



Working Paper

**Why Sub-Saharan cities should look into  
Parametric Insurance Schemes to Enhance their Climate  
Risk Management Policy**

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Images: James Millington, landscapemodelling.net

## **Abstract**

For the global humanitarian community, disaster risk is most concerning in developing countries where natural hazards are increasingly threatening their fragile economies and the lives, health, and livelihoods of vulnerable populations. Providing fast relief and recovery is a fundamental aim behind humanitarian action, but costly and frequent aid has raised concerns in the global development community. Effective DRR strategies matched with innovative risk transfer options through parametric insurance, have been successful in managing sovereign risk. This is match is particularly relevant in countries where hazard information for a region is reliable, but data for exposure and vulnerability is either not available or of low quality.

This research explored the opportunity that parametric insurance mechanisms bring to climate risk management (CRM) policies of city governments. This research was pursued by understanding insurance in sovereign CRM models, as well as different elements in a Sub-Saharan city that influence its CRM policy. The Nairobi City County served as a case study and was analyzed using an adapted PESTLE – SWOT framework of analysis to obtain a bird's eye view of the different contexts of the city.

**Key words: Climate risk insurance, climate risk management, urban risk, sovereign risk, PESTLE framework, protection gap, layered disaster risk management, parametric insurance, begging bowl model**

## Table of Contents

List of Figures, Tables, and Boxes .....	5
List of Abbreviations.....	7
Introduction .....	8
Problem Background - A Broken Aid System.....	11
Elements of Necessary in a CRM Strategy.....	14
Stakeholders .....	14
Stages of Decision-making.....	15
Urban Risk Identification .....	16
A Multi-layered Approach .....	18
How Insurance Builds Resilience .....	21
Cat Risk Pools.....	23
Applicability in the Urban Setting.....	24
Implement with Caution – limitations.....	25
PESTLE framework.....	26
Research Design and Methodology.....	29
Standpoint.....	29
Choice of research.....	29
Primary Data.....	30
Pilot Interview .....	31
Secondary Data .....	31
Limitations and Biases .....	31
Analysis.....	33
Political .....	33
Financial.....	35
Socio – cultural .....	38
Data technologies.....	41
Legal .....	43
Environmental .....	45
Conclusion.....	47
References.....	50

Annex 1: Interview Questions ..... 56

Annex 2: Insurance products for disaster risk financing schemes ..... 58

Annex 3: List of all interviewees..... 59

## List of Figures, Tables, and Boxes

### Figures:

Figure 1: Disasters from natural hazards hitting developing and developed countries.....	8
Figure 2: Global Insured vs uninsured losses (protection gap) in billions of USD .....	10
Figure 3: UN appeals since 2007 .....	12
Figure 4: Number of disasters versus cost of disaster per hazard (BEH & UNU, 2016).....	13
Figure 5: Damage due to extensive and intensive disaster events since 1990 in a sample of 65 countries and 2 states .....	17
Figure 6: Layered disaster risk management .....	18
Figure 7: Proposed multi-layered linking DDR and insurance-based tools to enhance a DRM plan.....	20
Figure 8: The layered CRM approach for financial protection .....	22
Figure 9: FONDEN's CRM plan .....	24
Figure 10: FONDEN's hybrid scheme of indemnity insurance and a catastrophe bond.....	25
Figure 11: Effect of subsidies in premium cost for a government .....	26
Figure 12: Stakeholder landscape in extreme events and CRM .....	32

### Tables:

Table 1. Basic Pillars for a Comprehensive CRM Framework (with data from the World Bank (n.d)).....	15
Table 2: Threshold for distinguishing between extensive and intensive risk.....	18
Table 3: PESTLE categories and adapted categories .....	27
Table 4: Adapted PESTLE framework and SWOT analysis matrix.....	28
Table 5: Political Context.....	35
Table 6: Financial Context .....	38
Table 7: Socio – Cultural Context .....	41
Table 8: Data Technologies Context.....	43
Table 9: Legal Context .....	45
Table 10: Environmental Context.....	46

Boxes:

Box 1: Consequences of a begging bowl model ..... 13

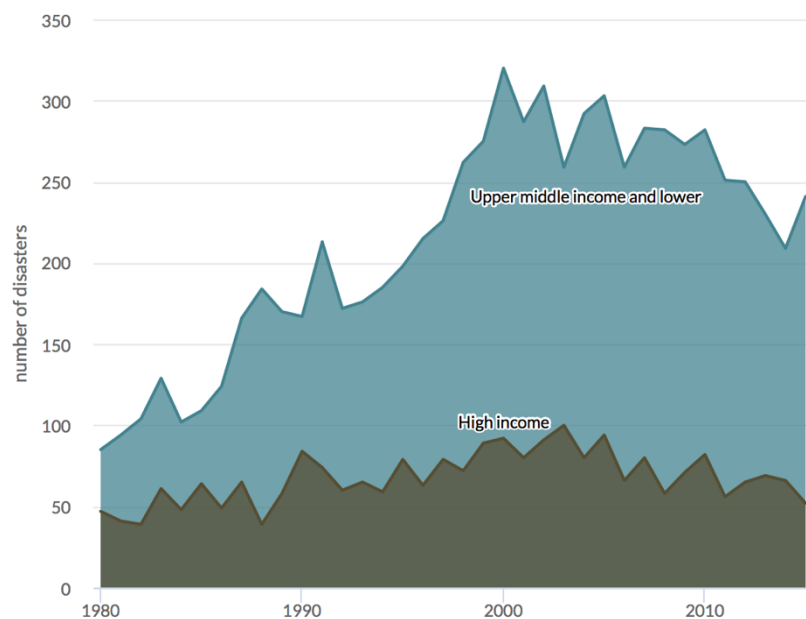
**List of Abbreviations**

ARC:	African Risk Capacity
CCRIF:	Caribbean Catastrophe Risk Insurance Facility
CRM:	Climate risk management
DEM:	Disasters and Emergency Management Act
DRM:	Disaster risk management
DRR:	Disaster risk reduction
FONDEN:	Fondo de Desastres Naturales
IDF:	Insurance Development Forum
KMD:	Kenya Meteorological Department
KRC:	Kenyan Red Cross
NCC:	Nairobi City County
NDOC:	National Disasters Operation Center
NIUPLAN:	Nairobi Integrated Urban Plan
NWC:	National Water Company
PCRAFI:	Pacific Catastrophe Risk Assessment and Financing Initiative
SFDRR:	Sendai Framework for Disaster Risk Reduction
UN:	United Nations

## Introduction

Weather Index-based technologies used in insurance have improved the streamlining processes of disaster risk estimates, and the analysis of vulnerabilities, exposure, and natural hazard interaction. This innovation is a major support tool for the development world and disaster-hit nations because when crises erupt, the financial constraints can undermine the capacity for countries to make capital investments and social expenditures to develop sustainably (UNISDR, 2015). For the global humanitarian community, disaster risk financing is most concerning in developing countries, where natural hazards are increasingly threatening their fragile economies and the lives and livelihoods of vulnerable populations (Figure 1). As weather extremes become more frequent and costly, while growing in uncertainty and variability (Wisner et al. 2004), the humanitarian community is recurrently called upon to demonstrate its generosity and solidarity to bring relief to those affected.

Extreme weather events generated economic losses reaching USD 175 billion in 2016. Germanwatch (2017) estimated a death toll of more than half a million victims as a result of nearly 11,000 extreme weather events since 1996. These figures evidence why disasters in developing countries generate unprecedented financial strain that force national



**Figure 1: Disasters from natural hazards hitting developing and developed countries. (Source: CGD, 2017 with data from EM-DAT)**

and local governments to respond by first, reallocating resources budgeted for other sectors, second, by looking for contingency loans and credits, and finally by appealing for international assistance to cover any funding gaps.



Providing relief and reconstruction is a fundamental aim behind humanitarian action and development, but costly and frequent aid has raised concerns from a sector of the global humanitarian community. They hold that the current humanitarian system is broken, resembling a begging bowl model (Clarke and Dercon, 2016) held out for collecting charity every time a crisis hits and the limited funds that exist run out.

It is widely accepted that disaster risk reduction (DRR), preparedness and early response to natural hazards helps save lives, livelihoods, and costs of relief and reconstruction. Adopting a begging bowl model implies taking a reactive behavior to fund disasters instead of engaging in proactive planning and pre-agreed funding of disasters. This is a keystone in the SFDRR's conceptual approach of managing disaster risks as opposed to disaster management (UNISDR, 2015b). Effective risk retention mechanisms using DRR strategies, and affordable risk transfer options through index-based insurance like parametric insurance, have brought successful results for managing sovereign risk<sup>1</sup> in the last few years.

These practices have helped governments better face weather extremes by:

- speeding up the availability of finance and thus reducing their costs of emergency response
- protecting populations and their livelihoods with more effective deployed financing
- shielding fragile finances and preventing a slowdown in their growing economies

However, the urban setting, which is hit by its own particular shocks and stresses from natural hazards and socio-economic trends (100 Resilient Cities, 2017), has not yet been targeted by a similar macro-level climate risk management (CRM) model. Evidence demonstrates that cities currently generate over 70 per cent of the world's GDP (UN Habitat, 2017), and that by year 2050, two thirds of an expected world population of 9.7 billion will have migrated to and will be living in urban areas (FAO, 2017). With low insurance penetration and high asset and people exposure in cities, the scenario in developing countries presents a massive CRM challenge for local governments and an opportunity for them to explore the suitability of adopting successful models to their context.

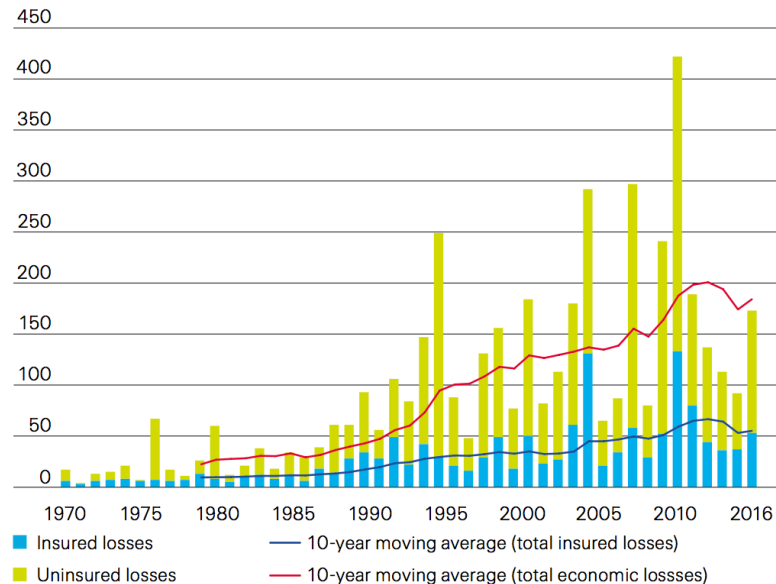
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<sup>1</sup> Sovereign risk: it's the economic or financial impact a government would face in the event of a disaster.

Munich Re (2017) reported that in 2016, overall loss due to natural hazards in Africa represented 1% of the world's total loss (approximately USD 1.75 billion), from which less than 1% of it was insured. In this context, Sub-Saharan cities are the world's most vulnerable and present a massive

protection gap<sup>2</sup> (Figure 2).

