and drought (IPCC, 2014; Field et al., 2012). Many of these trends are already occurring, with attributed impacts on the fundamental components of human development, including livelihoods, health and food production (ibid; Sachs, 2014; Fischer et al., 2005).

Within this context, it is important to consider how to build resilience, at both the macro, national level and the micro, household and individual level, to reduce or avoid the economic and societal costs of climate change. This will allow decision makers within government and bi- and multi-lateral donor agencies to identify what development trajectories can support climate resilient growth and poverty reduction. As such, this research, focused on a case study of the city of Maputo, Mozambique, and aimed to understand better how patterns and trends of economic development affect vulnerability and exposure to climate impacts across sectors and populations, including distributional effects. This project is embedded within a broader agenda exploring the nature of climate resilient growth in lower-income countries, in order to mitigate risks and avoid 'locking-in' vulnerability to hazards.

This report presents a case study from Maputo that explores the relationships between economic development and climate change. Commissioned by the Climate and Environment Department of the UK Department for International Development (DFID), it is one component of the project "Understanding Patterns of Climate Resilient Economic Development", a research project to improve understanding of how climate change will affect economic development, and in turn, how economic development shapes resilience to climate extremes and changes. It will make practical recommendations as to how policymakers in developing countries can influence patterns of economic development in order to avoid or reduce the costs of climate impacts. This phase of the research is undertaking four in-depth case studies to understand better how economic development has influenced vulnerability and exposure to climate impacts and the distribution of this vulnerability across different groups.

Context of the study

Considered a post-conflict, relief-to-development success story, Mozambique is nowadays characterised by robust economic growth, decreasing levels of aid dependency and a rapidly growing and urbanising population. Following a protracted civil war (1975-1992) Mozambique's annual Gross Domestic Product (GDP) growth averaged 7.4% over the past two decades and forecasts are optimistic following the discovery of large coal deposits and off-shore gas, setting the country *en route* to become one of the most dynamic non-oil economies on the continent (World Bank, 2014). With foreign direct investment (FDI) and public expenditure driving economic growth, the fastest growing sectors are now the extractive industries and the financial sector (AfDB, 2014), whilst levels of aid dependency have been halved from 60% in 1990 to 33% in 2013 (MASP, 2013). Mozambique has also experienced steady population growth and urbanisation levels, 2% and 3% respectively, between 2005 and 2013 (World Bank, 2015). Whilst urban dwellers currently only make up 30% of the total population (25 million), future estimates predict that by 2030 the number of urban-based people will double, positioning Mozambique to become the fourth most urbanised country in the region (Standard Bank, 2012).

Economic growth and urbanisation levels have however been historically skewed towards the south of the country and concentrated in the capital city. With Maputo producing over 20% of the National GDP (Ventura et al, 2013), it plays a key role in the country's economic revival thanks to its strategic positioning as part of the Maputo Development Corridor and its deep-sea port which has practically no competition from other national and international ports (van Drunen and Veldman, 2008). As an economic attraction pole, masses have flocked to it over the years making it the most populous city of Mozambique with an estimated population of 1.2 million, and host to 40% of the entire country's urban population (UNHABITAT, 2010). Poverty rates are now also lower than the national average (36% compared to 54%) and levels of service provision, GDP per capita and minimum wage are also considerably better than in other parts of the country (Tvedten, 2013; World Bank, 2015).

Climate hazards have also affected Maputo. Situated in the coast and downstream of two major river systems, the city has been affected by recent major coastal and inland flooding episodes in 2000, 2012, 2013 and 2014, which have caused death and destruction. Exacerbated by the rapid urbanisation in hazard-prone areas, climate change has affected 720,000 people and has put at risk 7% of the city's assets, with the informal settlements and areas of key economic activity (e.g. port and coastal real estate developments) being the most affected (INGC, 2009; INGC, 2012).

Lessons have been learnt from the big floods of 2000. Since 2005, the central government has been mainstreaming climate change adaptation, instigating institutional reform and improving its disaster response capacity. However, this high-level action has yet to translate to an overarching and structured local approach to climate change adaptation. Municipal governments remain dependent on an extremely limited pool of human and financial resources, and interventions are either small scale and localised, or decided on the grounds of the level of economic return an investment they might bring. In Maputo, zoning and protection of mangrove/wetland areas and coastal defences received the bulk of climate investment, at the expense of the urbanising flood-prone areas, which received small-scale community-based pilot schemes instead.

Maputo is at risk of increasingly frequent climate-related hazards (McSweeney et al, 2008; Theron & Barwell, 2012) thus the probability of flooding hitting the city in the near future is high. In the eminency of another extreme event, it thus becomes relevant for decision-makers and development partners to learn more about historical geographic patterns of development, and how these have affected exposure of people and assets, on top of what actions and investments have responded to those risks. Such approach will hopefully support a better-informed decision-making process towards increasing the city's future resilience. With that in mind, research was guided through the following question:

To what extent has Maputo's traditional role as the epicentre of the Mozambican economy and hub of economic investment contributed to increase the city's climate resilience, in particular of those living in the informal settlements?

Conceptual framework

This case study was developed around a conceptual framework, which aims to capture how patterns of geographic and sectorial development affect resilience, while also considering distributional effects, in particular the impact on the poor and marginal groups (Tarazona et al., 2014). Resilience is conceived within the IPCC-recognised framework of exposure and vulnerability to climate-related hazards, i.e. the presence of people or assets at risk to climate variation, and the degree to which a system is susceptible to or unable to cope with adverse climate impacts (IPCC, 2001; IPCC, 2014). Vulnerability can be disaggregated as a function of sensitivity, the degree to which a system is affected by positive or negative climate shocks, and adaptive capacity, which measures a system's potential to adjust to climate changes, to moderate damage, capture opportunities, and cope with consequences (*ibid*). These different aspects are integrated into the framework in Figure 1.

Figure 1: Conceptual framework for climate-resilient patterns of economic development

		Vulnerability	
	Exposure	Sensitivity	Adaptive capacity
Geographic			
Sectoral			
Distributional			

Source: Vivid Economics and ODI (2014), developed from Tarazona et al. (2014)

Methodology

We used a mix of desk-based research and fieldwork. Over 100 documents were reviewed, ranging from technical reports to policy and legal documents, and several databases. Fieldwork took place between 16 and 27 February 2015. Over 20 informant interviews from a purposively diverse sample of stakeholders were held, key statistical municipal data was collected and one field visit was conducted to flood-prone areas in the *Magoanine C bairro*. A list of the organisations consulted during fieldwork and information about general databases used is included in the References chapter at the end of the report.

Mozambique is not a rich data country and thus it is important to highlight that this study faced considerable data limitations in comparison to the Philippines one. Challenges included lack of data availability for key indicators and within appropriate timeframes, quality of data recovered, statistical relevance and availability of useful time series.

Structure of the report

The report is structured into four main chapters. Chapter 2 provides an overview of the two key trends of Maputo's historical patterns of economic development. Chapter 3 assesses the impacts of these trends on the city's resilience, singularising a particular acute situation on the Magoanine A, Magoanine B and Magoanine C *bairros*, located in municipal district V and IV – one of poorest and most marginalised *bairros* of the city, which coincide with the largest flood-prone zone in the city. Chapter 4 discusses issues around distributional impact, policy drivers and lock-in, followed by Chapter 5 where key findings are highlighted and policy implications explored.

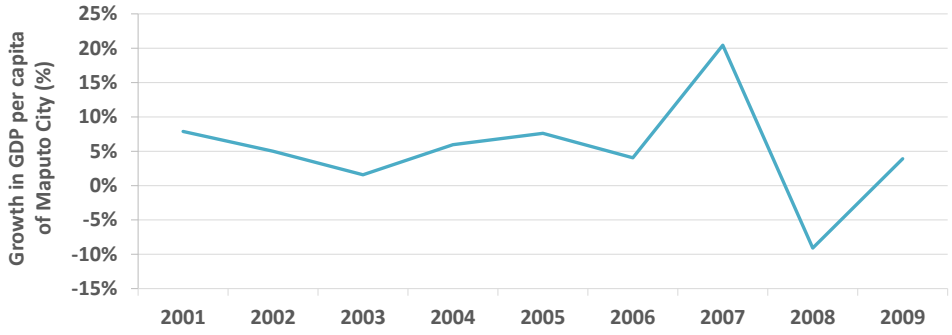
2. Historic economic patterns

City context

Maputo is the economic hub of the country. Its proximity to Johannesburg coupled with its deep-sea port, trade corridor and largest industrial parks make it the "gateway to Southern Africa", establishing the link with the hinterland countries. Occupying 0.05% of the national territory and comprising 5.3% of the entire Mozambican population, the city alone is responsible for generating between 19-20% of the national GDP (PPEUM, 2008). Sectors like commerce, transport and manufacturing dominate the economy, but 65% of the working population remains reliant on the informal economy (Ventura et al, 2013).

Maputo's GDP per capita (fig.3) grew at a relatively high rate up to 2007, driven by external aid and FDI, increases in social infrastructure investment and liberalisation of the economy. Following a sharp 9 per cent contraction in 2008, economic growth quickly rebounded.

Figure 2: Maputo city GDP growth (2001-2009)



Source: INE

Despite a decline in public and private investments since 2009 (WB, 2010) the city's assets and income are estimated to increase threefold by 2030 through economic growth. Whilst residential, commercial and industrial assets are projected to increase from US$6.5 billion in 2010 to approximately US$21.2 billion by 2030; the city's GDP is predicted to increase from US$1.6 billion in 2010 to US$5.2 billion in 2030 (Logchem and Queface, 2012).

The city's past economic growth is the embodiment of post-war macro-economic policies largely influenced by free market principles, favouring export to international markets, privatisation and devolution. Since the early 1990s, economic patterns in the city have been influenced by two key elements: Spatial Development Initiatives Programmes (growth-poles), which led to the Maputo Development Corridor and political decentralisation which enabled the city Mayor to acquire considerable political stronghold and capitalise on FDI. Moreover, the city is situated near one of the largest FDI-led mega-projects to be built after the war - the Mozal Aluminum Company, currently the second largest in Africa (Almeida-Santos et al, 2014).

Maputo's urbanisation was triggered by large influxes of war displaced people, impoverished rural migrants seeking better economic prospects, and emigrants (mainly Portuguese) escaping the crippling effects of the euro crisis. With a GDP per capita increase from US$ 473 in 2000 to US$ 1,379 in 2012 (CMM, 2008; JICA, 2011), the city remains an attraction pole growing at an average rate of 1.5% per year with its population rising from ~990,000 in 1997 to 1.2 million in 2013. With the current highest population density in the country (~3900/km2) (INE, 2010a), Maputo's population is nonetheless expected to continue to increase to approximately 1 984 000 by 2030 (ibid).

