



Building Climate Resilience in Cities Through Insurance

September 2021



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ACKNOWLEDGMENTS

The authors wish to thank the following for their cooperation and valued contributions, including, in alphabetical order, Barbara Buchner, Bella Tonkonogy, Jorge Gastelumendi, Priscilla Negreiros, Vikram Widge. Thanks also to Angela Woodall, Elana Fortin, Caroline Dreyer, and Melina Dickson (CPI) for their editing, layout, and graphics.

The authors of this report would like to acknowledge the following partners and professionals for their valuable insights and inputs including, in alphabetical order: Amy Leitch (Arup), Biggy Nguyen (ICEYE), Daniel Stander (UN & Resilient Cities Network), Ekhosuehi Iyehen (Insurance Development Forum), Enrique Nunez (Conservation International), Gareth Morgan (City of Cape Town), Julieta Guanlao (Conservation International), Kathy Baughman McLeod (Adrienne Arsht-Rockefeller Foundation Resilience Center, Atlantic Council), Katie Sabo (AON), Lauren Sorkin (Resilient Cities Network), Michael Berkowitz (Resilient Cities Catalyst), Swenja Surminski (Grantham Research Institute on Climate Change and the Environment, LSE), and Yoon Kim (Moody's).

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DESCRIPTORS

SECTOR

Climate Finance

REGION

Global

KEYWORDS

Climate Finance Flows, Private Finance, Adaptation Finance, Tracking, Urban Climate Finance, City, Insurance, Urban Resilience, Risk



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[The Global Landscape of Climate Finance 2019](#), [Understanding and Increasing Finance for Climate Adaptation in Developing Countries](#), [Global Commission on Adaptation Background Paper: A snapshot of global adaptation investment and tracking methods](#), [2021 State of Cities Climate Finance Report](#), [An Analysis of Urban Climate Adaptation Finance](#)

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EXECUTIVE SUMMARY

As climate risks escalate and climate-related hazards become more frequent and costly, cities ought to increase their focus on ex-ante preparedness and resilience. Indeed, cities are often at the frontline of response to climate-related hazards because of their geography – often in low-lying coastal areas – and their concentration of population, infrastructure, and assets. Economic losses from climate-change related hazards are trending upwards. From 1980 to 1990, an average of 149 climate-related disasters occurred annually, posting economic damage estimated at about USD 14 billion each year. Between 2004-2014 this number had more than doubled, averaging 332 disasters and USD 100 billion in damages each year (UN FAO, 2016) with 2010 – 2019 being the costliest decade for natural, weather-related disasters (AON, 2020). At the same time, the global insurance protection gap is widening, meaning we are collectively underinvesting in climate-risk protection.

Cities can play a key role in closing the global protection gap by acting as insurance consumers and funding risk reduction, as stewards of risk reduction and management through policy and planning, and as promoters of knowledge about risk and insurance provision within the urban ecosystem. Insurance plays a crucial role in transferring and mitigating risk, but the benefits of climate-risk insurance for cities go beyond increasing financial and fiscal resilience to climate-related risks. Insurance can increase risk awareness, provide incentives for risk mitigation, and support economic growth and capital mobilization. Still, cities continue to underutilize insurance, with few including insurance components in their resilience strategies.

Indeed, increasing insurance penetration in cities has been a challenge due to factors such as the short-termism of insurance products, difficulty of incorporating future climate change into catastrophe models, lack of insurance knowledge and training for government officials, limited data availability on existing risks and vulnerabilities, as well as financial, legislative behavioral, and political barriers.

To address these, this report recommends to:

- Increase investment in risk assessment and technical capacity building to use risk assessments effectively.
- Provide incentives to local governments for the assessment of these risks and understanding the broader landscape of risk management plans.
- Address implementation barriers.
- Develop an effective resilience plan for the city along with the insurance industry.
- Engage the insurance sector around urban needs, capacities, and data.

The combined impacts of Covid-19 and the current onslaught of climate shocks and stressors emphasizes the need for the reimagining of a vision for protection systems for the future – where people are better protected from extreme risk. Insurance is a part of that protection system in cities to respond to climate risks as extreme heat and other urban climate shocks and stressors force us to build protection systems for the future.

1. INTRODUCTION

1.1 THE URGENT NEED TO BUILD RESILIENCE IN CITIES

The frequency and magnitude of climate change-related hazards are increasing – with a five-fold increase over the past 50 years alone (WMO, 2021). Increasingly frequent and severe hazards like heatwaves and floods have caused over USD 3.6 trillion in losses and killed more than two million people in these five decades (WMO, 2021). Totalling approximately USD 175 billion in damages in the 1970s, climate-induced costs have surged to an estimated USD 1.4 trillion in the 2010s; 2019 being the costliest year for natural, weather-related disasters (AON, 2020). This trend shows no signs of slowing down. Already, the first half of 2021 has seen historic winter storms, flooding, a deadly heat dome, and a dramatic wildfire season across North America, as well as record-breaking floods across Germany, India, and China. These climate-induced risks present increasingly grave dangers to lives and livelihoods around the world.