In a city like Nairobi, which generates 55% of the country's total GDP (NCC, 2014), an innovative and affordable layered CRM model, that includes parametric insurance products can help de-risk and allow sustainable growth to both, national and city governments.



**Figure 2: Global Insured vs uninsured losses (protection gap) in billions of USD (Source: Swiss Re, 2017)**

This brings up the following questions:

- To what extent can sovereign multilayered CRM models be applied to an urban setting, particularly African, if there are very few (if any) city case studies?
- What challenges and opportunities do different stakeholders perceive in their cities DRM policy that condition the successful implementation of parametric insurance schemes in the urban setting?
- **But most importantly: When is a parametric insurance an appropriate option to enhance a city's DRM policy?**

The aim of this research was to explore the opportunity that a parametric insurance mechanism brings to a CRM policy in the urban setting. This was pursued by understanding key structural and operational aspect of index-based insurance in successful sovereign CRM models, as well as different elements in a city that influence its CRM policy. Nairobi City County

<sup>2</sup> Protection gap: It's a term coined by the insurance sector that used to refer to the difference between insured and economic losses over time (Swiss Re, 2017).

(NCC) served as a case study and was analyzed using an adapted PESTLE framework to obtain a bird's eye view of the political (P), economic (E), social (S), technological (T), legal (L), and environmental (E) elements that interact in the city. To strengthen the spectrum of analysis of each element and better outline the challenges and opportunities perceived by interviewees, the PESTLE framework was complemented by a SWOT analysis that observed the strengths(S), weaknesses (W), opportunities (O), and threats (T) of the city elements.

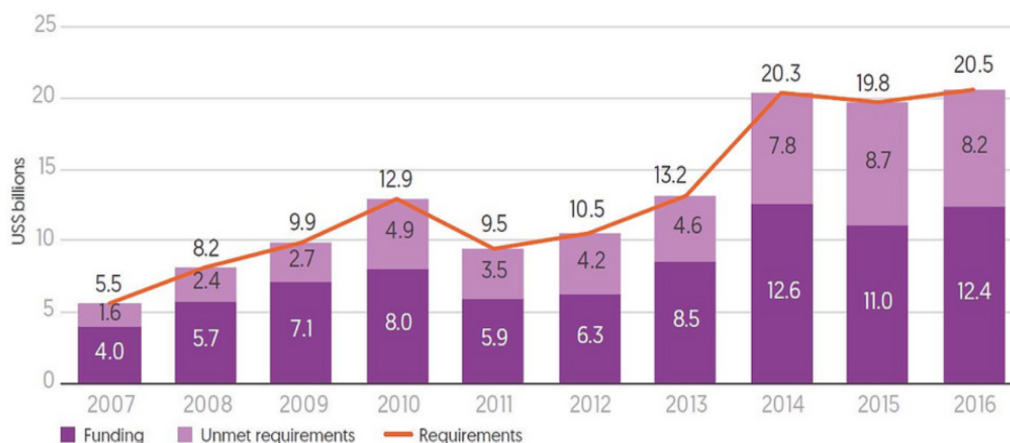
### **Problem Background - A Broken Aid System**

The concern about a broken humanitarian aid system becomes a global issue when considering the millions of people affected annually by disasters due to natural hazards (377 million people in 2016 (Development Initiatives, 2017b)), and the growing trend in the number and cost of disasters (USD 175 million in economic losses in 2016 from which 70% of it remained uninsured (Munich Re, 2017)).

In May and April of 2015, Nepal was hit by two major earthquakes that killed nearly 9000 people, and left the country in ruins. Millions of those who survived were left with vanished livelihoods, and little or no social protections. Almost a million homes were destroyed or damaged, telephone lines and power supply were cut off, and poorly built public infrastructure like hospitals, schools and roads collapsed (BEH & UNU, 2016). The UNOCHA launched an appeal with a requirement of USD 422 million, but 5 months later, only 57% of the requirement had been funded (UNOCHA, 2015). The degree of poor institutional coordination and CRM planning in Nepal is such that, until today, it's been a difficult task for the government to spend USD 4.4 billion pledged for reconstruction (Aljazeera, 2017).

As shown in figure 3 with UN appeals, the capacity of the international humanitarian community to effectively fund disasters through appeals and donations is outpaced by the cost of disasters. These appeals have consistently increased through the years, but unmet objectives outline the uncertainty nature of using them as a disaster funding option. During severe crises, there's no doubt about the great potential support to appeals and with

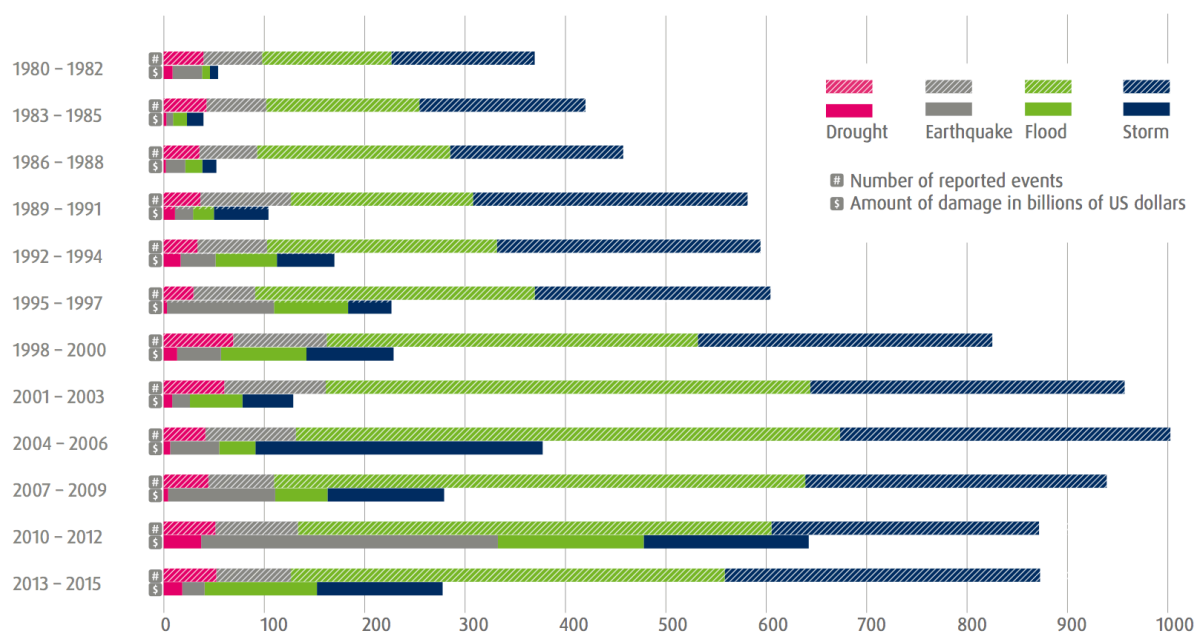
donations, but their limitations define it as an unpredictable and unreliable source of funding, and a threat to the disaster funding strategies of governments.



**Figure 3: UN appeals since 2007 (Source: Development Initiatives, 2017)**

The evidence is a serious concern for governments of developing countries who see their vulnerable populations and fragile systems threatened by costly hazards, poor planning, and uncertainty to fund them. The Nepal Earthquake is an example of an ineffective reactive model of post-disaster funding resembling begging bowls (Clarke and Dercon, 2016) held out for collecting charity. Overwhelmed by the scale of extreme events, governments recurrently find themselves reaching out to the international community to beg for help. However, depending on the crisis profile, the response the community’s may be insufficient, delayed, and certainly left to donors to judge who needs it, how much, and how to use it.

The begging bowl model also generates other behavioural consequences in beneficiary countries that can aggravate the severity and/or duration of a disaster as seen in the Nepal Earthquake (Box 1). Poor management and funding strategies of disasters reveal common undermining patterns such as bureaucracy, political interests, and slow inefficient response.



**Figure 4: Number of disasters versus cost of disaster per hazard (BEH & UNU, 2016)**

Talbot and Barder (2016) are equally critical of the system and illustrate the flaws of post-disaster funding in three symptoms:

- a) overstretched (i.e. there is insufficiency of funds from donors to cover for rising needs)
- b) mismatched (i.e. there are consequences of adopting a reactive post-disaster behavior as opposed to planning ex-ante)

#### **Box 1: Consequences of a begging bowl model**

Clarke and Dercon (2016) hold that the begging bowl model generates several consequences:

- It creates an ambiguity of who is responsible for, who pays, and who should pay for disasters.
- The lack of pre-agreed planning can cause procrastination and delay in response (e.g. Ebola case in West Africa, Nepal Earthquake)
- It encourages an exaggerated dimension of crises and appeals to lessen the gap between raised and needed funding.
- It causes fragmented, uncoordinated responses from political leaders with individual interests.
- It discourages investments in DRR and preparedness (e.g. a political leader is applauded and rewarded in election time when they provide relief to people rather than when they invest in DRR).

- c) distorting (i.e. discretionary funding from donors reduces the incentives to invest in DRR, produces unequal levels of funding support, and distorts accurate pricing of the costs of response).

### **Elements necessary in a CRM strategy**

The literature offers several city resilience models which incorporate disaster management strategies for the urban setting. However, for the purpose focusing on climate risks to which index-based insurance instruments provide protection to people and assets, a more targeted and compatible option is needed. Within this scope, Clarke and Dercon (2016) propose three conditions that CRM planning should comply with to tackle the problems of the current broken system:

- a) To design a coordinated plan for post-disaster action agreed in advance
- b) To have a quick evidence-based decision-making process
- c) To secure a pre-agreed source of funding

As we are dealing with macro-level mechanisms, a government authority seems in the best position to lead the initiative of designing a new model provided it demonstrates enough leadership and influence to bring together the relevant CRM stakeholders for a participative planning process. Ideally, the new model should establish the participating stakeholders' roles and responsibilities, and a rules-based decision-making processes that outlines a coordinated plan and secures funding.

### **Stakeholders**

At least four types of stakeholder profiles are needed in a CRM strategy (Clarke and Dercon, 2016):

- a) public institutions and agencies (ideally with financial literacy) that prepare policy and enable it
- b) scientists and risk modelers that identify, calculate and communicate risk

- c) implementers and responders that carry out the plan on the ground before, during, and after a crisis (e.g. emergency first responders, field workers from NGOs, INGOs or the governments, volunteers, etc),
- d) financiers as “the glue that holds all the pieces of the plan together by bringing credibility to the plan” with the money on the table.

### Stages of decision-making

The World Bank (n.d) illustrates a comprehensive DRM framework that can be linked up with the three enabling conditions described above and the capacities of named stakeholders to work in a CRM strategy (Table 1). In the first stage, properly identifying disaster risk allows a government to assess and choose its DRR and preparedness actions, which will also allow it to calculate its risk retention capacity to financially cover for assets at risk. The DRR and preparedness stages take substantial consideration for ex-ante action, while the financial protection stage secures funding, especially in the events that exceed a government’s retention capacity. Such excess in retention capacity would need to be transferred to others, like the insurance sector or the international humanitarian community in order to complete any funding gap.