Rapid growth coupled with little urban planning and limited public investment in social infrastructure since the end of the war in 1992, has led to an uneven distribution of people and assets across the municipal territory. This has come to generate a city of 'two tales' where unplanned and deprived peri-urban areas sprawl and radiate out from the commercial and residential 'cement city'. Over 70% of the population lives in these settlements, many of which have been built on flood-prone areas. Illiteracy rates remain high at 10% (INE, 2007) and unemployment is rife with 38% of the total population being out of work (PPEUM, 2008). Maputo also remains the most unequal urban area in Mozambique with a Gini coefficient of 0.512 (JICA, 2011) and a poverty incidence rate of 36% (PPEUM, 2008).

Maputo is run by a Municipal Council whose Mayor is elected directly by the people themselves, thus surpassing the usual nomination process by the President. Such configuration allows the Mayor to act independently from the central government and to hold substantial political power. Despite running on a multi-party democracy on paper, state structures remain embedded in a paternalistic and corrupt culture (USAID, 2010). The state is also affected by other internal constraints such as weak institutions, lack of coordination, compartmentalization of policies and legislation (Wingqvist, 2011). Maputo has experienced occasions of civil unrest and bloody riots a few times during the last years, triggered by higher cost of urban transportation and bread (DRFI, 2012). Furthermore, delayed official response to disease outbreaks or flooding, continue to spark wide discontent.

Climate hazards have also affected the city. According to the 'Coastal City Vulnerability league' table, Maputo is the fourth city in Mozambique most at risk (Theron and Barwell, 2012). Due to its location near the coast, the country's capital is particularly vulnerable to extreme events such as floods, cyclones and effects of sea level rise. The municipality estimates that there are 81 955 people at high and very high risk of heavy rains and sea level rise in an area of 3,110 ha (CMM, 2011a), which coincide with the location of informal settlements with a medium to high population density. Historic data reveals an increase in the number of climate related disasters over the past years: severe flooding in 10 out of the last 15 years, including three tropical cyclones, severe droughts in 1981-1984, 1991-1992, 1994-1995, and various episodes of strong winds (e.g.2010). The costliest and deadliest of all these episodes were cyclone Demoina (1984) and Eline (2000) when 336.8 mm of rain fell within 4 days. In 2010, many parts of Maputo were also severely flooded after 290mm fell in 12 hours, more than the normal monthly mean precipitation of 166 mm. Just last year, the city was severly affected by flash flooding and mudslides. Maputo is also at risk of sea-level rise. Historic sea level data for Maputo Bay is scarce and inconsistent due to gaps in records, but trends are comparable to regional and global estimates and thus it can be cautiously assumed that since 1993 sea level has been rising at an accelerated rate of 3.1 millimetres per year (Ruby et al, 2008; INGC, 2009).

What's the story

Like in many other African cities, Maputo's historic growth has not triggered an industrialisation-led type of urbanisation (Philipps, 2014). Moreover, a premature rural exodus prompted by war in the first instance, and economic development afterwards, ballooned the number of impoverished migrants settling in an already ill-equipped city.

In the absence of planned growth and ability to afford the high costs of living within the 'cement city', migrants responded in an informal and ad hoc way by settling within available pockets of land. This led to the continuous growth of informal settlements and expansion of these into flood prone areas. Additionally, key economic and touristic infrastructure like the port and hotels continued to expand into areas prone to sea-level rise and coastal flooding. **Despite the last decade's galvanised economic growth and investment in the Maputo Development Corridor, much of it has failed to trickle down**

to the marginalised communities living in these areas, as richer parts of the city have received the lion's share of public and private investment.

Maputo's context thus compels us to pose the following question:

To what extent has Maputo's traditional role as the centre of the Mozambican economy and hub of economic investment contributed to increase the city's climate resilience, in particular the resilience of those living in the informal settlements?

This question compels us to look for evidence as to what led to Maputo's current spatial, social and economic configuration. By focussing on two key trends of geographic and distributional historical patterns of economic development – *Marginalisation of Informational Settlements* and *Uneven Disposition of Assets and Services*, we will demonstrate where investment in social and economic infrastructure has gone over the last decade and what impact that has had in the city's overall resilience.

3. Historical patterns of economic development

With an economy largely built on export, manufacturing and FDI, propelled much by the Maputo Development Corridor and the Mozal complex, **Maputo's economic growth has had a somewhat limited impact in the majority of its population.** Especially as the largest share of public and private investment gains acquired throughout the last the decade were channelled towards the richer parts of the city.

Consequently, Maputo's growth over the last has been marked by two key patterns of geographic and distributional development:[2]

- Geographic and Distributional [People] – ***Marginalisation of Informal settlements:*** historical economic growth has triggered population growth, but lack of urban planning and investment has increased the climate risk of informal settlements;

- Geographic and Distributional [Assets & Services] – ***Uneven Distribution of Assets and Services:*** historical economic growth has led to investments being earmarked for the 'cement city' at the expense of extending public and basic services to informal settlements.

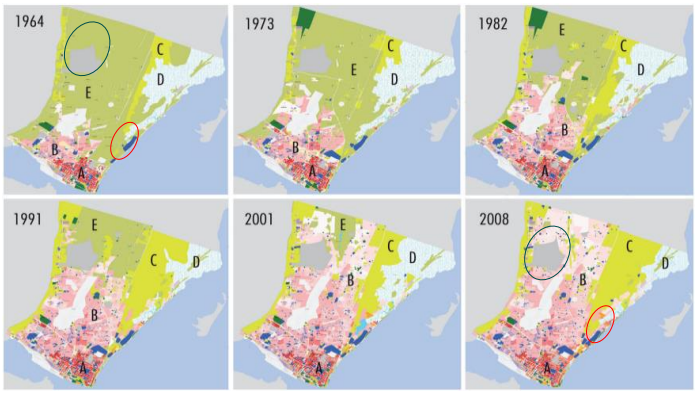
Geographic & distributional trend 1: marginalisation of informal settlements

Initially built to accommodate half a million people, the city's population has been growing at an average rate of 1.6% since 1997, with population rising from 990 000 in 1997 to 1.2 million in 2013 (INE, 2007; CMM, 2013). With an estimated 1.2 million people currently living in Maputo, the city went from a provincial/agricultural core to an urbanised ground in the space of 40 years, with 78% of the entire territory currently being occupied by informal settlements and a population density 135 times higher than the average in the region (3 779 hab/km^2) (CMM, 2008).

The impacts of this urban sprawl were revealed in Melo (2013) where it is clear that Maputo's growth was made at the expense of agricultural land and natural areas (figure 1), with settlements and key hubs of commerce and trade being built on marshlands (blue circle) and mangrove areas (red circle). Albeit future projections point towards a deceleration of population growth (0.9% by 2040) (INE, 2010 unpublished), this configuration has already increased the pressure on the environment and put population and key economic infrastructure at risk of flooding and sea level rise.

[2] Due to data limitations and quality of data available, a decision was made not to explore patterns in sectoral composition of the economy. These patterns will be referred back to in Chapter 3 when their impact will be assessed on the City's level of resilience.

Figure 3: Evolution of Maputo's urbanised areas (1964-2008)

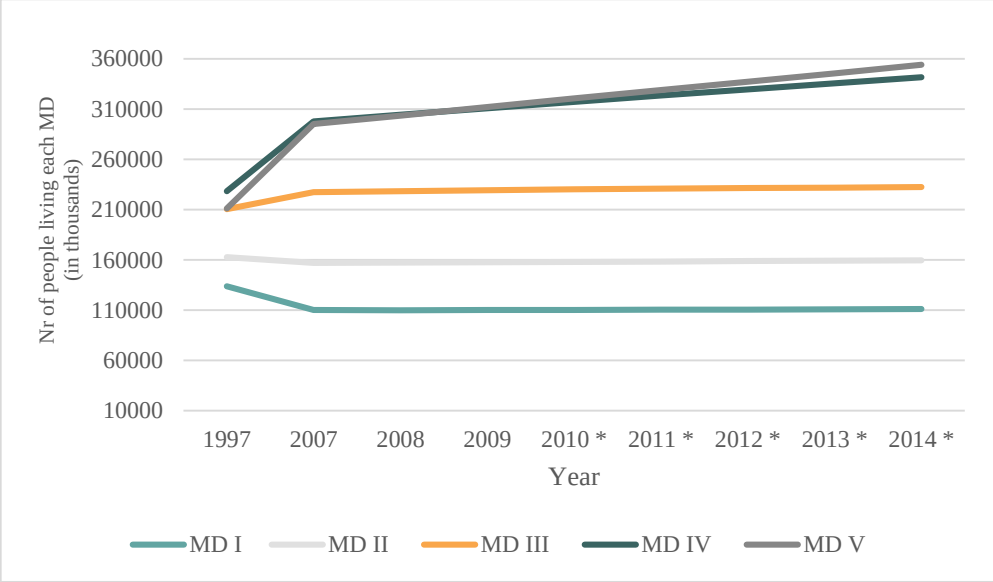


Source: Maps by Melo (2013) and caption adapted by author

Caption: A = Urbanised Centre (*cement city*); B = Informal Settlements C = Areas of agro- livestock; D = Wetlands and floodplains; E = Other natural areas, for leisure, inhabited

Economic growth also led to ghettoized patterns of spatial distribution of population, triggered by exponential rise of living costs which squeezed the poorest out of the economic center or 'cement city'. This is evidenced by population growth in the different municipal districts (MD) over time. For example, between 1997 and 2007 MD I registered a 20% decrease in the number of residents, while MD IV and V saw increases in the range of 28% and 40% respectively. Such settlement pattern also reveals that a higher number of people has come to settle in low lying areas, prone to inland flooding.

Figure 4: Evolution of the number of people living in each municipal district of Maputo (2007-2014)



MD I = main business district and wealthy residential areas, situated near the coast; **MD II / III / IV =** informal areas, low lying and prone to inland flooding; **MD IV =** low lying areas & mangroves
**Projected data*

Source: INE (1997, 2007, 2010)

Spatial ghettoization also mirrors the consequences of Maputo's highly 9pecialized economy. Unemployment rates in the city are double the national average (40% in comparison to 19%) (INE, 2006; JICA, 2011), and informal activities are more important in the periphery than they are in the more central, business district of the city. Whilst MD I is dominated by the financial sector and public administration, in the remaining municipal districts the informal sector represents a key source of income. With 64% percent of urban workers engaged in some sort of informal activity, the informal economy provides additional sources of funding for approximately one third of families in the informal settlements, and full- or part-time work for up to 20% of the entire informal workforce (INE, 2006).