The effects of climate-related hazards are often exacerbated in cities because of the concentration of population, infrastructure, and assets, as well as continuing urban expansion. Moreover, many major cities are located in low lying coastal areas, factors that to this day facilitate trade and development, but that now place cities at greater risk of current and projected climate risks such as increased coastal storm events, flooding, coastal erosion, and sea-level rise. As rates of urbanization continue to increase, particularly in low- and middle-income countries – cities need to focus on building resilience to climate change related hazards.

Economic losses from climate-change related hazards are trending upwards, all while the global insurance protection gap widens. The global insurance protection gap- the difference between the economic loss of a catastrophe and the amount that is covered by insurance- reached a record high of USD 1.4 trillion in 2020, with 76% of natural catastrophe losses uninsured (Artemis, 2020). While the insurance gap has lessened slightly in recent years in high-income countries (Munich Re, 2021), there is still a considerable gap in low- and middle-income countries because of lower insurance penetration levels and high vulnerability to natural disasters. In these countries, natural hazards and poor infrastructure are estimated to cost households and firms USD 390 billion a year (World Bank, 2019). Moreover, economic losses from disasters remain vastly underreported in low-income countries (13% compared to 53% in high-income countries).

Beyond economic losses, natural hazards put lives at stake, particularly in low- and middle-income countries. While an average of 130 deaths per million occurred in disaster-affected areas in developing countries, high-income countries saw a relatively lower figure of 18 per million (UNDRR, 2018). Nonetheless, despite increasingly costly

climate-induced economic damages over the last five decades, the annual death toll has decreased by over 60%, largely thanks to improvements in more effective warning systems (WMO, 2021).

Cities are often at the frontline of response to climate-related shocks and stressors and hold significant potential to build resilience in the face of these risks. The increased frequency and severity of urban climate risks and persistent challenges in climate risk management contribute to the increasing protection gap in cities. The IPCC warns that projected climate change will result in significant urban climate risks including amplified heat waves, extreme weather volatility, floods, droughts, coastal inundation, and an increase in vector borne diseases (IPCC, 2014). CDP data indicates that in 2018, 85% of cities reported major climate-related disruptions, including flash and surface flooding and extreme weather events like heat waves and droughts (CDP, 2019).

With all these hazards in mind, cities around the world are falling behind in measuring and adapting to climate-induced risk. Challenges in risk management derive in part from a lack of information and technical capacity in risk modeling for under-insured regions, especially when key data inputs on hazards, exposures, and vulnerabilities are missing. Many municipal governments are not aware of the status of insurance coverage among households and businesses within their jurisdiction, let alone the full inventory of city assets that require protection. Without a robust baseline understanding of underlying vulnerabilities, the implicit policy choices of a government can leave large gaps in coverage and exacerbate inequalities (Oxfam, 2018).

1.2 DEFINING ‘CITIES’ AND REPORT STRUCTURE

This report focuses on the role of insurance in addressing climate risks in cities. The objectives of the report are to provide a common understanding of the current role of the insurance sector in the urban space related to climate resilience and to identify barriers and opportunities for closing the protection gap for climate risk.

When referring to ‘cities,’ this paper is referencing the role of municipal governments in addressing climate risk through insurance and resilience building efforts. This approach aligns with categorization of ‘cities’ in The Cities Climate Finance Leadership Alliance’s (The Alliance) 2021 State of Cities Climate Finance report, which analyzes both how city governments can encourage the direction of finance towards low-carbon and climate-resilient investment in urban areas¹ and also looks at the wider urban ecosystem including households, small and medium sized enterprises (SMEs) and other stakeholders within the urban area, and how external stakeholders like development financial institutions and national governments can support cities.

¹ The 2021 State of Cities Climate Finance Report examines the current state of urban climate investment, the barriers to reaching the needed investment levels, and the steps to overcoming these challenges. Produced by the Cities Climate Finance Leadership Alliance (the Alliance), the report contributes to the Alliance’s mission to mobilize city level climate finance at scale by 2030. Part 1 features the Landscape of Urban Climate finance and Part 2 features the Enabling Conditions for Urban Climate Finance. Available at: <https://www.citiesclimatefinance.org/2021/06/2021-state-of-cities-climate-finance/>

This report is structured as follows:

- **Section 2:** Introduces the role of insurance mechanisms in addressing climate risks in cities and summarizes the role that cities play with regards to insurance.
- **Section 3:** Highlights opportunities for non-city actors to work collaboratively to develop further insurance-based solutions. Case studies are provided to highlight opportunities and lessons learned from innovative insurance schemes.
- **Section 4:** Outlines key barriers preventing cities from utilizing more insurance solutions.
- **Section 5:** Conclusion and recommendations for next steps for future research.