<b>Table 1. Basic Pillars for a Comprehensive CRM Framework (with data from the World Bank (n.d))</b>	
<b>Risk Identification</b>	Risk Assessment and communication using evidence-based decision-making processes
<b>Risk Reduction</b>	Structural and nonstructural DRR measures like infrastructure, urban planning, regulations
<b>Preparedness</b>	Early warning systems, capacity building, contingent planning
<b>Financial Protection</b>	Financial planning for disaster response with pre-agreed sources of funding
<b>Response and Resilient Recovery</b>	Resilient recovery and reconstruction policies based on a coordinated post disaster plan agreed in advance

### **Urban Risk Identification**

Cities have become the champions of strategies for development by fostering greater productivity, opportunities, and quality of life (UN Habitat, 2016). They're often encouraged to take initiatives to fill in gaps that national governments cannot, particularly in face of global challenges like climate change, environmental degradation, or poverty and inequality. The UN's Habitat II in 1996 had already foreseen governments in the future as enablers of strategies much more than providers (UN Habitat, 2016).

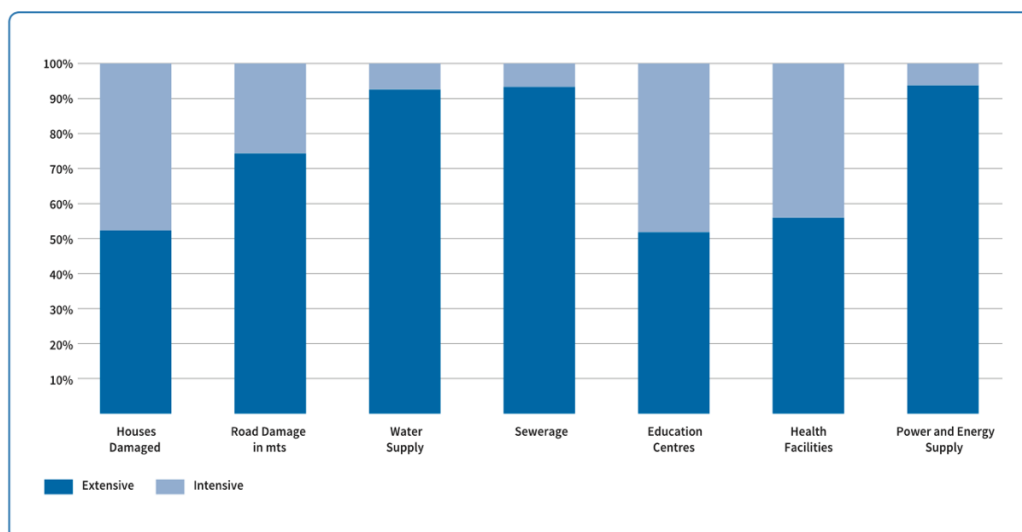
Pelling et al. (2017) hold that the successful implementation of the Sendai Framework for DRR (SFDRR) in cities increasingly depends on the actions taken to manage the risks that accumulate in them. In Nigeria, for example, governors of four major cities joined the DFID-funded Nigerian Infrastructure Advisory Facility in 2016 to create the Nigerian Resilient Cities Network, an NGO now integrated by a total of eight cities in the country. The network seeks to advance resilience thinking across the country, and promote reflection and innovation in applying resilience to the political-economic context of Nigeria (100 Resilient Cities, 2017). It also integrates academia into its work by partnering with a local university to develop resilience-themed courses targeted at municipal employees in Nigeria.

In Africa, corrupt and unstable political and economic systems have generated high levels of poverty and inequality, consequently turning it into the most vulnerable world region to disasters (WEF, 2017). The spectrum of risks in Sub-Saharan cities is outlined by extensive risks (low-severity, high-frequency hazards and disasters like localized floods and landslides) and intensive risks (high-severity, low-frequency disasters).

Coupled with poverty and inequality primarily observed in informal unserved settlements, extensive risks are an overwhelming challenge to local governments because they deteriorate the well-being of the citizens, their impoverished conditions, and represent a slow permanent erosion of assets, such as houses, schools, roads, and major infrastructure. Mortality rate for extensive risks is relatively low, but they are responsible for the most damage (Figure 5) and



are exacerbated by unplanned development, weak governance, and environmental degradation (UNISDR, 2017).



**Figure 5: Damage due to extensive and intensive disaster events since 1990 in a sample of 65 countries and 2 states (Source: UNISDR, 2015)**

The lack of enforcement of building codes and poor solid waste management are examples of poor urban development that can substantially damage or destroy any developmental gain. The collapse of buildings has often been attributed to such type of weak regulation in Sub-Saharan cities (BBC, 2016). Similarly, garbage accumulation in inefficient drainage systems, constantly bring chaos to those cities.

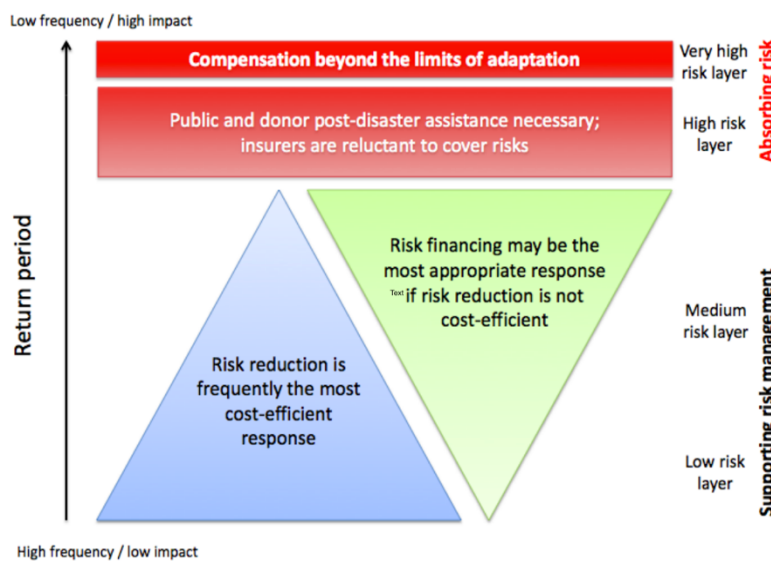
Extensive risks are manageable and avoidable with effective DRR (UNISDR, 2015a), which places cities in front of a massive challenge, but allows for an opportunity to financially improve the protection of their people and assets. Satterthwaite (2016) holds that without competent, effective and accountable urban governments, it will not be possible to capitalize on the potential of cities for supporting adequate living conditions and health. An urban government's leadership and identification of disaster risk becomes of utmost importance, because these qualities enable it to engage relevant national and local stakeholders in coordinating efforts to develop an effective CRM policy.

On the opposite side of the risk spectrum, intensive risks require a different approach. Climate risks are a major hazard for entire regions that can be hit by insurable earthquakes, floods or storms. As in Nepal, they have the potential to cause high mortality rates, destroy livelihoods and inflict large economic damage. In Sub-Saharan cities like Nairobi, where over half of the population lives in informal settlements (UN Habitat, 2016b, Amnesty International, 2013), vulnerability and exposure to natural hazards is extremely high. This is where insurance can help build resilience. As opposed to extensive risks, where accountability of the total losses is hard to keep track of, data of total and insured losses of intensive risks can be more precisely managed for pricing risk.

	<b>Extensive Risk</b>	<b>Intensive Risk</b>
<b>Disaster deaths (mortality)</b>	Less than 30 people killed	30+ people killed
<b>Damage to housing</b>	Less than 600 houses destroyed	600+ houses destroyed

### A Multi-layered Approach

A broken aid system and the concern of urban risk accumulation call for careful and case by case design of CRM plans. Mechler et al. (2014) propose an adaptable risk layering approach based on the return period of natural hazards (Figure 6). This approach opens a window of opportunity to interlink in a single model optimal cost-efficient managing and funding



**Figure 6: Layered disaster risk management (Mechler, 2014)**

strategies in a spectrum of extensive and intensive risks.

Lower and medium risk layers encompass manageable and avoidable extensive risks. DRR strategies and investment incentives laid out in a CRM plan can prove to be the most cost-efficient method for a government to face that bottom layer of hazards and disasters. In cities, risk accumulation calls for DRR work to be relentless and encouraged in all sectors of society. As Pelling et al. (2017) suggest, African cities will become an increasingly important priority area for risk reduction given their demographic importance, rapid growth, high poverty levels, and weak urban governance.

As cost-efficiency diminishes for DRR with higher impact events, risk retained by a government on its own funding capacity are better protected with other financial tools such as emergency reserves and/or contingency loans or credits offered by multi-lateral development banks like the World Bank or the Asia Development Bank (figure 7).

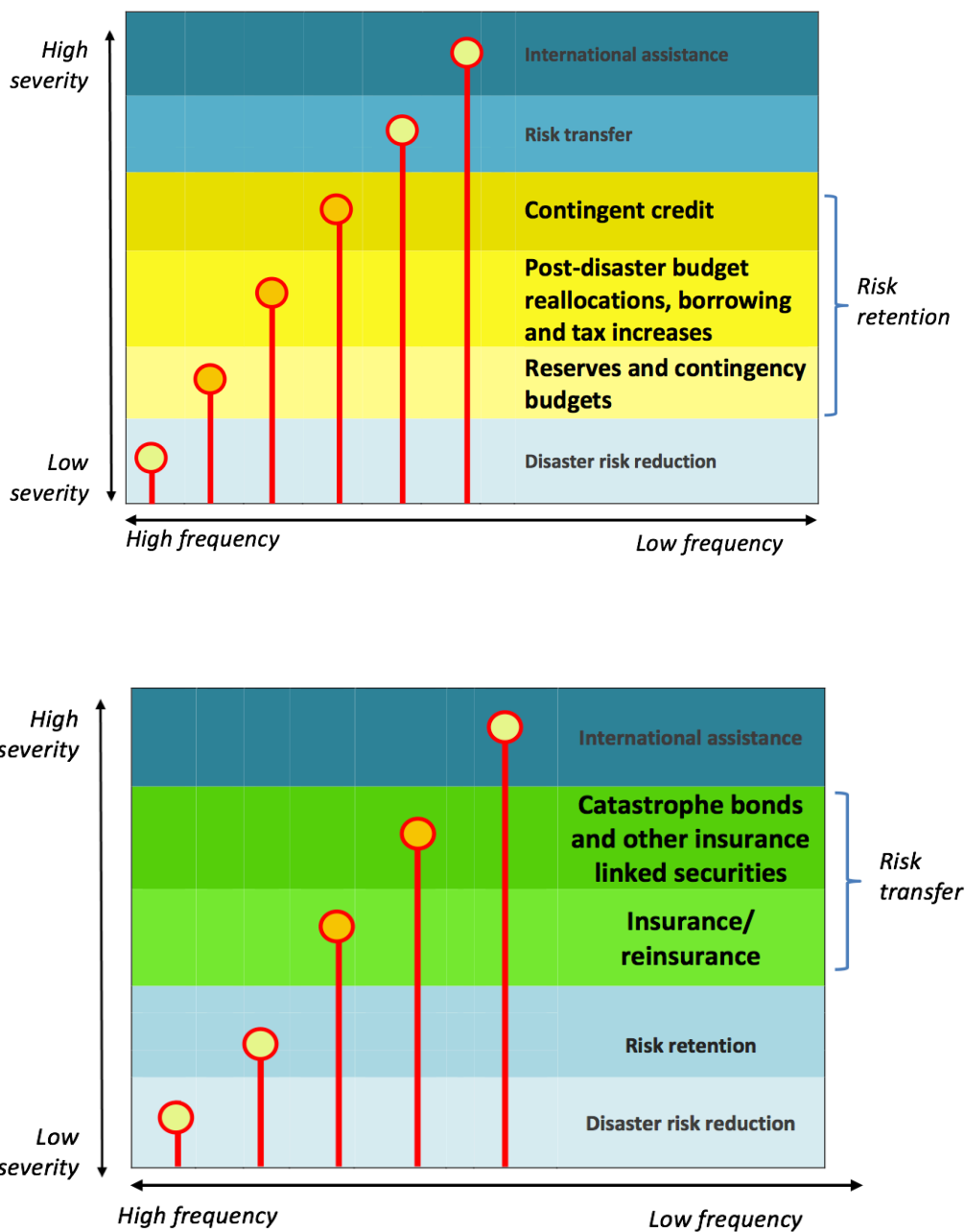
As the return period increases, we begin moving into the realm of intensive risks, those that can suddenly destabilize a governments' finances in a single extreme event. For these risks, governments need to transfer that risk to fund excess losses. It is here where weather index-based insurance tools, such as parametric insurance or catastrophe bonds, take the spotlight and become an optimal cost-benefit option for disaster risk financing for local governments. Any remaining gap from an event beyond the limits of adaptation can then, and only then, be covered by the international humanitarian and development community.