This ghettoization of space and social and economic opportunity helps explain why, despite having the highest per capita GDP in the country, Maputo also has high levels of inequality. For example, Maputo's GDP per capita is five times higher than the poorest province of Zambezia (US $1285 in contrast to US $254) (INGC, 2012). Poverty incidence is also high with 51% of the population having an annual per capita income that falls below the annual per capita poverty threshold, and higher than the national average of 41% (JICA, 2011). Poverty incidence rates vary across the city with MDs associated with informal settlements registering the highest rates – twice more than those found within MD I of 28% (CMM, 2008). Maputo is also the most unequal city in Mozambique with a GI of 0,510. Again, this inequality varies across different districts, with MD I registering the highest (0,618) (ibid).

Economic draw of rural migrants towards Maputo led to an unprecedented population growth from the mid-1990s onwards. Due to a substantial lack of urban planning, the high costs of living in MD I, coupled with lack of available spare land and high population density of MD II and III, the city expanded through *ad hoc* unplanned settlements. Although the municipal council has developed strategic plans that institutionalise urban planning since 2006[3], interviewees highlighted that profound budget limitations and the reactive rather than pre-emptive nature of urban planning remain the two main obstacles to change this pattern. By being unable to monitor urban expansion, the municipality has allowed the establishment of human settlements and economic infrastructure in areas previously allocated to mangroves and marshlands thus increasing the risk of human and economic impact following a climate extreme event.

The perpetuation of informal settlements is also related with a mismatch between Maputo's economy and the market labor as there is limited industry to absorb the majority of low-skilled labor force. With the economy diversifying towards sectors that require more specialized labour, this has the potential to continue pushing more people towards the informal economy. The Municipal Government is currently implementing a program aimed at tackling informal markets by training informal businessmen and women in key business skills, but it has so far reached a very limited number of people and is focused on eliminating informal traders currently operating within the 'cement city'.

Informal settlements have also been the most affected areas by inland flooding caused by heavy rainfalls, with MD IV and V corresponding to 55% of the total flood-affected areas (CMM, 2011a). Since records begun by the National Disasters Management Institute in 2010, around 2,500 families in these districts have been affected by flooding (INGC, 2015 – unpublished data) and the frequency of extreme events is likely to increase. In some cases, the council has been working with communities living in marshland areas to avoid new construction and raising awareness to the necessity to consider resettling somewhere else. However, these have been sporadic and localised interventions that will not address the bigger need – that of cordoning marshland areas off. Climate risk management policy

[3] 2006: "Maputo Solid Waste Management Strategic Plan of Maputo City" ; 2007 "Maputo Municipal Development Programme (PROMAPUTO 2010-2016)"; "Sustainable Consumption and Production (SCP) for Maputo and Matola Cities"; 2008: "Urban Master Plan of Maputo Municipality (PEUMM)"; 2010: National Slum Upgrading Strategy

does exist at both national and local levels.[4] Nonetheless, implementation has been slow. Central government retains much of the responsibility to disburse funds related to climate adaptation that can be a slow and heavily burocratised process and there is a generalised lack of understanding amongst governmental ranks as to what climate adaptation means, leading it to be perceived as a barrier to economic development.

In an alternative scenario, the government could have sought to divert and deploy investment towards controlling urban expansion. It could have zoned out flood-prone areas and invest in developing transport networks in order to develop other economic hubs, for example. Although a significant investment would have been needed, this could have led to a more inclusive development.

Geographic & distributional trend 2: uneven disposition of assets and services

Economic development and the spur of construction it triggered did not necessarily coincided with the expansion of infrastructure able to support and accommodate a growing population. The geographical disposition of public social infrastructure and basic service provision systems in Maputo has thus become extremely uneven over time, as the city kept outperforming its boundaries.

Most of these systems are over a century old and were built to supply a fifth of what Maputo's current population is. Having been built by the Portuguese, the infrastructure is mostly concentrated within MD I and II as they were aimed at sustaining the life of the settlers. The furthest away from the core, the most deprived the MDs are. Such trend is observable in a number of key different sectors, relevant to increase the resilience of the urban space and its communities.

Rapid increase of the city's population and a hasty unplanned expansion has come to generate a mosaic of water provision modalities in Maputo, with much of the existing water conduits concentrated within MD I and II whilst alternative service providers (Matoso, 2014) have served the remaining MDs. Despite that, access to improved drinking water has increased substantially with 98% of the entire population living in Maputo found to be sourcing its drinking water from an improved source by 2011 (DHS Survey, 2013). Between 2003 and 2011 the number of people using public standpipes also decreased from 26.8% to 12.6%; whilst the number of people sourcing from their own yard tap has increased significantly (from 0.8% to 37.8%) (DHS Survey, 2005; DHS Survey 2013). These figures reflect recent investments in the expansion of the water utility network and governmental subsidized water connection programs. These initiatives also translated into an increase in the number of customers with a connection from the water utility within the informal settlements. This pattern is especially visible within MD III and IV, where between 2007 and 2011 the number of customers more than doubled and tripled in these districts (CMM, 2010; CMM, 2013).

Despite improvements in access, water prices vary substantially with those living in the city center and/or connected to the water utility paying substantially less than those being supplied by alternative service providers. A study found that informal settlers receiving water from these agents were paying twice as more, thus putting more pressure on the already constrained family income (Matoso, 2014).

[4] ***National level:*** 2007: National Adaptation Plan of Action; 2012: National Climate Change Adaptation and Mitigation Strategy; INGC Master Plan (2006-2016). ***Maputo:*** 2011 "Detailed Evaluation of impacts of climate change of events in the city of Maputo", "Zoning and Protection Study of Costa do Sol Mangrove/Wetland", "Review of studies of legal instruments and methods that deal with climate change", "Proposal of the Municipal Plan for Environmental Education".

Economic development has also failed to translate into improvements and expansion of the sewerage network, which is more than 50 years old and remains constricted to central districts. Statistics at the city level are almost non-existent. A report from the Municipality (CMM, 2008) was still referring to data collected in 2001. At that time, 68.9% of the households in Maputo had access to improved sanitation, whilst 30.6% were using unimproved latrines. The census in 2007 registered that 1.5% of the population was still openly defecating. Comparing both sets of data with the 2011 DHS survey, it is possible to conclude that sanitation has nonetheless improved with 74.2% of all households reportedly having access to improved (not shared) sanitation, and open defecation levels being down to 0.9%.

The majority of the city is not reached by a drainage system. Again, these are concentrated in MD I and II but even here they have fallen into disrepair due to poor construction quality and lack of maintenance. Anecdotal evidence uncovered that in some cases drainage had been destroyed by recent flooding or no longer held the necessary capacity to drain water appropriately, resulting in constant flooding even if rains were of low intensity. Much of the water also runs-off to the Bay further contributing to its pollution. Numerous areas throughout the city have also been affected by faulty drainage systems caused by accumulation of garbage and clogged up conduits, which can ultimately cause soil erosion (CMM, 2008).

Across the city, public social infrastructure like schools, hospitals, and medical centers is also unevenly distributed. For example, in 2008 the majority of primary and secondary schools were still concentrated in MD I, where the only universities and technical colleges were also located (CMM, 2008). Reports and in-loco observation in MD IV and V confirmed that the small number of operational school units remain dilapidated and in need of serious rehabilitation, with most posing serious health and hygiene threats due to operating without water supply or electricity and lacking toilets altogether. A trend that once again reflects the flows of preferential investment towards rehabilitating and equipping schools and recreational infrastructure in the cement city – albeit not yet enough to meet the demand. Health infrastructure follows the same with only a few scattered health clinics based in some of the informal settlements (ibid).

What this uneven disposition of assets and services reveals is that the communities living furthest away from MD I, which coincidently are the poorest, have extremely limited capacity to increase resilience on their own. For example, if a climate hazard were to hit MD IV or V people would have extremely limited access to key and potentially life-saving health infrastructure. Moreover, they would also incur higher transportation costs, would most likely lose working days, decrease their daily income and another whole myriad of knock down effects.

Summary

This section examined how **historical growth failed to translate into identical geographic patterns of economic development across the city's population and assets.**

On one hand, **economic growth led to ghettoized patterns of spatial distribution of population**, whereby the poorest were pushed away from the business district of the city into further outer areas, affected by high levels of poverty incidence and at high risk from climate extremes. By living in marginalized settlements people were left with reduced chances of accessing key valuable infrastructure that would have otherwise enable them to obtain better education, increase their jobs prospects and their health.

On the other hand, **economic development did also not coincide with the development of infrastructure able to support the rapid expansion of the city**, leading to a starkly uneven disposition of public social infrastructure and basic service provision services and limiting people's access to vital assets (which could have enabled them to become more resilient).

Conditionalities were further exacerbated by land use practices and climatic trends, which over a 30-year period led to informal settlements expanding into marshland areas, for example. Nonetheless, the cost of moving away from these high-risk zones into less prone areas (e.g. central *bairros*) continued to remain exceedingly high and well above the economic capacity of these dwellers.

Such **context derived from a confluence of factors**:

- *Late development of urban policies and urban planning tools* (worth reminding that the first comprehensive report on the characteristics of the municipality was done in 2008);
- *Lack of human resources and capital to invest in the enforcement of existing urban plans* (for example, despite identification of marshland areas the municipality remained unable to stop people settling in or selling plots of land);
- *Focus of central government on consolidating legal and institutional frameworks first* (e.g. water sector, education, etc.), with implementation lagging behind;
- *Economic development fostered by sectors requiring highly skilled labour and concentrated in areas away from the informal settlements* (thus limiting accessibility to majority of dwellers and barring economic prosperity to cascade down across the poorest).

It is thus clear that **Maputo's historic geographic patterns have contributed to accentuate distributional differentials across the city, ultimately influencing the overall resilience of the poorest**. In the next chapter, this issue will be further explored, and impacts will be measured through exposure, sensitivity and adaptive capacity.

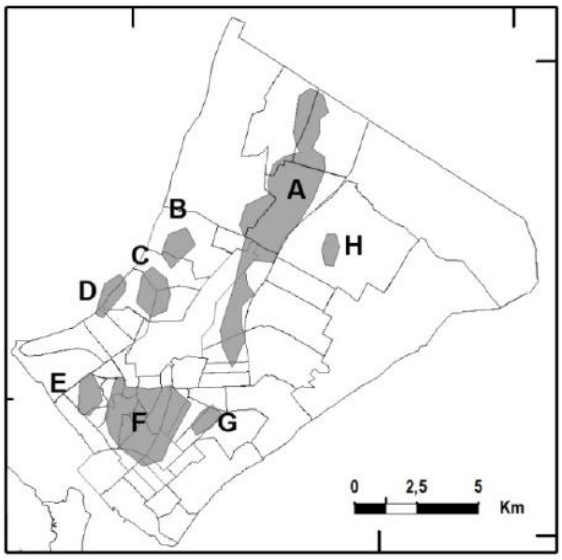
4. Analysis: impacts on resilience

Introduction

The last section unveiled how **Maputo's historical growth motor did not produce even geographic patterns of economic development across the city's population and assets**. Instead, accentuating the distributional differentials across the city. In the next paragraphs, we will unpack how these uneven historic patterns of economic development have **had a direct impact on Maputo's level of resilience**.

We will apply the two historical trends previously identified, in combination with research questions on Annex 1. This will help measure levels of exposure, sensitivity and adaptive capacity from the perspective of those dwellers most at risk from inland flooding. We will focus on the poorest and most marginalised *bairros*, which coincides with the largest flood-prone zone in the city (Zone A –figure 4). Comprised of 1.28 km2, this area is located in one of Maputo's main marshland areas and incorporates the *bairros* of Magoanine A-B-C, located across municipal districts V and V.

Figure 5: Surface of Maputo's floodable areas



Source: CMM (2011a)

The analysis will unveil how people living in these areas have seen their exposure increase due to: rises in population density, lack of law enforcement, limited availability of basic services, low levels of schooling and employment opportunities, coupled with high poverty rates. It will also reveal how geographic patterns have influenced levels of sensitivity by providing information on destruction and disruption levels caused by climate extremes and anthropogenic factors. Finally it will highlight elements of adaptive capacity that have begun to emergence, such has changes in the kind of employment and living standards, relocation programmes and initiatives aimed at increasing people's perception awareness of climate change.

Geographic patterns

Impacts of geographic patterns on exposure

Development has triggered economic migration and due to lack of available land and high living costs within the central radius of the city, people have moved to flood-prone areas.

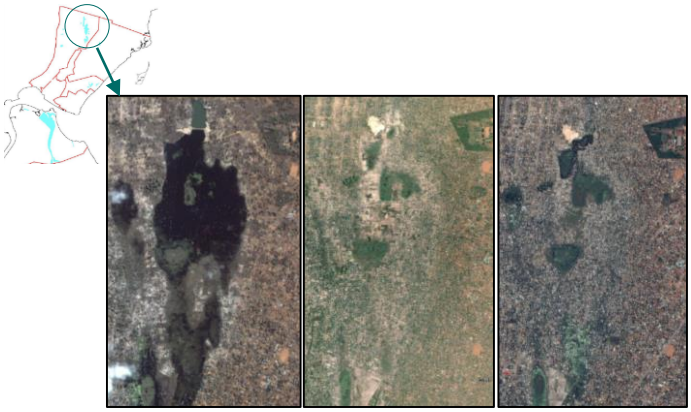
Little investment and urban planning have gone into these areas, which combined with the former has led to an increase of people's exposure to climatic impacts.

Located in municipal districts IV and V, *Magoanine* A+B+C *bairros* are part of the so-called 'expansion' area. These were edified following resettlement processes after the 2000 floods and most of its first inhabitants were people relocated from inner city bairros (MD II, III). As discussed, elsewhere these municipal districts have registered the sharpest growth in Maputo over a period of 7 years, with 44,000 people settling into MD IV and nearly 60,000 in MD V. Such rapid growth and concentration of population has put significant pressure on the available land leading to housing being developed on marshland.

Although it corresponds to one of the most severely affected areas by the 2000 floods, for over a period of 15 years, the marshland has almost completely been parcelled-out and largely built up. Following a 'dry spell' between 2007 and 2012, a new settlement sprouted with over 800 building plots being totally developed by 2011 (figure 5 and 6). In was only following the heavy rains of 2013, 2014 and 2015 that the marshland area widen again.

Stakeholders of the local *bairro* revealed that two main factors had contributed to the increasing occupation of the marshland. Firstly, that residents had been selling land to new settlers during 'dry periods' where there was no water in the marshland and buyers were unaware of the kind of land they were buying. Secondly, that despite being aware of this, local authorities had failed to enforce law against construction in flood-prone areas, as they lacked the means to cordon them off and to put a stop to those selling land on it.

Figure 6: Evolution of the marshland areas in *Magoanine* districts following the 2000's floods (2000, 2009, 2010)



Source: CMM (2011a) and Google Earth

Figure 7: Rate of urbanisation of the marshland areas in the *Magoanine* districts following the big flood of 2000s (2000, 2006, 2015)

Source: Google Earth

These areas also coincide with the most deprived municipal districts, as demonstrated in the last chapter. None of these *bairros* is contemplated by neither of the drainage systems and the public water utility network has yet to expand to these areas, leaving residents relying on the more expensive service provided by small-scale informal providers. Sanitation levels are also low and sceptic tanks are of poor quality leading to potential seepages. There is a total lack of health infrastructures, whilst schools are limited in their numbers and usually in very bad condition.

The majority of residents living in these *bairros* are rural migrants, who flocked to the city throughout the mid-2000s, looking to benefit from the economic surge. Considering the high costs of building and renting within the cement city and the densely populated *bairros* around it, settling in these areas was considered the only option – notwithstanding the level of deprivation described above and the exposure to climatic hazards.

Their level of education is also poor and they lack substantial financial means. Moreover, families are usually large, with an average of five people per household, and the high dependency rate signals reduced mobility and increasing pressure on family income. Such combined pressures, led to the majority of people being incorporated in the informal economy with women (in the age brackets 0-6 and 65+) facing the biggest burden. These municipal districts are also faced with one of the highest poverty rates in the city, with 55% of people living on less than US $1.25 a day in comparison to MD I (27.6%) or MD II (51.3%).

Impacts of geographic patterns on sensitivity

People living in these flood prone areas have also experienced higher sensitivity because less investment has been diverted to equip the districts with key assets and services that enable them to respond and/or adapt quicker.

The *Magoanine* districts represent one of the areas where inland flooding has had a higher human cost, causing the most level of destruction and disruption in comparison to the other districts in the city – especially MD I and MD II where flooding has had little or no impact. Between 2010 and 2014, flash floods episodes in MD IV and V have affected 10,310 people and 2,429 families in total, resulting in two deaths (table 1). Moreover, floods have also led to the total destruction of 119 homes, whilst partially destroying 261 and flooding over 3,000 (ibid).

In terms of social infrastructure, research revealed that some of the worst floods have led to destruction of electricity posts, water points and roads in MD IV and V [Annex 2] One of the main causes being that soils are predominantly of a sandy nature and gullies rapidly eroded, threatening the stability of surrounding houses and infrastructures. Pit latrines remain the main sanitation system in these districts and open wells are still in use. In case of flooding, the pit latrine content tends to overflow and the areas surrounding open wells are polluted, thus increasing the risk of drinking water contamination. Water stagnation has also lead to other health problems, such diarrhoea, malaria, and cholera cases which tend to increase after flood.

Interviews with local residents uncovered that funds channelled towards reconstruction are very small in comparison to levels of destruction, leaving communities in MD IV and V left with the burden of rebuilding their lives. Even after minor rains, one resident explains, deep puddles will occupy the entire street section for long stretches, preventing the circulation of vehicles and goods, whilst hindering pedestrians. It also directly affects informal markets, says another one. As this trade takes place mainly on unpaved streets, trading activities are usually suspended during flood. Flooding also directly impacts schooling levels as when the access road or the backyard of some schools are flooded, schools close and children are

unable to attend. In some cases, people are even forced to stay indoors, unable to leave the flooded surroundings and failing to work.

Table 1: Impact of inland flooding across Maputo's municipal districts (2010-2014)

		People affected				Houses		Social infrast.
Year	MD	Dead	People	Families	Partially Destr.	Totally Destr.	Flooded	# Class--rooms Affected
2010 - 11	**I**	0	0	0	0	0	0	0
	II	0	135	27	0	1	26	0
	III	0	9,500	1,900	0	0	1,900	0
	IV	0	650	130	3	3	124	0
	V	0	874	187	0	0	187	0
2011 - 12	**I**	0	0	0	0	0	0	0
	II	0	44	13	0	2	12	0
	III	0	7	2	0	2	209	0
	IV	0	5	1	1	0	207	0
	V	0	359	70	0	0	80	0
2012 -13	**I**	0	0	0	0	0	0	0
	II	0	640	93	0	093	4	0
	III	3	3,536	759	15	17	759	2
	IV	2	3,010	931	253	113	951	3
	V	0	2,824	659	2	1	1,058	6
2013 -14	**I**	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0
	III	0	6,013	1,265	0	0	1,265	0
	IV	0	959	189	0	2	189	0
	V	0	1,629	262	2	0	262	0
Total over the years		5	30,185	6,488	276	234	7,233	11

Source: INGC-Maputo (2015) *Unpublished Data*

On top of experiencing disruption in terms of water, sanitation, electricity, education and work, in most cases these people will also lose their belongings and houses. Moreover, not only will they lose any food they might have in their dwellings, but they will also experience the loss of crops, as the gardens will be flooded.

Magoanine districts have experienced one of the highest increases in population density across all municipal districts. Whilst in 1997 the census estimated that there were 577 people per square kilometer, in 2007 this number had increased more than five-fold to 3 287 hab/km^2. Considering the very low level of infrastructure available, it will eventually become harder to provide basic services to more and more people, whilst becoming more costly to fund recovery initiatives.

Impacts of geographic patterns on adaptive capacity

Considering that economic development has failed to trickle down to those at the base of the pyramid, the majority of people living in flood-prone areas has failed to reap the gains from decades of economic growth. Both unemployment and poverty incidence rates remain high which ultimately hampers people's ability to step out the poverty trap. Nonetheless, people's level of education and health has registered slight improvements. Moreover, government has invested in disaster risk management programs and is currently implementing awareness raising pilot projects in other municipal districts (with the intent to scale them up).

Socio-economic characteristics

The number of economic active population has increased over the years and as previously mentioned, around 50% are actually situated within MD IV and V. The latest stats available at municipal district level are from 1997. At that point, the key sector of employment within MD IV and V was commerce (35.93% and 38.08% respectively), followed by agriculture (14.84% and 12.98%) and services (13.10% and 12.08%). (INE, 1997). Considering the city trend highlighted before, we can assume that since 1997 those working in MD IV and V have also become more involved in the retail and services sector, at the expense of agriculture. However, unemployment rate is still extremely high and over 80 per cent of households in both neighbourhoods have at least one member who is engaged in informal trade (most likely, one of the household's women) (INE, 2006). Field visits also confirmed that it is either the very young girls or the older women that usually run the informal trade stalls by the side of the road. Additionally, the majority of those involved in informal trade will also travel to MD I during the day to peddle small goods and produce across the wealthier *bairros*.

Such context has led to an increase in the poverty levels of these areas, with both districts registering high poverty incidence. For example in 2008, 54% of all the households in MD IV and V had an income below the poverty threshold. Additionally, both had registered 0.4 in the Gini Index indicating that income inequality is considerable. Furthermore, it is unlikely that in the overall those living in MD IV and V will have been directly benefiting from the increase on the average monthly salaries, especially within the financial and industrial sectors, which require a higher level of education and expertise. Nonetheless, the construction sector has also registered a considerable increase since 2013, which might mean that a small percentage of MD IV and MD V working population can potentially be reaping the benefits of it. It is also quite unlikely that the increase in GDP per capita has translated into significant changes in the well-being of those living in MD IV and MD V.