The challenge of this model is defining the rules to make evidence-based decisions to determine the threshold levels for each layer. Mechler et al. (2014) suggest that stress testing using a probable maximum loss (PML<sup>3</sup>) to identify those threshold levels in a layered approach, which is a common method in the finance and insurance field. In other words, the PML becomes an adequate tool to mark the limits of capacity of each layer/financial instrument.

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<sup>3</sup> Probable maximum loss: In the insurance industry, it is the maximum loss that an insurer would be expected to incur on a policy. It represents the worst-case scenario for a risk bearer.

Since many governments may start feeling high financial stress levels at relatively low return periods, an ideal way to increase those threshold levels can be done by investing in prevention infrastructure like raising protection levels against river floods, or improving and enforcing anti-seismic building codes for houses and buildings. A higher threshold level also means that risk transfer instruments like insurance would be required at a higher risk retention level. This results in a lower premium cost since the insurance will be facing less claims.



**Figure 7: Proposed multi-layered linking DDR and insurance-based tools to enhance a DRM plan (Benson, 2017)**

### **How Insurance Builds Resilience:**

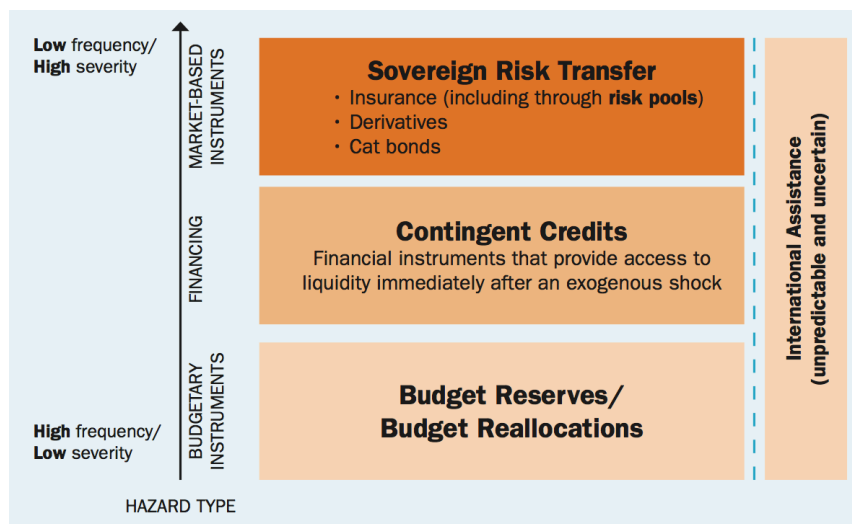
In 2015, the UN Agenda brought the insurance industry to the spotlight in a remarkable effort to outline a path for resilience and development. During the COP21, the G7 Group launched the InsuResilience Initiative with plans to increase insurance coverage by up to 400 million people in developing countries by 2020, and to provide funding for climate risk insurance for strengthening these countries' resilience to climate change (G7 Group, 2016). An estimated 50%-55% of those new 400 million beneficiaries are expected to come from Sub-Saharan Africa (GIZ, 2015). This instance closed a year marked by milestone global agreements. It started when the SFDRR prioritized DRR for resilience and aimed to promote insurance as a mechanism for financial protection, and later on the Sustainable Development Goals determined the targets of development finance.

In July 2017, the UK announced it will provide GBP 30 million for the London-based Centre for Global Disaster Protection which, among other aims, will be working with the World Bank and the German Government in providing more cost-effective, rapid and reliable disaster risk financing and insurance solutions for Africa (IDF, 2017b). This follows the Insurance Development Forum's (IDF) advocacy for insurance as a resilience building tool for governments by helping parties better understand, assess risks, prevent and reduce them, and, ultimately, price and diversify sovereign risk. The IDF partnership brings together the support of the World Bank, the UN Development Programme and global insurers.

In the context of CRM, parametric insurance is an innovative type of coverage against weather extremes that provides timely payouts before a crisis hits (e.g. droughts) or post-event (e.g. earthquakes, excess rainfall leading to floods), which enables rapid emergency response.

Early funding and timeliness are fundamental characteristics of climate risk insurance and its ability to make payouts before a crisis unfolds. When a weather index threshold level is surpassed after an event (e.g. using magnitude for earthquake or rainfall for floods), an insurer can release funds necessary to prevent a crisis from unfolding, or to mitigate the detrimental consequences of the hazard. In the case of a slow onset event like a drought, for example, low soil moisture or the change in vegetation index can be exposed weeks before a crisis hits a

region, thus triggering payouts that would minimize the risk of food insecurity and post-event response costs.



*Figure 8: The layered CRM approach for financial protection (WB, n.d.)*

Parametric insurance is a paradigm shift from the popular indemnization insurance, which is based in actual losses usually determined by field adjusters assessing the disaster hit area. The cost of adjustment of indemnization insurance is high and results in payment delays. With payment-triggering mechanisms based on weather indexes, and thanks to weather data technologies, insurers have been able to streamline the loss estimation thus minimizing the time to complete a payout.

With weather index-based mechanisms, insurers have been able to develop accurate catastrophe risk models that analyze the interplay of hazards, vulnerabilities and exposure of people and assets. These models validate the importance of insurance mechanisms in identifying, reducing, preventing, diversifying, pricing, and financing climate risk in developing countries. Catastrophe risk models have allowed the development of several insurance products for sovereign risk (see Annex 2) for a complete description), as well as products in the capital markets such as catastrophe bonds (a.k.a insurance-linked securities) or weather derivatives.

### Cat Risk Pools

With an opportunity to improve the protection of finances and citizens, some governments have used these resilience building products and layered CRM strategies through special vehicles called catastrophic risk pools. These mechanisms allow the diversification of sovereign risk, thus lowering the cost of insurance, while allowing governments to access predictable and timely funding for extreme weather events. This is complemented with DRR investment incentives that help minimize extensive risks.

The most relevant examples of sovereign level catastrophic risk pools are the African Risk Capacity (ARC), the Caribbean Catastrophe Risk Insurance Facility (CCRIF), and the Pacific Catastrophe Risk Insurance Company (PCRIC, formerly known as PCRAFI). The three risk pools group 26 countries in three world regions with an annual coverage of USD 870 million and USD 105 million in payouts (WB, n.d.). These risk pools are multi-donor-sponsored initiatives at the macro level that cover natural hazards such as droughts, earthquakes or excess rainfall, providing coverage where other forms of disaster funding or insurance penetration are low or nonexistent among the poor and vulnerable populations.

The African Risk Capacity (ARC), for example, is a specialized state-level agency of the African Union providing disaster risk financing solutions to its member states particularly in risks that affect their agriculture (e.g. droughts, floods and cyclones). For a member country to participate in the risk pool, ARC (2017) mandates countries to undertake several processes, including:

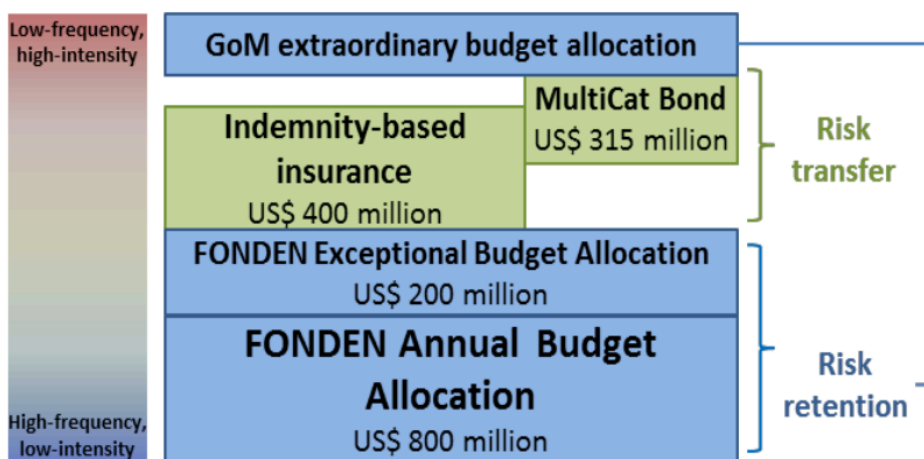
- a) customizing its risk modelling software
- b) signing a memorandum of understanding that commits capacity development resources from both, ARC and the government
- c) defining a contingency plan for the optimal and safe use of funds from payouts
- d) determining risk transfer parameters, such as total coverage, and the amounts of to retain and cede to the risk pool.

ARC's scope of risk management matches the best CRM practices so far discussed, making it an exemplary model to consider for a potential urban risk pool such as the Nigerian Resilient

Cities Network. Urban risk pools could be a great opportunity to enhance cities’ CRM policies while diversifying risk.

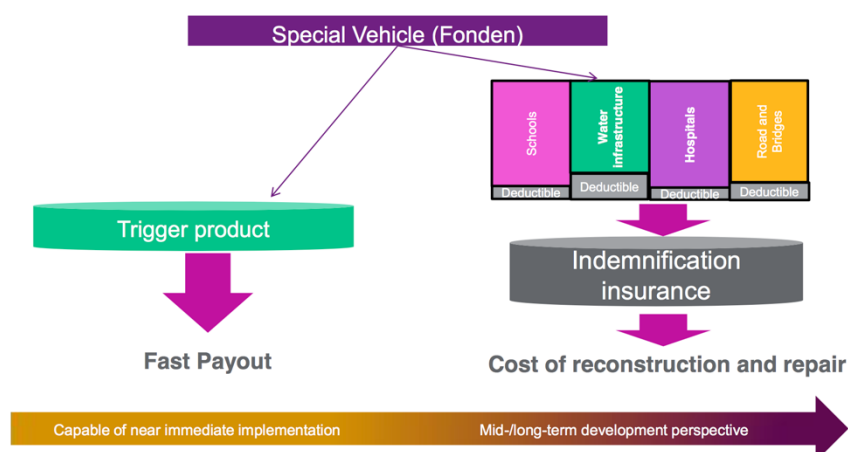
Applicability in the Urban Setting

Literature on the applicability of insurance schemes at the urban setting is limited. However, the case of the Mexican Natural Disasters Fund, FONDEN, provides a particular case study with a CRM policy for states and municipalities. FONDEN lays out a model (figure 9) that combines a catastrophe bond which provides a fast payout for relief and recovery, with indemnity insurance which secures funding for reconstruction of public assets (figure 10). The scheme covers against earthquakes and hurricanes and prioritizes the protection of local and national infrastructure, low-income housing and eligible natural environment assets. A key to the success of the model is how the model has been able to build on its inter-institutional framework, where the collaboration and coordination of state ministries and sub-national governments to determine a well-defined rules-based system is paramount (GFDRR, 2013).