In the overall, living standards within MD IV and V have seen a slight improvement over the years, despite service provision networks remaining extremely uneven with most of the districts within the expansion area remaining highly deprived. However, there have also been governmental programmes focused on extending basic services to these areas.

Noticeable improvements within these municipal districts can be found for example on the number of customers owning a water utility tap. In the space of four years, in MD IV there were an extra 172,719 people connected to the utility's network, whilst in MD V there were just under 1,500 new connections. Sanitation wise, these *bairros* are not connected to the sewerage network and there is no available data at municipal district level. However, field visits revealed that the majority of people were using latrines with septic tanks, with only the poorest relying on unimproved sanitation. Concerned was expressed by local authorities that septic tanks had been poorly constructed and that those who had been flooded had begun seeping out. Electricity coverage rates have generally improved across the city as well, but people living in MD IV and V rely majorly in pre-paid electricity meters.

Access to education has improved in Maputo, especially as illiteracy and low levels of education have been registered within the older age brackets, thus implying that more and more young people are now attending school (DHS Survey, 2005; DHS Survey, 2013). Having more people in formal education enables households to increase their income by undertaking more skilled and better paid jobs, thus decreasing their reliance on the informal economy and helping their households to avert climate risks. Furthermore, it also allows for diversification of household livelihood sources help buffering the risks posed by climate.

However, education has not reached everyone on an equally basis, with the trend varying across gender, as less women are reportedly literate and attend/complete school than men. For example in 2007, 15% of women could not read or write, against 4.4% of men (INE, 2010b); and in 2011 women registered the highest percentage of basic primary school incompletion with 48% in comparison with 41% of men (DHS Survey, 2011). There are no

statistics at municipal district level; but considering the combination of lower numbers of educational infrastructure, the high poverty incidence rate, and the level of reliance on the informal economy, it is possible to assume that those living within MD IV and V are less literate. Since the level of education may reflect awareness of climate change problems and openness to a variety of adaptation solutions, such low level of education can potentially represent an obstacle to increase adaptive capacity. The high age dependency ratio experienced by Maputo's dwellers (58 dependent people per 100 working-age population) also constitutes a barrier to improved adaptive capacity. This means that a higher burden is put on earning members. Health has improved generally within the city. Average life expectancy at birth has increased by two years since 2007, with most people expected to live until they are 56 years – a trend especially higher in women (INE, 2010b). The under-5 mortality rate has also declined between 2007 and 2014 from 61/1000 live births to 51/1000. Such improvements are with linked with investments in the national health system, whereby the number of health infrastructure and human resources in the sector has increased and people are able to access free medical care (JICA, 2011). A DHS Survey in 2011 captured for the first time the percentage of residents in the city with health insurance (~15%). Albeit extremely small, this indicates that there is an increasing interest.

Considering the lack of statistics at municipal district level however, it is difficult to judge just how much of this positive impact took place in MD IV and V. Especially, as health infrastructure is extremely limited in these municipal districts. We can conclude however that an uneven distribution of this kind of assets and services means that if people fall ill, they have to travel all the way to MD I, thus incurring in higher expenses and extending the length of time they take to see a doctor and get treatment. Not only does this have the potential to hamper people's access to health by adding an extra financial strain; but it also might have catastrophic consequences to someone's life.

The housing market varies across the city, with rental being more common within and housing prices costing considerably more in the cemented city than within the periphery. For example, the majority of those living in the most central districts were found to be either leasing or renting their homes. These are usually expats or middle-class Mozambicans paying around US $3,000+ per month for an average three-bedroom property (The Economist, 2013). Houses in MD II and III can reach US $570 per month, whilst those renting in MD IV and V can pay on average around US $56 per month (anecdotal evidence). The same discrepancies apply to buying. Whilst those buying a property within the city center can expect to pay up to US $500,000 those buying land in the new expansion areas can pay anything between US $2,300-$5,700 for a plot 15mx30m (ibid).

Despite this, the latest statistics highlight that between 2004 and 2008, the number of people owning a house had increased by 4% (from 68% to 73.3%); whilst those renting had suffer a slight decrease from 23.2% in 2004, to 21.4% in 2008 (CMM, 2008). Most of the rental market is however concentrated in MD I and II (60% of all rental properties), with only 10% found elsewhere in MD III and V.

The characteristics of the properties vary substantially and those houses found in informal settlements are usually of a self-built nature due to the high costs incurred with hiring building contractors. This leads to houses being constructed with basic materials and lacking a connection to most basic services. Nonetheless, between 1997 and 2007 there has been a significant improvement in the housing quality, with 32% of houses being considered improvised in 1997, against 12% in 2007 (INE, 1997; INE, 2007). Majority of people living in informal settlements also lacks an official title deed (CMM, 2008), which applies to those living in the *Magoanine* districts.

Although such housing improvements are seen as a way to increase adaptive capacity and reduce the impact of extreme weather events, in these districts this has not resulted in an adaptive capacity measure, as independently of quality of housing materials houses were affected by inland flooding due to their location in a marshland.

Ongoing adaptive measures

Awareness of climate related impacts and the necessary changes needed have increased over the last years, especially as people are more and more affected, or see others being affected. Although governmental-led initiatives are still sporadic and localised, communities have come to develop other means of adapting to climate-related risks.

Until 2015, the government had developed two major initiatives that contributed directly to increase people's perception and awareness of climate change:

1) 'Public Private People Partnership – 4PCCD'

Pilot project implemented between 2011 and 2013 (and funded by CDKN) the aim was to introduce the notion of climate change to slum communities and to increase their levels of awareness to what factors might be contributing to worsening effects and what kind of adaptive solutions were actually within their reach. The process involved deconstructing the global climate change impact discourse, and bringing it to the community level, for example, by explaining how rains, bad sanitation and drainage all contributed to worsening the impact of flooding.

Such exercise was implemented in only one bairro - *Chamanculo C* (which translates as 'huge bath' in reference to how much this low-income district experiences severe flooding on a regular basis). In 2011, 26,000 people inhabited the *bairro* but the project only directly benefited 350 people. Despite that, it was considered a success and has contributed towards a small proportion of slum dwellers perceiving what climate change is and what kind of measures can be put in place to respond to those challenges. It has also led to communities being aware that local authorities are committed to fighting against climate change and supporting them through this process.

Box 1: 4PCCD – participatory approach to developing climate compatible development in Maputo

1.1.1 The project took place in the *bairro* Chamanculo C, *Quarteirão* 16A[5], where flooding has been particularly bad (due to soil being very compact and with low permeability), but also because it was already being targeted by the municipal's rehabilitation programme. It was delivered in two stages:

Stage 1 – Community Plan Workshop: community members were split into different thematic groups ('women', 'housewives', 'youth', 'small informal sellers' amongst others) to capture how each of these societal segments were being affected by climate shocks. Through this exercise, the community managed to identify their own problems and began thinking of solutions within their reach (financially and locally sourced/available). For example, one of the major problems identified was that the practise of sweeping their sandy gardens every morning was actually contributing to a reduction of the ground level in comparison to the street – in some cases this had happen by as much as 80cm. If there were a flood, the compound would flood much easily. If solutions were more complex or demanded significant changes, the community was

[5] A *quarteirão* is the smallest administrative unit in the urban areas of Mozambique and has in theory contains approximately 50 houses. Quarteirão 16A has a population of approximately 350 people living in 82 households in 54 yards, with an average of 4.3 persons per household and 6.5 persons per yard.

encouraged to speak directly with the Municipal authorities. The outcome of this workshop was a 'Participatory Mitigation Plan'.

Stage 2 – Community Learning workshop: at this stage the project organised a workshop with different stakeholders aimed at providing the community with an opportunity to present their Plan and to create a space for forging potential partnerships that would help mitigating climate change impact in the *bairro*. One of the ideas that came out of this was to get the community based association (AMANDHELA) to partner up with the local municipality within garbage collection. A recycling company called AMOR also showed a lot of interest in collaborating with AMANDHELA. FUNAB (environment fund) saw great potential on this and decided to fund it, however, when it came to the proposal and the level of investment required from both parties (AMANDHELA and AMOR) there was some disagreement and the project never took off. For example, whilst for AMOR this was seen as an opportunity to capitalise financially (for profit), AMANDHELA was keen to capitalise on the social value of it. The partnership did not go ahead.

Source: CDKN [https://www.youtube.com/watch?v=kMpgylSWcSk]

2) Constitution of 'Local Committees for Disaster Risk Management'

This bottom-up strategy has been developed and promoted directly by INGC as a nationwide DRR strategy since 2011. It aims at getting local residents from *bairros* to voluntary come together as a Committee, whilst acting as an arm of INGC within their local communities. Not only do they act as early warning systems, but they also play a key role when a disaster strikes, as they are involved in rescue and search operations and directing people out of the danger zones. These committees are also responsible for organising small talks in schools and inform other residents about climate change hazards, impacts and adaptive measures. They work very closely with local authorities, chiefs and other community leaders.

Box 2: Local Committees for Disaster Risk Management (*Bairro Magoanine C*)

These community-based institutions play a key role in disaster risk management. They are trained to receive and interpret alerts from INAM and INGC and raise the appropriate alarms within their own community. They take stock and map the existing local resources in order to be able to assess damages after the occurrence of a climate

extreme event. They are also trained in search and rescue operations and in the aftermath of a disaster, they identify the basic and urgent needs of the community in order request humanitarian assistance.

Source: Photo by the Author (fieldwork, 2015)

Since 2011, INGC-Maputo has helped forming 34 committees that incorporate 622 people. Currently, committees are only operating in *bairros* and districts considered to be most at risk (e.g. *Catembe, Kamavota, Chamanculo, Maxaquene, Kamubukwana, Kanyaka*) and only 10 out of 34 have been provided with 'Emergency Readiness Kits'[6], mostly donated by DANIDA. Moreover, due to its voluntary basis, some committees are also struggling to retain members. Nonetheless, this initiative has greatly contributed to increase people's perception about the impact of climate extremes and the anthropogenic factors that have the potential to make them worse.

Local communities most at risk from flooding have also come to develop on going flood adaptation areas. For example:

Some of *bairros* visited as part of field trips revealed that some investment had gone into building drainage canal networks or that residents developed makeshift solutions to stop the water flooding their homes by raising their entrances. The railway network, which runs through these *bairros* has also invested in flood protection barriers and improved drainage following the destruction of some sections of the railway network after recent flooding (Annex 3).

Tiepolo (2014) study on going flood adaptation areas also uncovered that in some districts hospitals were equipped with generators, and that vaccination campaigns were carried out following floods. This study also revealed that many of the existing adaptation measures identified are only present MD V, including disaster drills in schools, emergency plans for schools, disaster preparation, drinking water tanks in hospitals, raised latrines, and resettled residents.

[6] These include: 1x hammock to carry wounded people/dead, 2 bicycles, 1x first aid kit, 1x pickaxe, 1x machete, rope, flag of different colours to be hoist whenever there's a bad weather warning (it it's in 72hrs the flag is blue, if it's in 48hrs the flag is yellow and if it's within 6 hours the flag is red), whistles, megaphones, boots, raincoats, high vis vests, lights, radios, folders to archive data, etc

Summary

This chapter considered the impacts of Maputo's historic patterns of economic development on its level of climate resilience, especially amongst those communities living in informal settlements. We examined the geographic patterns from Chapter 2 interwoven with distributional patterns, and assessed their potential impacts on each of the three components of our resilience framework – exposure, sensitivity and adaptive capacity.

Our resilience scoring[7] (Figure 8) suggests that **communities living in the poorest parts of Maputo have become more resilient**. The scores also evidence that **a more structural action is needed to stop people building in marshland areas**, to provide them with alternative settlement areas, to invest more substantially in improving their basic living conditions or by expanding service networks and diversifying the formal economy in order to absorb a higher percentage of low-skilled workers.

Although slightly more resilient today, **projections indicate that Maputo will remain extremely vulnerable to increasingly frequent rainfall, storms and cyclones**. This necessarily demands that more work is done to decrease its level of vulnerability. Sensitivity to future flooding needs to be curbed by zoning out flood prone areas and legally oversee the construction and expansion of informal settlements, in order to avoid a new wave of displaced people. Preferential investment also needs to be focussed on the requalification of these areas.

This assessment suggests **that sustained economic growth may be necessary, but is not sufficient to build resilience of the poorest people.** Despite the considerable frequency of flooding, Maputo continued to grow economically. This trend was only maintained firstly because climate hazards did not directly affect key economic assets such as the port or the tourism infrastructure by the coast. Secondly, because reinvestment of public economic gains was concentrated in improving the core 'commercial' and 'financial' municipal district I. In the last instance, this context led to a further marginalisation of the poorest and an accentuation of uneven spatial disposition of assets and basic service infrastructure that would have contributed to a trickle-down effect of economic growth.

[7] The direction and relative scale of the impacts presented in the scorecard are subjective judgements based on quantitative data wherever possible. Due to the availability of credible and accurate data, approximations are used for each indicator, which may vary, by geographical focus or time period and others may draw from qualitative research.

These findings suggest that for economic growth to improve the resilience of the poorest people, that economic growth needs to have deliberately pro-poor strategies.

Figure 8: Maputo's resilience scoring

EXPOSURE

The presence of people and assets in places that could be adversely affected by climate change.

People

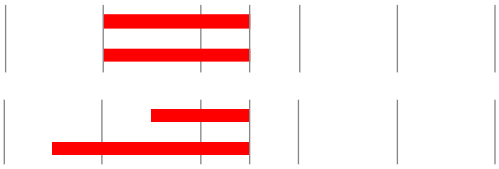
Risk of inland flooding

Population at risk of inland flooding

Assets

Development in high-risk areas

Homes in high-risk areas



Informal settlements built in the marshlands experienced rapid population growth, construction of houses and informal infrastructure. As a result, these communities and structures are highly exposed to the risk of inland flooding. Average annual rainfall rose increasing the risk of inland flooding, though this is not attributable to economic development.

SENSITIVITY

The degree to which a system is affected by or responsive to a climate stimuli.

Societal resilience

Access to water

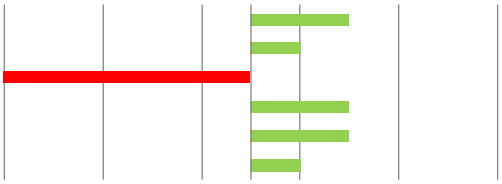
Access to sanitation

Population density in high-risk areas

Access to health care

Quality of low-income housing

DRRM activities



City-wide access to public amenities such as water, sanitation and health slightly improved alongisde the quality of low-income housing, as indicated by a decrease in the percentage of informal structures. However, this was not true for the most vulnerable bairros which experienced rapid increases in population density. This worsened sensitivity to floods both in terms of the number of people affected and the severity of the damage due to the additional strain on public services and the spread of disease. Disaster risk reducation and management (DRRM) activities included the distribution of emergency readiness kits though only to a small number of bairros and not those at the highest risk of flooding.

ADAPTIVE CAPACITY

The potential or capability of a system to adapt to, or alter to better suit, climatic stimuli or their effects or impacts.

Wealth

DRRM planning

Education and training

Poverty incidence

Depth of poverty

Inequality

Wealth rose across the period, as reflected by an increase in the home ownership rate, while the high level of inequality remained relatively constant suggesting the rich benefitted the most from GDP growth. That said, both the poverty rate and the average income gap to the poverty line fell indicating a moderate increase in adaptive capacity across the city. Education and training improved as the secondary enrolment rate rose and climate change awareness programmes were established. DRRM committees in vulnerable bairros were also established to provide structure to DRRM activities.

5. Discussion

Distributional impacts of economic change on resilience

The resilience of poor people living in Maputo has slightly improved over the years thanks to public investments in the provision of basic services such as water and electricity. People have also begun building sturdier houses and investing in education. However, the poorest have also been the most affected by climate extremes, settling in areas prone to flooding and where governmental intervention is not deemed a priority. On top of it all, the effects of economic growth propelled by the financial and services sector have failed to trickle down, and much of the income gains are not filtered through the lowest quintiles of Maputo's society. This derives from a number of factors.

As mentioned elsewhere, the emergence of informal settlements more than a decade ago partly arose due to the high cost of living experienced within the *cement* city. This meant that new migrants flocking to the city were forced to settle in *bairros* where living conditions were cheaper and houses more affordable, in spite of lacking social infrastructures and basic services. Moreover, in situations like those described in section 4, in some cases this coincided with people having to settle in areas with a higher probability of climatic impacts, or unknowingly buying plots of land in marshland areas.

Fast-forward a decade, and despite the steady economic growth accompanied by a surge in the salaries across different sectors, the reality is that such trend remains. Still today, properties within the *cement* city substantially supersede the financial capacity of the average Maputo dweller. Considering that the poverty incidence rate is at 50.9%, it is clear that a significant percentage of Maputo's residents are unable to move away from flood prone areas and settle somewhere within MD I (one of the few districts where there is no flood risk), as they would not be able to afford the average US $3,000 monthly rent. Moreover, they are also unable to move into districts such as MD II or III, where land is getting scarcer and its crammed *bairros* are at the verge of breaking point. Such combination of factors has limited the ability of the poorest to choose alternative places to settle, away from flood prone areas. Pushing them to settle in areas away from the center, where access to social infrastructure and basic services is severely restricted, as it is the access to key road networks and jobs (mostly concentrated in MD I and MD II).

The impact of this context is substantial. Take accessibility to health services, for example. Considering their uneven distribution across the city, the cost of seeking health care is highest for the poorest, as people have to travel for longer and pay more for transport to get to hospitals and medical centres. Poorest people have also been found to be paying for their water at a considerably higher price than those in the richer quintile. The educational environment made available to them also lacks in infrastructure, human resources and basic conditions. Additionally, the main job market for them remains the informal economy, as the economic growth has been associated with sectors that require a higher degree of specialised labour force (such as manufacturing, finances and services). This means that for most of the 1 million informal workers, the increase on the average salary might not have been felt at all.

On top of it, gender disparities persist making it much more difficult for women to break the poverty cycle than for men. For example, more women than men do not know how to write or read; unemployment is higher amongst women, as it is the percentage of women dropping out; and women start working in the informal economy earlier than men do.

This derives from the highly patriarchal levels of the Mozambican society, with gender relations having been affected by deep structural changes in the form of war, migration, urbanisation and a general „commodification" of social relations (Tvedten, 2011). Moreover, in urban areas, male bias among policymakers is still persistent, and there is a tendency for gender to 'disappear' as a category in aggregate statistics used for decision

making (Tvedten et al, 2013). The combination of these elements severely hampers women's ability to access to more skilled, well-paid jobs, which limits access to finance.

In sum, unless there is an integrated intervention by a number of key stakeholders such as the local authorities, international donors, NGOs and CBOs poorer people might continue to have inadequate access to finance, finding themselves unable to make investments necessary to improve their resilience to climate change.

Policy drivers of economic patterns

Maputo's economic growth is the embodiment of post-war macro-economic policies largely influenced by free market principles, favouring export to international markets, privatisation and devolution. As such, economic patterns in the city have been influenced by two key elements: Spatial Development Initiatives Programmes (growth-poles) and decentralisation.

Spatial Development Initiatives Programmes (SDIP) was brought into the national context with the perspective of optimising infrastructure investments in key areas or along geographic corridors and amplifying the impact of limited financial sources- this spill-over growth strategy being conducive to attracting small and medium-sized enterprises up and downstream of large- scale investment projects. One of the most successful RSDIPs was the Maputo Development Corridor, which 20 years one is among the most well developed corridors in sub-Saharan Africa. According to Santos et al (2015) it has also been highly successful in generating local economic development by redirecting large amounts of investment to the capital city. Thanks to its geographic location, Maputo quickly became *the* national business hub – the core of *the* trade axis, reaping the benefits of being the closest port city to Johannesburg and capitalizing on FDI. The city also benefited from its close proximity to the first FDI-led megaproject in the country - the Mozal aluminium company. Operating since 2000, this smelting facility was built to produce aluminum for export. This combination naturally led to a consolidation of the port's economy and a growth of the construction and financial sectors – all services required to nurture a dynamic business environment.

Mozambique introduced decentralisation of administrative and technical responsibilities in 1998, but reforms remain relatively modest and in need of further development. Maputo does enjoy of a special status, as the city is run by a Municipal Council whose Mayor is elected directly by the people themselves (thus surpassing the usual nomination process by the President). Albeit this political gain allows more say on the strategic development of the city, the fact that its economy is highly reliant on mega-projects financed through central government, and that the Municipality is extremely under resourced reveals that any political influence can be easily undermined.

The combination of these two elements does however raise critical questions regarding Maputo's economic patterns and the wider impact on the majority of its population. On one hand, SDIP's channelled investment towards highly specialised sectors, which require a higher degree of education. Considering that only 9% of men and 6% of women in the city go on to achieve a level of education higher than secondary school (DHS survey, 2013) exemplifies the need to import human resources from abroad. On the other hand, by having little political leeway and limited access to financial resources, the municipality has failed to improve the delivery of basic lifeline services, and to deliver and enforce urban planning policies (especially around land usage and infrastructure) based on realistic projections of economic, social and environmental progress.