*Figure 9: FONDEN's CRM plan (Source: GFDRR, 2013)*





**Figure 10: FONDEN's hybrid scheme of indemnity insurance and a catastrophe bond (Source: Simmons, 2016)**

#### Implement with caution – limitations

De Schutter, Sepulveda (2012) hold that climate risk insurance should not be seen as the only solution for financing extreme weather events, nor should it be a substitute for DRR, adaptation or social protection systems to combat poverty and inequalities. Surminski et al. (2016) agree with this and warn that climate insurance can enhance resilience, but only if it is part of a wider adaptation strategy, rather than being considered in isolation or, worse, as an alternative to adaptation. So, to work well in a CRM strategy, insurance needs to be complemented with DRR and preparedness efforts such as social safety nets (e.g. the Hunger Safety Net Program in North Kenya (HSNP, 2017)), early warning systems and risk information capacities (e.g. CREWS Initiative (CREWS, 2017)), or insurance literacy of stakeholders (e.g. ARC's contingency plans). Otherwise, governments and populations may be exposed to a false sense of security, unwise risk-taking decisions and maladaptation (Whalley, 2016, Bond, 2016).

One point of concern is the affordability of insurance for developing countries. Budgetary pressures and political priorities are two reasons that condition their decision to buy insurance. Reeves (2016) holds that there must be sustained, predictable and long-term financial support to pay the premiums for vulnerable countries. But this means that every country needs and individual assessment since they all own a different profile. This is what ARC does with its members that want to access its sovereign risk pool. This can help determine the amount and

time frame of the subsidy, or perhaps an alternative strategy to lower the premium cost such as those shown in Figure # (Evidence on Demand, 2016).

	<b>Direct premium subsidies</b>	<b>Donor capitalisation</b>	<b>Payment of reinsurance costs</b>	<b>Technical assistance</b>	<b>Payment of operational costs</b>	<b>Risk reduction</b>
<b>Effect on premiums</b>	Large effect	Medium effect	Medium effect	Small effect (but can vary significantly)	Small effect	Small effect

**Figure 11: Effect of subsidies in premium cost for a government (Evidence on Demand, 2016)**

Surminski et al. (2016) explain that if we don't address the underlying issues, then risks will become uninsurable because of lack of supply (unwillingness to offer coverage) or demand (affordability of premiums). The complexity of urban risks in developing countries with limited DRR culture and capacities makes it an area filled with uncertainties that risk modelers are still having difficulty minimizing and transforming it into affordable insurance options for local governments or municipalities. However, we should not forget that their decision to invest in insurance may well be marked by political decisions.

Nevertheless, as investment in development from high-income countries grows in Africa and insurance technologies for data collection and risk modelling continue improving risk identification, models like ARC and FONDEN allow us to consider key elements that help enhance CRM policy in cities.

### **PESTLE Framework:**

The literature sheds light on the opportunity there is to better protect the fragile finances of cities, their people and their livelihoods against the threats of extreme weather events. Taking advantage of it may prove to be of big step forward in development efforts for Sub-Saharan cities considered to be of high vulnerability and risk accumulation.

This research has taken the Nairobi City County (NCC) as a case study to explore if different elements of its context suggest that it is in a position to consider integrating innovative index-based insurance mechanisms to enhance its current CRM policy. To determine these elements,

the CRM environment was investigated through different angles paying special attention to the perils of earthquake and excess rainfall leading to flooding.

Due to the word count limit and nature of this paper, the framework chosen needed to provide a bird's eye view of such environment. Organizations looking to better understand the environment in which they operate, or those that may want to implement a new product or service, constantly utilize marketing and analytical tools that allow them to, a) keep a broad perspective of the location, and b) to begin making strategic decisions. The PESTLE analysis, was chosen for this task as it allows the "audit of an organization's environmental influences with the purpose of using this information for strategic decision-making" (CIPD, 2017). It facilitates the assessment of a CRM environment from the political (P), economical (E), social (S), technological (T), legal (L), and environmental (E) perspectives.

For the purpose of this research some of those categories were adjusted (see Table 3) to better reflect the type of data that was elicited through the questions.

<b>PESTLE Category</b>	<b>Adjusted Category</b>
Political	Political
Economic	Financial
Social	Socio-cultural
Technological	Data technologies
Legal	Legal
Environmental	Environmental

In order to further enhance the robustness of the analysis, the PESTLE framework was complemented with a SWOT analysis in the matrix shown below. This combination outlined each category data more clearly, especially those opportunities (O) identified, as well as the threats (T) challenging the city. The strengths (S) and weaknesses (W) sections intends to provide a glimpse of the cities qualities. This framing of data provided an ideal mechanism to

classify the answers of respondents that received open ended questions and facilitated reaching policy making recommendations and lessons learnt.

<b>Table 4: Adapted PESTLE framework and SWOT analysis matrix</b>				
	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Political</b>				
<b>Financial</b>				
<b>Socio / Cultural</b>				
<b>Data technology</b>				
<b>Legal</b>				
<b>Environmental</b>				

For each classification, one or two question were asked to each interviewee, plus additional improvised questions considered pertinent to add insight, a better example, or richness to the data being collected. The list of the core questions is shown in Annex 1. Below is a brief description of the objective behind the questions in each category:

**Political:** Exploring the politics of disasters helps understand the manipulative and adaptive strategies and decisions taken by politicians in a city where voters are mainly represented by highly vulnerable medium-low and low income populations.

**Financial:** The questions address what decision-making processes for fund allocation exist, who participates in the processes, and how funds are secured for and used during a crisis.

**Socio-cultural:** This category primarily explores aspects of communication, coordination and collaboration amongst the municipality departments and national institutions, fundamental in building relationships and establishing rules-based plans for CRM.

**Data technology:** The questions focused on weather data technologies that Nairobi has, including those available through partnerships with the KMD.

**Legal:** Explores the existing national and local regulation and enforcement for Nairobi's CRM policy.

**Environmental:** The question center around the awareness of the interviewees of extreme weather events threatening the city, and the actions taken to mitigate and adapt to them.

### **Research Design and Methodology:**

#### Standpoint

I support and celebrate the global community's efforts to improve disaster risk financing through insurance mechanisms and weather technologies. But it needs profound understanding of risk and local governments' environment before case-by-case recommendations for tactful implementation are made. My biased perception of the adequacy of using specific insurance as an optimal way to protect and build greater resilience in a society, comes from personal experience using it to overcome a life-threatening and financially destabilizing accident, as well as working in the field. This shaped my belief that the insurance sector holds a major role and shared responsibility in the reduction of poverty and sustainable development of low and middle income nations.

This research tries to remain objective in the eclectic choice of models and strategies found in case studies worldwide, as well as in the application of chosen methodology and analysis of its results.

#### Choice of research

The source of primary data collection for this qualitative research were in-depth, semi-structured interviews that facilitated a two-way, conversational discussion with the key informants. This choice also provided flexibility to add improvised follow-up questions that provided deeper insight, better examples, and rich narrative on the topic of CRM policy and actions in Nairobi.

The main key informants were department chief officers or directors of the NCC. However, in order to open up the possibility to add robustness and reliability to the data that NCC respondents provided, additional key informants were included from other public administrative and scientific institutions (e.g. National Disasters Operation Centre (NDOC), Kenya Met Department (KMD)), as well as the civil society (e.g. Kenyan Red Cross), and the academia (e.g. University of Nairobi). All interviewees occupied managerial-level positions in institutions playing a relevant role in providing technical assistance, support, and/or scientific input to the NCC in CRM aspects.

Annex 3 provides a complete list of all interviewees.

#### Primary data:

General and targeted questions to each interviewee aimed at obtaining their perception of behaviors and efficacy of the management and financing of disasters by the NCC. They were also requested to illustrate their answers, whenever possible, with examples of floods (caused by excessive rainfall) and earthquake hazards and disasters. All questions were thus framed in a way that allowed “culture to ‘speak itself’ through individual stories” (Hoggart et al., 2002) of interactions between the city’s CRM actors. The intention was to understand the past and current actions of Nairobi and its context, as opposed to hypothesizing about the city’s future with a proposed parametric insurance scheme. As argued in this research, parametric insurance is a tool that requires integration in a city’s CRM policy and willingness to create a strong link with DRR strategies to be financially and demonstrably effective.

For the sake of providing context of the research to the interviewees and familiarity with the innovative characteristics of parametric insurance, the interviews were preceded by a brief PowerPoint presentation. This presentation included an overview of facts and cases studies of national and local schemes in the world and their role in building resilience. The presentation was then followed by a question that served two purposes: a) to elicit the respondent’s impressions about such disaster financing schemes based on their financial literacy, and b) to provide direction and a smooth flow into the core interview.

#### Piloted interview:

In order to get a clear definition of the focus of the study, a piloted interview was performed on a researcher of King's College London familiar with studies of Sub-Saharan cities and interviews with city officials. As a result of this, the question in the Politics category, was modified to gain clarity for the interviewee and freedom for the person to answer the question from the perspective of an eligible politician and/or a voter.

#### Secondary data:

Secondary data was secured from grey data published by variety of actors involved in disaster risk financing and urban resilience programs like the insurance industry, the international development community, the United Nations, NGOs, the Government of Kenya and the academia (see Figure 4). Grey data published by major reinsurers like Munich Re or Swiss Re provided a market perspective for the suitability of parametric insurance in cities of developing countries. Similar data obtained from multilateral financial institutions like the World Bank or the Asian Development Bank shed light on CRM models and financing mechanisms available at the sovereign level in different world regions including Africa. The UN documents offered objectives and roadmaps for stakeholders through the UN Agenda including the relevancy of risk transfer tools to achieve those objectives. Peer-reviewed papers from the academia bring a balance to the type of data and a deeper analysis from a global perspective.

#### Limitations and Biases:

The almost inexistent index-based insurance schemes in the urban setting was the main limitations to the research, mainly because this paper bases its investigation not in an urban model that exists, but in one that could be adapted based on successful experiences. Thus, the research was focused on identifying some components of good CRM practices adaptable to urban risk using against the suitability of a city like Nairobi to implement them successfully.

Another limitation rose when the respondents were asked to include their success stories and blunders when collaborating with other departments or agencies. Some responded with the natural bias of politicians to show-off their accomplishments and minimize, or evade talking about any negative experiences.

Also, the focus on incidents related to floods and earthquake were soon overlooked by most NCC respondents to focus on more common hazards hitting the city (or those they were more familiar with) like fires or collapse of buildings. This was soon overlooked as more information about risk management behavior was going to be left out rather than gained from interrupting the conversation to focus on floods and earthquakes.

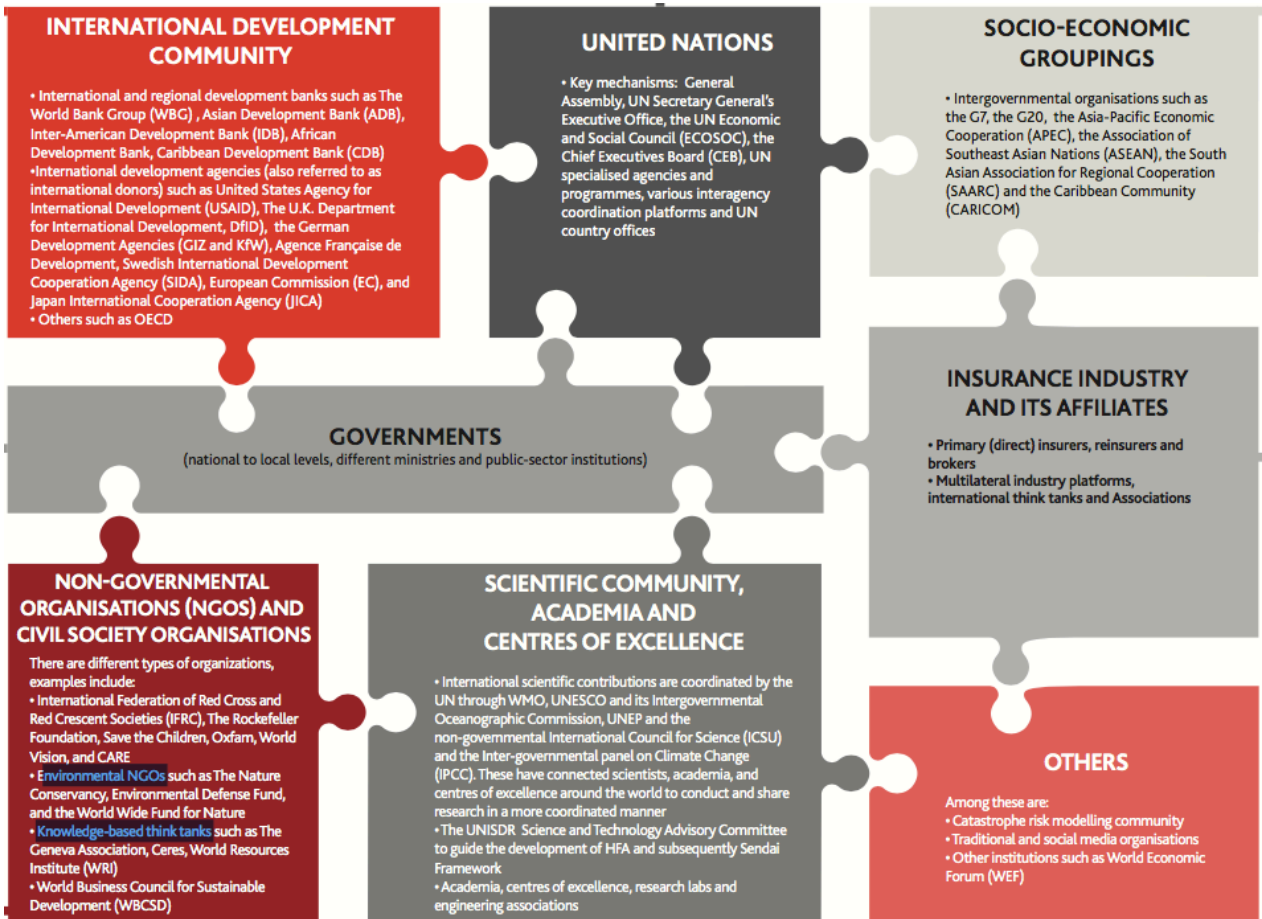


Figure 12: Stakeholder landscape in extreme events and CRM (GA, 2017)



### Analysis:

The adapted PESTLE – SWOT matrix of analysis that structures this section provides a bird’s eye perspective of the CRM environment in Nairobi that allows the broad understanding of the readiness of the city to consider integrating a parametric insurance scheme to enhance its CRM policy.

<b>Table 4: Adapted PESTLE framework and SWOT analysis matrix</b>				
	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Political</b>				
<b>Financial</b>				
<b>Socio / Cultural</b>				
<b>Data technology</b>				
<b>Legal</b>				
<b>Environmental</b>				

### Political

The politics of disasters in Nairobi follows a similar pattern in Sub-Saharan cities and national governments: systematic and politicized mismanagement of CRM evidencing a begging bowl model of managing disasters. Interviewees corroborated this and added that leaders in power use disasters as political platforms and take advantage of the complexities of poor urban development and poverty observed mainly in informal settlements. A Red Cross risk manager explained that in Nairobi, people accept this because they “prefer the emergency response aspect of a crisis rather than DRR”. This is because relief comes with cash, with food handouts, non-food items that alleviates, at least temporarily, the hardship of their precarious situation.

Politicians know that people in need quickly remember during election times those leaders that bring (temporary) relief after a disaster, rather than those that work in DRR or development projects that sometimes are not even physically visible (eg. sewage projects).

This type of politics and social inequalities hardly encourages DRR policies, which can explain why the most vulnerable populations do not see DRR as a priority nor an incentive. It also shows why some politicians prefer the status quo, especially in informal settlements. This behavior enhances the effect of the Samaritan's dilemma discussed by Clarke and Dercon at the basic level of society - the household.

Non-NCC officials explained that disasters in Nairobi are a way to capitalize on victims, low income populations, and a broken system. An individual response is one way to do this in Nairobi. It ensures that a politician gets full credit for the action rather than a joint coordinated effort with other agencies that can use resources more efficiently. It also leaves on a single decision-maker the power to choose which bowl to fill and how the funds should be used. The Sonko Rescue Team is an example of the opportunism of one of the most audacious and charismatic politicians in Nairobi, the newly sworn-in governor of the County. A former senator and a wealthy businessman, in 2015, Mike Sonko set up a brigade financed with his money, that offered the low-income citizens of Nairobi services such as ambulances, fire response, security, water supply, and garbage collection amongst others (SRT, 2017). His action also evidences those deficient services the city offers in the poorest areas of the city.

### Opportunities and Threats

Interviewed urban planners are, unsurprisingly, the most outspoken critics of the current political class in Nairobi. They believe that although leaders are aware of how disasters expose their deficient CRM policy, they are still not willing to put their attention and resources into long-term strategies. Sometimes when they do so, their actions take too long.

But the politics of disasters might be changing in Nairobi in a time when climate change discussions are gaining political audience, since exposure of assets and vulnerable people in urban areas are increasing at unprecedented rates. When disasters hit, people expect the government to provide relief as a response to it. But with their frequency, intensity, and variability on the rise, political leaders cannot afford to keep running to those areas every time this happens.

“People start to question about how long they are going to be going through this. So they question about the time leaders have been in power and amount of help directed to them. Politicians hate disasters but preparedness is a different issue.” (Rose Muema, Urban Planning Chief Officer)

Political leaders are feeling that disasters may be too expensive, politically for them and financially for the country, to maintain a reactive strategy. This suggests that with no direct impact on people, leaders are likely feeling a rise in the degree of questioning from the electorate and the media about how disasters risks are handled and their negative impact in the economy.

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Political</b>	Relatively stable African democracy	Practice of begging bowl funding model	Climate risks can change the begging bowl model	Myopic vision and lack of commitment of political class
		Opportunist political class choosing status quo	To replace ineffective leaders	Unprecedented level of vulnerability and exposure of population

### **Financial**

At a national level, the Public Finance Act (2012), states in Art. 110 that county governments should use no more than 2% of their revenue capacity for an emergency fund. The Constitution of Kenya (2010) also enables the use of additional contingency funds for urgent unforeseen or forecasted events. For the 2015-2016 El Nino phenomenon, the Response Plan (NDOC, 2015) estimated a total loss of 16 billion Kenyan shillings (approx. USD 160 million) and a budget deficit of 3.5 billion shillings (approx. USD 35 million) after local and foreign contributions from development partners. Dr. Kiema from the National Disasters Operation Center (NDOC) explained that the government’s contingency funds contributed with 5 billion shillings (approx. USD 50 million). However, just like the Plan, he failed to explain how, who, or when the deficit would be covered.

This finding coincided with some of the interviewees' responses. They explained that pre-disaster planning and funding is done ad hoc, focusing mostly on forecasted extreme threats, and without certainty of deficit funding. The result of this systematic behavior will likely slow down or stall development. At the moment, drought disasters solely have caused an average 3.3% fall in annual GDP growth (Mutie, 2017).

Nairobi might be a step ahead from many others in Africa in urban legislation, in addition to the mentioned national legislation for disaster funding. The relatively new Disaster and Emergency Management (DEM) Act (2015), foresees a County Disaster Management Fund that considers resources coming from:

- a) the County revenue, as per the Public Finance Act
- b) monies or assets accrued to the fund Directorate in exercise of its powers and functions
- c) grants by the National Government or other County Governments
- d) loans, aid, and donations from national and international agencies
- e) monies provided, donated or lent to the fund Directorate.

Surprisingly, the existence of this Fund is not known by most NCC officials, which depicts the extent of the degree of their participation in fund allocation and ring-fencing for CRM in the city.

Except for the Security, Compliance and Disaster Management (SCDM) Department, the NCC responders stated that they do not receive funds specifically for disaster management, and are not enforced to budget for it. Their answers casted a feeling of unassigned role to collaborate in CRM decision-making processes, and in a conformable position to finger-point at the debilitated SCDM Department for answers and action in such matters.

The interview revealed a SCDM Department focused more in the enforcement of security services and emergency management rather than comprehensive CRM. Owning a police background and using a marked political rhetoric, the Chief Officer explained in full detail how

his department budget was effectively used in post-disaster actions. However, he did not demonstrate how the department uses funds in DRR action or weather extreme response.

Financial literacy and awareness of DRR was shown by some NCC respondents. The Chief Officer of Health, for example, demonstrated a great understanding of the importance of DRR policy and a systematic application of it. He explained that part of their project-based budgeting goes to a disaster management unit which identifies risks, makes efforts to reduce them, prepares for them, and responds when crises hit. He added that fast and pre-agreed availability of funds for disasters was crucial for his work.

The participation of departments in the city's budget planning exists as a process laid out by the NIUPLAN 2030. However, the Plan does not foresee any CRM planning nor any pre-positioned funding for disasters despite the fact that it contains an ambitious city development vision for 2030. Nairobi generates most of Kenya's wealth and its population is expected to grow from 3.6 to 5.2 million (NCC, 2014). However, the interviewees failed to explain how the threat of extreme weather events posing on the citizens and projected infrastructure is a priority in the city's long-term development plan. Failing to see climate change as a threat to development as much as a consequence of it (Pelling, 2011) is a major weakness from Nairobi's NIUPLAN 2030.

#### Opportunities and Threats

Respondents from the Kenyan Red Cross (KRC) explained that they have been lobbying to operationalize the Disaster and Emergency Management (DEM) Act, since it was passed in 2015. Drafted with the collaboration of the KRC, this law is an opportunity for Nairobi to start implementing a rules-based funding mechanism to protect its people and assets. It also uncovers its challenge to define specific rules and to discipline fund-allocating, ring-fencing and accountability. The city will gain transparency and will be rewarded by trust from stakeholders. Without them, the Fund may attract the misuse of funds, which eventually erode the trust of donors who then, may want to condition relief funds to their specific rules.