Despite these patterns, PwC (2015) expects that Maputo will continue to be the hub for development thanks to its levels of businesses' concentration and political power. And it seems the central government, municipality and the donor community have acknowledged

that fact as well – especially in the context of expected climate variability and the need to protect future investments and make the city more resilient.

These can be seen in a range of instruments developed to improve local government's ability to understand the economic growth of the city and predict its expansion and development. For example, In 2007 two key main planning instruments at the city level were approved: the Urban Master Plan of Maputo Municipality (*Plano de Estrutura Urbana do Municipio de Maputo: PEUMM*) and the Maputo Municipal Development Program (*Programa de Desenvolvimento Municipal de Maputo: PRO-MAPUTO*).

More recently, MCC has also invested in conducting a series of in-depth studies that look at climate-change related issues, such as: "Assessment of the Impacts of Climate Changes to Sea Level Rise at Costa do Sol Beach in Maputo" (2008); "Detailed Evaluation of impacts of climate change of events in the city of Maputo"(2011); "Zoning and Protection Study of Costa do Sol Mangrove/Wetland"(2011); "Review of studies of legal instruments and methods that deal with climate change" (2011); and "Proposal of the Municipal Plan for Environmental Education" (2011).

The combination of both sets of instruments has provided local governing bodies with key information on the characteristics of Maputo's residents, their living standards, key sectors of the economy, role of the informal economy, land availability and usage, whilst acknowledging those areas most at risk from sea-level rise and inland flooding (*Costa do Sol* and *Magoanine bairros*). This has allowed local authorities to make informed decisions about the future planning of the city and how its resilience to climate change can be improved.

These instruments have also illustrated the level of social, human and economic impact that climate hazards will have in the short to long run, facilitating prioritisation and decision-making processes. These are reflected in the projects already in course within different parts of the city. For example, within informal settlements like *Magoanine bairros* and other flood-prone areas, these plans envisaged investment in drainage and waste management systems, mostly through low-cost bottom-up strategies. Whilst the bulk of the investment was deployed in *Costa do Sol*, where local plans involved building robust flood protection infrastructure alongside the marginal and investment in an ecological zoning and protection of mangrove/wetlands within the *bairro*.

These strategies were prioritised upon a set of three key rationales. Firstly, both local municipality and national government lacked the necessary financial resources to intervene in all of the areas considered to be at risk in Maputo. Whilst informal settlements were considered most at risk from inland flooding, *Costa do Sol*, area was found to be moderately sensitive to coastal erosion caused by the sea level rise. Secondly, considering the lack of funds, municipalities had to establish priorities for intervening, mostly based on the principle of protecting key economic infrastructure whose partial or complete destruction could potentially disrupt and hamper Maputo's most recent economic development trend. It was following that rational that investment in flood protection infrastructure and the ecological zoning and protection of mangrove/wetland was triggered. The municipality's decision was thus based on trying to capitalise on the intervention that could yield a higher return on investment, over adaptive strategies producing more socially related outcomes. For example, parts of *Costa do Sol* are characterised by a high-level rate of occupancy of medium to high-class habitation, it is also comprised of developing tourism infrastructure, and a very busy fish market along the beach. Moreover, mangrove/wetland protection is also key to the city as it represents the unique natural drainage system to the seafront. Thirdly, and lastly, the municipality believed that the kind of intervention required within the informal settlements should be a much more structural and holistic one, which was beyond its capacities and ought to be addressed under a national, high-level investment program.

Even though the Municipality has failed to prioritise interventions on flood-prone informal settlements, the climate change agenda has gained national momentum and there is a sense that it is a matter of time until more integrated and cross-sectorial initiatives are put in place. For example, the government has been working towards developing and implementing adaptive strategies, investing in a range of studies that looked at the future impact of climate change and ways of increasing national adaptive capacity since 2005. These have generated significant political momentum and the government has begun mainstreaming climate change adaptation through different ministries, across varied sectors. Moreover, this has also instigated institutional reform, leading to the introduction of new agencies responsible for dealing with climate change, and improving its disaster response capacity. Climate change and Disaster Risk Reduction agendas have also been incorporated in a series of other key policies, such as: Agenda 2025; Environmental Strategy for Sustainable Development; Master Plan for Prevention and Mitigation of Natural Disasters; INGC Master Plan 2006-2016; Gender, Environment and Climate Change Strategy and Action Plan; National Slum Upgrading Strategy; and Absolute Poverty Reduction Action Plan (2011-2014).

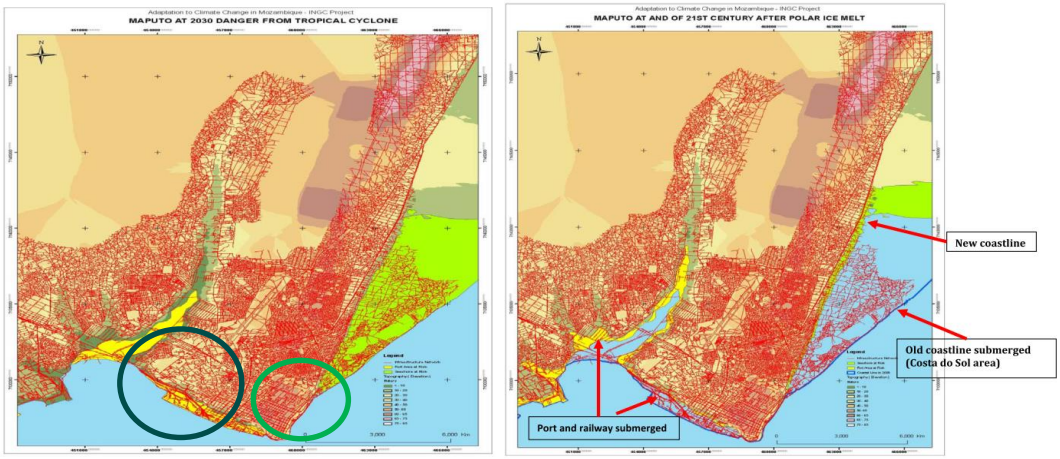
Vulnerability lock-in

Historic patterns of economic development in Maputo have led to pockets of physical and social lock-in, putting people and assets at risk of becoming vulnerable and stranded by specific development pathways.

Physical lock-in

While most of the city is situated on high ground, key economic infrastructure in the city is deemed to be at future risk of sea level rise and storm surges (INGC, 2009). As depicted in the picture below both the Port of Maputo, its rail links and oil facilities are situated on the nearby estuary (blue circle); whilst the tourism industry and high-end dwellings are concentrated in the Marginal (green circle). In both the High and Low SLR scenario calculated by INGC (2009), by 2030, the coastal land in Maputo and the people living and working there will be under threat from extreme sea level events.

Figure 9: Zones of Maputo at risk from future predictions of storm surges and sea-level rise

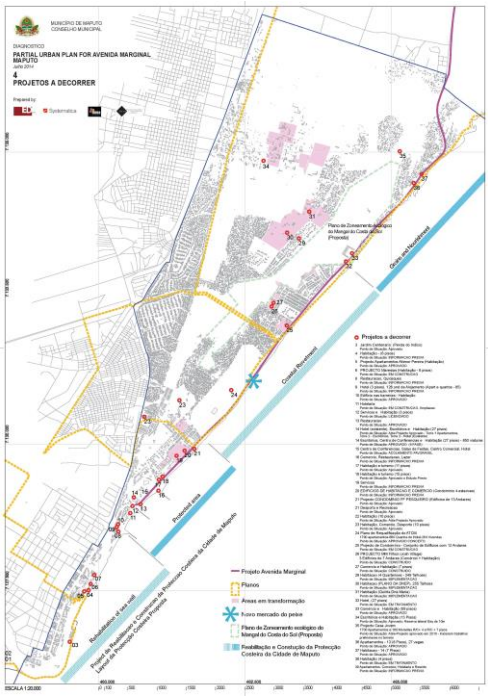


Source: INGC (2009)

Despite this acknowledgment, coastal development on flood prone areas is on the rise, mainly driven by the tourism industry and demand for high-end construction. For example,

in 2010 new housing developments worth USD $73 million were approved within fragile erosion-prone slopes (Mckinsey, 2012). More recently, a map produced as part of a Partial Urban Plan of Maputo's Marginal (2014) revealed the extent to which planned, approved and ongoing construction was underway in the Marginal (see figure 8). Out of a total 36 developments (including hotels, high-end apartments, retail units and recreational spaces), by July 14 plans had been approved and 2 were under construction.

Figure 10: Partial urban plan for the *Avenida Marginal* in Maputo – ongoing projects



Source: CMM (2014)

Due to the high fixed capital costs, long asset lifetimes and potential outlays in infrastructure retrofitting it is clear that assets in these areas are at a high risk of being stranded and locked-in. Since the majority of this infrastructure has already been built, the remaining option is to deploy protective infrastructure that will limit the impact of climate hazards. For the areas in the Marginal, this might include fortified seawalls, dunes or beach nourishment, or steep barriers along the new coast (as highlighted in blue in this picture). For the port, rail links and oil facilities this might imply gradual relocation as the water rises. In both cases, the government would be looking at putting down a considerable amount of financial resources – but no action has a potentially even more costly outcome.

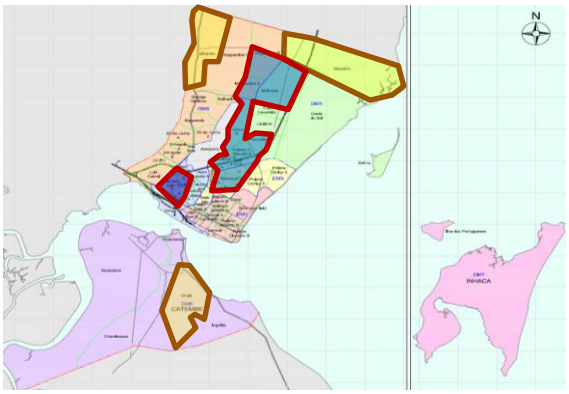
Looking forward, it is suggested that local authorities scrutinise future developments through climate change risk assessment tool in order to better evaluate the level of impact, risk and vulnerability of assets. Moreover, if better regulatory policies are in place, it is possible to avoid construction in vulnerable areas.

Social lock-in

Resettlement processes triggered by flooding have also led to some degree of social-lock in, whereby relocated population is transferred to the so-called 'expansion' areas of Maputo with low population-density, away from flood zones but with limited access to markets and employment opportunities.

Since official resettlements records begun in 2011, 559 families have been resettled so far. Nevertheless, the number of people benefiting from the governmental resettlement programme has been gradually increasing, with 2013 registering the highest number of families being moved away due to flooding (417), most of those coming from MD IV and V. As depicted in the figure, the majority of people living in flood-prone areas (highlighted in red) are being moved to bairros in the 'expansion area' (highlighted in yellow), those furthest away from central districts.