At the moment, pre-positioned financing or ring-fencing of funds for CRM is inexistent. Availability of public funds for disaster relief is a challenge for both local and national

governments, and may be subject to reallocation from other non-disaster response budgets (eg. development projects), as confirmed by the NCC respondents. This evidences how inefficient disaster financing can throw the finances of the city off balance and threaten sustainable economic growth.

Some non-NCC risk managers suggested the possibility of implementing a disasters operation center, similar to the NDOC, but for the County. They believe that including a parametric insurance mechanism for extreme events was an option that would suit the idea and save them time and resources. However, the idea of a disasters operation center raises the alarm that there could exist major disagreements between CRM actors in Nairobi, possibly politically motivated. Some incidents already lack coordinated efforts between local and national agencies, so the idea of a disasters operation center will definitely stall the optimization of all resources available.

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Financial</b>	Legal mandate to create contingency funds	Debilitated SCDM Dept. and no CRM funds for NCC depts.	Operationalizing DEM Act and Fund	Reaching collaboration to define CRM policy and DEM Fund
	Chief Officers with financial literacy and DRR awareness	No CRM policy in Nairobi's NIUPLAN 2030	Openness to innovative CRM and funding mechanisms	Reallocation of funds to cover insufficient disaster response

### **Socio – Cultural**

One of the strongest relationships is perhaps the one that binds the KRC with the NCC in emergency management and advocacy. Risk managers of the KRC described their role as auxiliary to local governments in emergency response, and explained that all their interventions are done in partnership with the County. They attribute their successful joint incident management to the delimitation of roles (i.e. the government takes overall coordination of the incident, while the KRC takes care of the emergency medical services such

as evacuation or management of dead bodies). This is how this relationship was able to enact the DEM Bill, undoubtedly their major success story. The relationship has positioned the KRC in relevant advice boards and committees for developing contingency plans for floods or for election times.

Another consistent collaborative relationship binds the KRC and the KMD. Mary Kilavi from the KMD described their collaboration efforts in DRM as “very useful” in community-operated early action and early warning systems, and supplying data for the KRC’s work. In this initiative to build capacities and awareness, other actors like NGOS, the academia, and even the private sector collaborate.

The examples of collaboration amongst NCC departments in CRM disclosed that relationships are built in a case-by-case basis. If a space where to share CRM practices existed, participation and information sharing amongst local CRM stakeholders could generate synergies and better use of resources. Support and data from the KRC and the KMD, for example, could help the multi-department effort to clean drainages during storm season. Another examples could be more effective coordinated efforts between Social Services and NGOs to protect vulnerable people in informal settlements from dyeing due to the rapid rise of water level from garbage-blocked drainage.

Instances like this is what raises the voice of the KRC about the weak CRM policy of Nairobi, and the little collaboration amongst its departments. The criticism centers on a lack of leadership in the executive level of the County that should engage the collaboration of different sectors. However, the current SCDM Department seems to lack the ability to bring together other departments perhaps because of a misjudgment of the spectrum of urban risks and possible collaborators. DRR advocacy and action will hardly come out from a department that stated its unawareness of a basic working tool such as the County Disaster Emergency Plan mandated by the DEM Act. The SCDM leader will need to acknowledge that addressing CRM requires building relationships, and that adaptation is a social and political act with a possibility for re-shaping power relationships (Pelling, 2011).

### Opportunities and Threats

Dr. Ochola in the Health Department claimed that “some sort of collaborative effort already occurs, but this space needs strengthening.” This statement coincides with the opinion of NCC and non-NCC urban planners and risks manager, who have seen the level of collaboration with other actors increase in the last 5-7 years. Pelling et al. (2017) also believed that the public health and DRM fields should come together to tackle the spectrum of different risks. Bringing in unbiased disaster risk experts as technical advisers is a great opportunity to guide and strengthen the operationalization of the DEM Act for example, and to better understand innovative, pre-positioned funding mechanisms. It could show that the NCC acknowledges the need for technical assistance, the importance of building relationships with various actors, and inclusiveness in decision-making processes for improved efficiency in DRM.

An initiative to open a forum for DRM discussions in which relevant public and private stakeholders take part was well received by respondents. The KRC pointed out that having a forum puts available resources on the table for the development of a joint strategy. These resources can then be allocated more sensibly to eliminate two things: a) the duplication of activities and competition amongst NGOs, and b) the arbitrary decision of a government to intervene and take over an incident. “For a joint plan to work all the actors in the county need to understand their priorities and interests, in infrastructure, in operations, etc.” said Mr. Gichuki, Managing Director of the NWC. This lesson was learnt in a non-weather related disaster, the Water Gate terrorist attack in 2013, where the lack of protocol revealed an uncoordinated response of the NDOC, the KRC, and NGOs involved (The Guardian, 2013).

Most respondents pointed out that Nairobi has been fortunate enough to suffer few extreme weather events. Its little familiarity with incidents of such magnitude may represent a response challenge. Examples given by interviewees that in extreme events, there’s little coordination, and response may be chaotic or ineffective. As one of the NCC respondents explained, in case of a disaster, “not every stakeholder would be reading from the same script. The challenge is harmonizing the actions and responsibilities of each sector.” To achieve this, communication channels need to be opened in opened spaces for discussions. Examples to follow can be found in the public sector (e.g Nigerian Resilient Cities Network), in the civil society (e.g. 100 Resilient



Cities), in the academia (e.g Urban ARK), or in public-private partnerships (e.g Insurance Development Forum).

<b>Table 7: Socio – Cultural Context</b>				
	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Socio - Cultural</b>	Some strong inter-agency collaborative relationships	Case by case collaboration & coordination amongst CRM stakeholders	Building relationships to harmonize actions and roles	Unfamiliarity of Nairobi with extreme weather events
	The KRC as an experienced collaborator of the city in CRM	Misjudgment and weak leadership from the SCDM Dept.	A forum to exchange data and experience of the city's CRM stakeholders	Ability to develop spaces for stakeholder to discuss/share CRM policy

### **Data Technologies**

Most responders coincided that the KMD is the most relevant public weather and climate technologies collaborator of the city. However, it suffered from the apathy of the public due to the limited capacity to forecast accurate data that would be useful, usable, and timely to allow public response. Limited resources of the institution, capacity of the staff, and weak communication strategies may have shaped their low popularity. However, things seem to be changing in the last few years. Ms. Mary Kilavi from the KMD proudly stated that Kenya was much better positioned than its neighboring countries in matters of technology, data collection, and systems. This was also corroborated by Development Initiatives (2017a).

Kenya's capacity to prepare for disasters may not necessarily be a data or information challenge. In the last few years, the KMD has managed to build trust and consistent work relationships with local agencies like the KRC, as well as with international agencies like the UK Met Department (UKMD). According to George Gibson from the UKMD, in 2015, the agencies formally signed in a Memorandum of Understanding that defined their scope of collaboration. It revolved around areas of knowledge sharing, training, and development of products and services for commercial use. It is also through this relationship that the Weather and Climate Information Services for Africa (WISER) project, funded by DFID, will improve the quality,

accessibility and use of weather and climate data for private and public decision makers in Kenya (UKMD, 2017). WISER expects to help an estimated 24 million people to become more resilient to disasters and climate change by 2030 (DFID, 2017), by communicating seasonal forecasting and improving early warning systems at the community level.

Regarding the NCC scope of work in data technologies, NCC urban planners stated that the young Information, Communication and Technologies Department is currently in an early stage of life and has very little or nothing to offer in terms of data for DRM and decision-making. Its main task, at the moment, is to manage the automation of the County services and its informative website, and to develop the County's branding.

### Opportunities and Threats

"Information sharing is a very important issue in dealing with a disaster. This helped minimize the loss...and raising awareness of the rains that followed last year. Having a forum (or a data-sharing source) where info can be found is great option." These words from the NWC Director reflected the concern of the city decision-makers to access reliable, well-managed weather information for strategic risk reduction and response. In this sense, the KMD has a great opportunity to take advantage of its built relationships with foreign Met offices to strengthen its reputation locally and its role in delivering usable, useful and timely data for effective CRM.

In addition to the KMD's data technology potential, data sharing mechanisms for DRR purposes like observation data equipment, mobile technologies, and crowdsourcing offer an opportunity to expand their scope of services. For example, Ms. Kilavi referred to a project that proposes the formation of a network of community climate monitors. The UKMD can provide rain gages and training to trusted people or institutions like schools or community groups, to take measurements of rainfall and forward the data to the KMD via SMS. This opens the opportunity for early warning and early action measures. Text messaging in Kenya is a proven effective and familiar way of communicating and doing transactions, including buying insurance (ACRE, 2017). This initiative may be challenged by the ability to implementing user-friendly data uploading procedures, as well as incentives to keep a consistent flow of data.

Additional facilitators to engage in an initiative like this may include private companies like FrontlineSMS, who are capable of building text messaging platforms to upscale data sharing, or the popular platform MPESA, from the telecom company Safaricom.

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Data Technologies</b>	KMD's built relationships with UK Met Office	Weak collaboration between the KMD and the City County	Take advantage of KMD's new resourceful relationships	Inability of NCC to profit from the relationship with the KMD
	WISER project for accessible quality weather data	Nairobi County's inexperienced ICT Dept. in CRM	New technologies from for DRR & preparedness	Inability to build capacities of social actors for data sharing

### **Legal**

The DEM Act is the major strength that the NCC holds to regulate and enforce its CRM policy, but surprisingly, it was only brought up in the interviews by KRC respondents. Worth highlighting here is the integration of the concept of "disaster risk reduction" defined as "all mitigation undertaken... to reduce the risk of hazards to the community and its property" (DEM, 2015). Part of the Act's objective is to promote the cooperation amongst agencies with a role in disaster management. It also mandates the formation of a Disaster and Emergency Management Council, a County Disaster Management Plan, and a County Disaster Management Fund.

The KRC's took a fundamental role in the design and promulgation of the Act. This shows the important level of trust that the institution has achieved within Nairobi (and within the society in general), as well as the fundamental technical assistance they've offered to the County in DRM matters. However, now that the DEM Act exists, KRC risk managers have struggled with bureaucracy, and likely with political interests, to operationalize it as a tool for decision-making and CRM enforcement.

Initiatives from the Chief Officers of Urban Planning and of Environment demonstrated that there is some potential to lead a change in the CRM policy of the city. In 2013, for example, Urban Planning attempted to enforce some building code regulations. The effort barely helped lower the number of structures that have collapsed in recent years in lower income areas of the city, where rapid urbanization has generated a spike in the demand for housing. Some risk managers and urban planners explained that this growing demand and the weak building code enforcement has awakened greedy interests from some leaders with political power to quickly erect their own buildings with little or no regard to minimum safety.

When asked if the DEM Act links to the NIUPLAN 2030, the KRC risk managers did not know or failed to find any alignment. The rest of the respondents, unaware of the DEM Act, failed to point out how the NIUPLAN 2030 prioritized any regulation in DRM. This seems as a major weakness in view of future plans to build development infrastructure such as roads, sewages, or water collectors.

### Opportunities and Threats

The DEM Act and the KRC technical assistance brings a great opportunity for Nairobi to continue shaping and strengthening its CRM policy. However, if insurance-based mechanisms are to be integrated in Nairobi's policy, current financial market regulation will likely need review.

The DEM Act offers the potential to define better innovative CRM and funding mechanisms. However, it's still on the current and future leaders of the County to strengthen and enforce it successfully in the city. The KRC reflects a trustworthy and ideal partner with expertise that can adequately advise on policy-making to shape future CRM legislation.

With the surprising unawareness of the DEM Act by many NCC Departments, the County seems to have produced a piece of CRM legislation without the full participation all County departments. The greatest threat to the present legislation may come from those leaders that are aware of its existence, but are reluctant to bring it out to the light. Its promotion and enforcement may become fundamental for achieving the objectives of the NIUPLAN 2030.

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Legal</b>	Nairobi's DEM Act as a CRM tool	No link between DEM Act and NIUPLAN 2030	Potential of DEM Act for CRM policy and achieving NIUPLAN goals	DEM Act kept in the dark
	KRC as technical advisors in policy-making and advocacy	Insufficient regulation to keep up with rapid urbanization	Collaborative work with KRC in policy and regulation	Leaders in power with hidden interests

### **Environmental**

Nearly all respondents highlighted the active participation of Kenya in global climate agreements. However, extreme weather events in Nairobi, particularly excessive rainfall leading to floods and earthquakes did not seem to be a major concern in the minds of most NCC respondents. It's poor waste management and blocked drainage issues rather than extreme rainfall the reason for recurring floods in most informal settlements. This is an example of mismanagement of extensive risks that NCC interviewees seem to have their attention on. A similar concern was manifested for hazards like building collapse, fires in informal settlements, and even terrorism.

Non-NCC respondents seemed more concerned about extreme severe droughts in rural northeast Kenya, that indirectly threatens the city. Close to 3 million people are food insecure and thousands of hectares of farmland have been affected causing the price of maize to soar nationwide and inflation to reach a five year high (Reliefweb, 2017[PC1] ). The NWC began rationing the water supply in the city last January due to low rainfall levels averaging a 25% reduction from the normal supply. The NWC also experienced a proportionate fall in revenue.

### **Opportunities and Threats**

A non-NCC risk manager raised a voice of alarm about the city's approach to climate change. He said that Nairobi is still unfamiliar with extreme weather events, but it has already started to feel the effects of the variability and uncertainty of rainfall. As for the earthquake hazard,

most respondents recalled the geographical location of the city along a geological fault line, but added that the risk posed little risk to the city. Is this excessive confidence or misjudgment? Since 1960, only two major earthquakes were registered in Kenya with a Richter scale over 7 (7.2 and 9.1 in Kapenguria and the coast of Mombasa), from which the strongest, caused severe material damage and one death (EM-DAT, 2017).

Some NCC respondents have questioned the Mayor’s inaction to lead a conversation about climate change issues. This, for example, may have caused a lost opportunity for the city to get funding for a climate action plan which was submitted late and not well-prepared. The Housing Department acknowledged the weakness of the local government saying that “climate change is a conversation that we need to start having (at the city level), because we don’t have it... people think it is just about agriculture and water scarcity and its rationing”.

“If we wait for [extreme] events to strike us, it will have a very negative situation [in the city]. [The County government] thinks that it’s never going to hit us, they think it’s about planting trees and cleaning the river”, said a KRC risk manager.

A NCC urban planner explained the opportunity that the Global Covenant of Mayors initiated after COP 21 in Paris was a first step to bring cities to the center of the climate change discussion. This initiative promotes the voluntary action of cities to develop their own adaptation plan and become drivers of change. They also create an opportunity for the development of risk pools and affordable diversified disaster risk funding for cities.

**Table 10: Environmental Context**

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats / Challenges</b>
<b>Environmental</b>	Climate change awareness at a national level	Nairobi’s disregard to climate threats to the city	City alliances promoting support and shared experiences	Common belief that extreme weather events won’t hit Nairobi
	Kenya as an active participant of global climate agreements	Priority is based only on extensive risks	City alliances as potential risk pools for insurance-based schemes	No conversation & unfamiliarity with climate change in NCC

## **Conclusion**

Parametric insurance schemes helping build resilience in developing countries is an issue that has been gaining momentum in resilience discussions globally. The framing of this research proved conducive to achieving the exploratory purpose of implementing an insurance-based scheme within the CRM policy city with high exposure and vulnerability to natural hazards like Nairobi. Commonly used for marketing purposes, the PESTLE framework facilitated a preliminary bird's eye assessment of the city's CRM context.

Through this framework, the analysis of the perceptions of NCC and local CRM stakeholders demonstrated two things. First, it disclosed key elements of Nairobi's CRM policy that helped better understand the complex socio-political relationships outlining the NCC behavior and strategies with CRM stakeholders and vulnerable citizens in a disaster cycle. These strategies confirmed the systematic use of a begging bowl model of disaster risk financing, the main feature defining a current broken humanitarian aid system.

Second, the flexible nature of the framework showed that it allowed slight modifications of some of its categories (eg. Economic into Financial) to more accurately focus on the analysis of disaster risk financing matters. The flexibility of the framework also allowed its combination with a SWOT analysis in a matrix. The resulting adapted PESTLE and SWOT framework fulfilled the research's need for a robust tool to identify the strengths and weaknesses the NCC offers, to pursue the opportunities identified in the context of each category. Those opportunities and challenges were judged not with a purpose of designing a new CRM policy for Nairobi, but with the intention of aligning them with elements of success observed in disaster risk financing models, such as ARC and FONDEN adaptable to the city setting.

The open-ended choice of questions may have not captured deep-rooted drivers of behaviors from NCC actors, which may be a topic for further research. However, the questions revealed patterns of collaborative and coordinated efforts (or the lack of) in past incidents that demonstrated that the political interests of a few still mark the decisions made in managing incidents. The challenge for those Chief Officers (those with financial literacy and urban risk

understanding) that advocate for change in the status quo, begins by convincing the rest that addressing disasters requires a joint collaboration of several actors in society. Therefore, it's necessary to start building relationships. The conversations with NCC officials and non-NCC interviewees revealed working relationships were created on a case-by-case basis rather than by consistently engaging in inter-institutional collaboration. Such relationships may not allow the full optimization of resources, and may be duplicating disaster response efforts.

Coordinated efforts will likely improve another weak aspect observed in the city, DRR culture and its benefits. Following the ARC and FONDEN models, Nairobi's CRM policy could consider integrating a coordinated plan for post-disaster action agreed in advance, while encouraging DRR and preparedness through capacity building and contingency plans. This will begin changing the approach to managing risks and disaster financing. Insurance-based financing mechanisms will not provide a cost-efficient risk financing option, and will not be perceived as valuable, if they do not come accompanied by local efforts to reduce risk and to prepare for disasters. This is just like the cost of our home insurance becoming prohibitively expensive or inaccessible if we do not get a safe to keep our most valuable jewelry.

Interviewing CRM stakeholders from different sectors of society also allowed to cross-reference information, and to validate facts expressed by interviewees. An example of this is the degree of the service that the KMD and current partners, and the potential its partnership with foreign Met offices, brings to the city.

Building relationships also implies sharing knowledge and information to better protect lives, livelihoods, and assets in a climate adaptation strategy. This is where the relationship between the local governments with the insurance sector becomes relevant. Fast evolving data technologies in several fields, particularly in weather and climate matters, aid the identification and pricing of risk for improved mitigation and adaptation strategies. Strengthening relationships with the insurance sector facilitates a fast, evidence-based decision making process for all stakeholders based on measurable threshold indexes thanks to accurate risk modelling software. This process results in the development of insurance mechanism suitable for a country's risk profile, which de-risk public finances, and allows pre-positioning financing that ensures that a plan for relief and reconstruction can be implemented when (or before) a



crisis hits. But again, it's necessary to understand the enabling conditions of insurance schemes that could provide benefits beyond risk transfer (Surminski et al. 2016)

Disasters are an opportunity for change. For Nairobi, it means challenging its ability to generate leaders committed to building relationships and changing aspects of the socio-political culture that may hide power interests. Unfortunately, such potential benefit might come at the expense of an overwhelming suffering of those bearing the effects of a broken system now.

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**Annex 1:**Question of perception:

- To what extent do you see a model like this benefiting other relevant departments in the municipality involved in DRM planning, budgeting, and enforcement?
  - [If the idea presented is not attractive:] What unsurpassable challenges do you see in the possible implementation this scheme?

<b>Adapted PESTLE – SWOT framework of analysis</b>	<b>Strength / Weaknesses</b>	<b>Opportunities / Threats</b>
<b>Political</b> –(politics of disaster) a) How do the politics of disasters play out in the context of the city? How are voters perceiving DRR actions vs relief? What are politicians prioritizing in CRM?		
<b>Financial</b> (budgeting and sources of disaster funding) a) How are you involved in the decision-making process of fund allocation for CRM? b) How are those funds ring-fenced so that the money budgeted is secured as promised, available when needed and used as needed? Use examples.		
<b>Socio-cultural</b> (collaboration, coordination, communication) a) Think of examples of implemented risk reduction and resilience programs for floods and earthquakes, what were the key aspects of their success? What areas seem to need improvement? b) How does your department participate in the city’s DRM decision-making processes? c) Who are your closest collaborators within the city and outside? d) What opportunities/challenges do you find in the idea to create a forum for enhancing the communication and discussion amongst different sectors of society about the city’s risk accumulation and disaster management?		
<b>Data technologies</b> (weather data technologies)		



<p>a) What are the positives and negatives of the current available weather data technology? How does the city work with the KMD in this field?</p>		
<p><b>Legal</b> (national and local DRM regulations)</p> <p>a) How do you evaluate the coordination and enforcement of DRM regulations between the city departments with national agencies?</p> <p>b) How do you evaluate the coordination between city departments and other collaborators, that enabled or undermined a timely and effective response?</p>		
<p><b>Environmental</b> (concerns of the city regarding climate change)</p> <p>How aware is your department of climate change issues affecting Nairobi? How does this affect your department?</p>		

**Annex 2:**

Insurance products for disaster risk financing schemes:

Loss adjustment & moral hazard ↑	<b>Indemnity</b>	Scheme pays on actual loss	Basis risk & payout speed ↓
		No basis risk	
		High cost of loss adjustment	
		Loss adjustment results in payment delays	
	<b>Modelled loss basis</b>	Model pays based on estimated loss from a catastrophe model	
		Basis risk should be low, but still real	
		Requires time and expense to build the catastrophe model	
		Catastrophe models are good for homogeneous exposures (i.e. domestic property), but less suitable for complex risks	
	<b>Parametric index</b>	A simplified version of a modelled loss	
		Formulae estimate hazard at certain reference points (e.g. wind speed, ground shaking, rainfall)	
		Additional formula estimate the loss resulting from this hazard	
		Lower basis risk than pure Parametric, but higher than Modelled Loss	
<b>Parametric</b>	An event occurs, payment is made		
	Simple and relatively predictable		
	Event definition made by a verifiable independent agency		
	High basis risk: smaller events may cause a large loss, a large event may conversely cause fewer losses		

**Annex 3**

**\* Please contact the author for further information on Annex 3.**



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