Figure 11: Resettlement dynamics within Maputo



Source: the author with information from INGC (unpublished data)

Although there has never been compensation for flooded infrastructure, up until 2011 resettlement included free land provision and fully built homes away from flooded areas. However, ever since then the programme has been plagued by lack of funding and families are now left to build their new homes, with material costs subsidised by the government. On top of limited capital available for families to relocate, the programme has also increased the vulnerability risk of people by settling them in underdeveloped municipal districts, where job prospects are limited as it is accessibility to key markets and basic services. In the long run, this can easily lead to a stagnation of incomes, locking-in residents' and further hampering people's capacity to rebuild their lives quicker.

For reverse this development trend, central government would need to develop a clear evacuation and resettlement plan in conjunction with the local authorities, setting aside enough funds to not only provide compensation for property lost, but also to improve transport links, markets and basic service provision. Prospective of this happening have for example been hampered by a residual pocket of political lock-in, whereby slow decision making speed and high levels of bureaucracy have led to significant delays in the process of finding suitable resettlement zones and providing people with the necessary infrastructure.

6. Conclusions

Key findings

- **Maputo is more resilient to climate extremes like inland flooding and sea-level rise now than it was a decade ago,** as governmental initiatives have increased people's adaptive capacity especially by raising awareness, and key economic infrastructure is being protected through specific hardware measures.
- **But economic growth was not the key factor in this process** and in some cases ultimately contributed to the uneven distribution of adaptive measures, with key economic infrastructure taking precedence over the poorest living in the most flood prone areas.

This report was one of four case studies within a project aiming to understand better, how patterns and trends of economic development affect vulnerability and exposure to climate impacts across sectors and populations, including distributional effects. We examined the case of **Maputo, as one of the key national economic attraction poles and main driver of Mozambique's economic revival for over two decades.** Considering the **city's high risk of increasingly frequent climate-related hazards**, primary fieldwork and secondary literature review were designed to answer the following question: *To what extent has Maputo's traditional role as the epicentre of the Mozambican economy and hub of economic investment contributed to increase the city's climate resilience, in particular of those living in the informal settlements*?

To deconstruct this idea, we identified two interwoven geographic and distributional patterns of Maputo's economic development over the last decades. These reflect the core development story of the city whereby despite being affected by multiple flooding episodes **Maputo has continued to grow both spatially and economically. Its economic growth has however been tainted by uneven deployment and distribution of assets and services leading to a reinforcement of social inequalities, especially amongst those in the informal settlements**. The two patterns thus were:

- Geographic and Distributional [People] – *Marginalisation of Informal settlements:* historical economic growth has triggered population growth, but lack of urban planning and investment has increased the climate risk of informal settlements;
- Geographic and Distributional [Assets & Services] – *Uneven Distribution of Assets and Services:* historical economic growth has led to investments being earmarked for the 'cement city' at the expense of extending public and basic services to informal settlements.

To assess Maputo's level of climate resilience we then evaluated the level of impact of these two historic patterns of economic development on the three components of our resilience framework (exposure, sensitivity and adaptive capacity). These revealed:

- *Exposure:* Despite the big floods in 2000, the *Magoanine* flood-prone areas are now more populated than before, with hundreds more houses being constructed in the marshland areas. These areas coincide with the most deprived municipal districts of Maputo where public infrastructure and basic services are almost non-existent and/or obsolete;
- *Sensitivity:* the *Magoanine* districts represent one of the areas where inland flooding has had a higher human cost, causing the most level of destruction

and disruption in comparison to the other districts in the city – especially MD I and MD II where flooded has had little or no impact. People's sensitivity is also greater here due to less public and private investment being diverted to equip the districts with key assets and services that enable them to respond and/or adapt quicker.

- *Adaptive capacity:* people's living conditions in the *Magoanine* districts have registered a slight improvement with more people now attending school, working in less climate dependent sectors and accessing health infrastructure. Nonetheless, the majority of people living in these flood-prone areas has failed to reap the gains from decades of economic growth, with both unemployment and poverty incidence rates remaining high in comparison to those living in central districts. Government has however been investing in disaster risk management programs and awareness raising pilot projects in other municipal districts with the intent to scale them up.

These impacts were then assigned quantitative scores. Overall, **the scoring uncovered that Maputo is now slightly more resilient than it was in 2000** mainly due to the development of an overarching climate adaptation national strategy, implementation of local early warning systems and resettlement programmes. **Yet, the scores also evidenced that a more structural action is needed if levels of resilience are to be increased**, especially when it comes to stopping people building in marshland areas, to provide them with alternative settlement areas and to invest more substantially in improving their basic living conditions.

The findings were also assessed in the context of distributional impacts on the poor, policy drivers, and lock-in to vulnerable development pathways.

Poor people's resilience has registered a slight increase since the 'big floods', thanks to some degree of public investment in the provision of basic services and increases in GDP per capita which allowed people to build sturdier houses and invest in education. **Yet, the poorest have also been the most affected by climatic extremes, having settled in areas prone to flooding.** As the city kept developing, **economic growth led by the financial and services sector was further concentrated in the core downtown**, raising the cost of living to levels similarly experienced in Europe. With much of the income gains failing to filter through the lowest quintiles of Maputo's society, and a growing pressure on land due to population growth, the poorest found themselves being pushed away from the safe areas of the city towards flood-prone zones.

Policy wise, **there have been clear governmental efforts since 2005 to galvanise the climate adaption agenda throughout different sectors, ministries, and local municipalitie**s. In Maputo, this led to the publication of multiple studies on the impact of climate change in the city and potential adaptive strategies, whilst triggering specific interventions to improve the resilience of key areas within the city. However, municipal governments remain dependent on a limited pool of human and financial resources, and interventions are decided on the grounds of the level of economic return an investment might bring. Pilot projects involving local communities affected by climate extremes have nonetheless also begun being implemented – but at a much smaller scale. Resettlement programmes have been developed, but people continue to settle in flood-prone areas. Municipalities continue to have weak capacity to monitor development activities, ensure compliance with the approved plans and regulate construction and resettlement programs. Furthermore, their financial resources remain scarce, especially because municipal tax revenues continue to be extremely low.

Policy implications

Sustained economic growth is only one component of the solution towards improving the resilience of the poorest. Unless this growth is captured, channelled and translated into suitable pro-poor programmes, that address core related poverty issues**, growth, alone, will not automatically contribute towards developing poor people's adaptive capacity**.

Below we thus provide policy suggestions to those working on issues around economic growth at city level (similar to Maputo), looking for ways to deploy a more *inclusive* transition towards climate resilient economies:

- **Call for a restructuration and diversification of the formal economy, in order to channel economic growth towards the poorest.** Sponsor initiatives aimed at diminishing the reliance on informal labour by looking at the development of new economic hubs spread across the city, or by improving the linkages between existing ones by investing in new transport networks – thus ensuring that informal settlements are at the receiving end of economic development.

- **Consider supporting the development of appropriate resettlement strategies that avoid new forms of lock-in**, by working with local authorities in identifying suitable alternatives and incorporating resettlement practices in line with predicted city growth. Ultimately, invest in supporting local authorities to develop a more pre-emptive rather than reactive response.

- **Consider investing in local institutional capacity building:** city-level development is engineered by local municipalities spearheading key decision-making processes that influence economic development and social growth. Unless those departments responsible for steering development and delivering plans are equipped with knowledgeable human resources, tools and funding, present and future adaptation plans run the risk of failing;

- **Do not assume local authorities' staff understands linkages between climate change and growth instead facilitate knowledge exchange platforms to increase awareness.** Climate adaptation is an intrinsically complex concept and local authorities' staff may not have a clear understanding of how to assess climate risks and deploy inclusive climate resilient initiatives. By organising horizontal (cross-departmental) and vertical (municipalities – national governmental bodies) seminars and workshops, support the cascading down of climate adaptation discourse, helping to realign different departmental strategies with the larger CC agenda, across the entire governmental structure. A specific example was provided by Maputo's local authorities themselves, who felt it would also be useful to conduct cost-benefit analysis of investments in climate resilience in order to measure their real impacts.

- **Consider supporting the development of a specifically adapted climate risk assessment framework with operational staff from the local municipality.** Work with the local authorities to overcome political blindness to climate risks, by instilling critical thinking on how new city level projects might:
    a. Benefit from climate-related improvements, or not;
    b. Affect the resilience of different areas and groups of people in the city differently, or not;
    c. Lock the city in to a particular resilience pathway which might be difficult to reverse socially, politically and economically, or not;
    d. Require political leverage to be deployed at the national level in order to minimise risks and foster the enabling environment, or not.

- **Consider supporting initiatives that promote national, local and grassroots level engagement.** Considering the direct human dimension associated with climate change impacts, the low level of financial resources and added pressure on local municipality staff, more emphasis could be put on involving the local communities (directly affected by climate hazards) in the process of developing adaptive solutions.

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- Maputo Municipal Council (CMM) – Department of Urban and Environmental
- Maputo Municipal Council (CMM) – *Bairro* secretary
- Maputo Municipal Council (CMM) – Department of Informal Settlements Department
- Maputo Municipal Council (CMM) – Department of Municipal Service Markets and Fairs
- National Council for Sustainable Development (CONDES) – Climate Change Unit
- Environmental Fund (FUNAB) – General Management Team
- Environmental Fund (FUNAB) – Department of Planning, Studies and Projects
- United Nations Development Programe (UNDP) – Climate Change and Environment Specialist
- DFID Mozambique Country Office – Climate Change Team
- United Nations Human Settlements Programme (UN-Habitat) – Urban Governance Team
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Annexes

Annex 1: Secondary research questions for the case study

- **Impacts of geographic and distributional patterns on exposure**
  - Following the different flood episodes since 2000, has the number of people living in flood-prone areas changed? Who has mostly been affected by flooding?
  - What are the characteristics of those living in flood prone areas?

- **Impacts of geographic and distributional patterns on sensitivy**
  - How have extreme weather events affected the poorest living in flood-prone slum neighbourhoods?
  - How has population density affected the severity of disruption caused by these extreme weather events?

- **Impacts of geographic and distributional patterns on adaptive capacity**
  - Has the proportion of Maputo's population that is not economically active increased or decreased over the last decade, particularly in the flood-prone areas? Has job prospects improved? Have changes in GDP per capita translated into significant well-being improvements?
  - How have living standards changed for the poorest living in flood-prone areas?
  - Following governmental plans to relocate people from flood-prone areas, have these taken place? If yes, to where and why? If not, why so?
  - What kind of initiatives have taken place aimed at increasing people's perception and awareness of climate change? Have these taken place within flooded-prone areas?

Annex 2: Disruption to key infrastructure

Source: INGC-Maputo Photo Archive (Flooding 2013)

Annex 3: Flood protection barriers and drainage built by the railway company

Source: the author (Fieldwork visit February 2015)

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