2. USES OF INSURANCE IN AND BY CITIES TO ADDRESS CLIMATE RISK

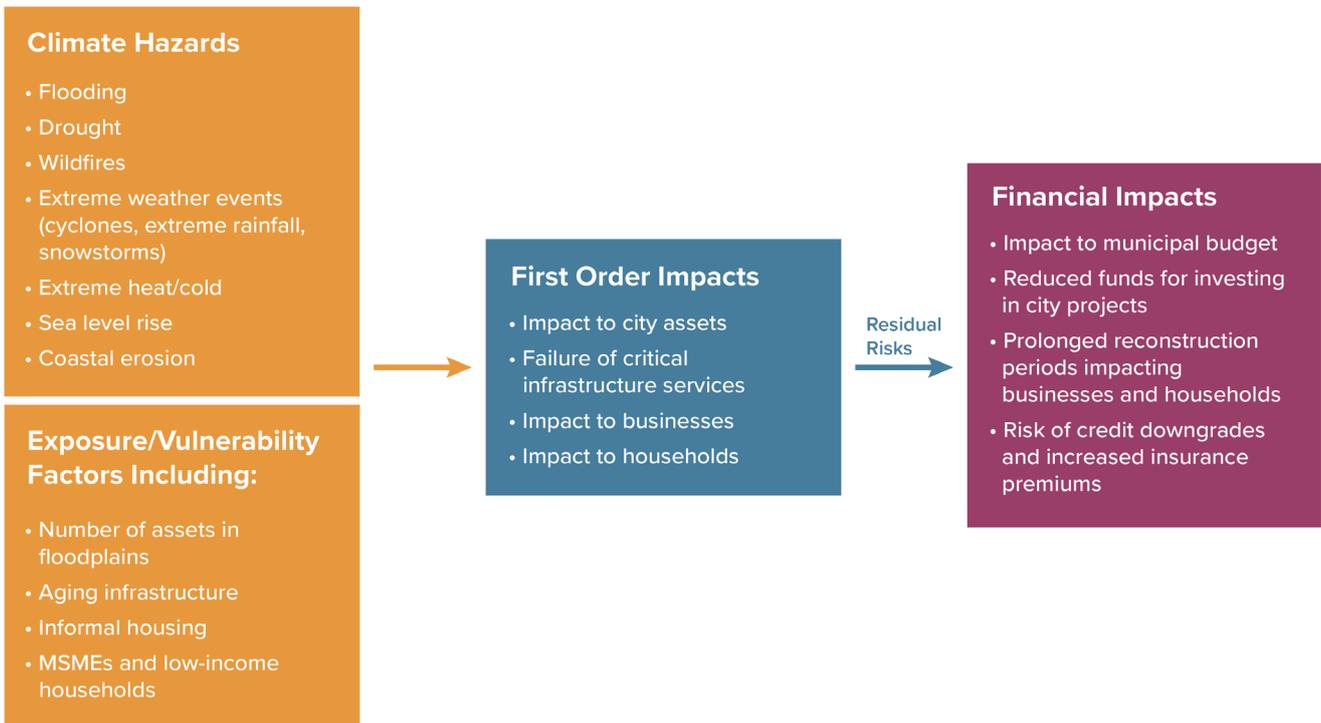
2.1 INSURANCE IS A CRUCIAL TOOL FOR BUILDING RESILIENCE

Insurance plays a critical role in terms of both transferring and reducing risk and is an important, yet underutilized, component of the resiliency building toolkit. The primary aim of insurance is to deliver financial and fiscal resilience by addressing the residual risks associated with the impacts of shocks and stressors that go beyond a system's existing capacity to absorb those risks. Additionally, insurance can help reduce risk by increasing risk awareness, incentivizing risk reduction, and supporting economic development. It is important to note that other traditional insurance products (see Table 1) as well as natural disaster insurance products can go a long way in building financial resilience to respond to climate change induced disasters in cities. These products, whilst not directly tagged as 'climate-change' related, can double up as insurance against climatic hazards.

Ideally, a city has the capacity to respond and recover quickly from most shocks and stressors without incurring huge economic losses. However, when significant economic uninsured losses are incurred from ever more frequent high severity climate risk events, these can pose serious and ongoing financial challenges for cities. With ever-narrowing preparedness windows, cities ought to increase their ex-post resilience. Municipal governments that do not build sufficient climate resilience may experience increased (1) climate-related losses (2) risk of credit rating reductions (3) city borrowing costs (McKinsey, 2021) as well as a loss of public trust.

Other associated financial impacts of climate-hazards include depleted municipal budgets, reduced capacity of municipal governments to undertake necessary investments, and impact on urban households and businesses due to prolonged recovery and reconstruction periods (Figure 1). In short, insurance is a necessary component of any robust resilience strategy to ensure that cities can bounce back from disasters in a financially sustainable manner.

Figure 1. Causal Chain from Climate Hazards to Financial Impacts



The benefits of insurance go beyond ex-post financial protection from disaster events. The process of designing insurance products and developing appropriate risk pricing can unlock many benefits:

- **Increased risk awareness:** The intent to increase insurance coverage can lead to increased data and modeling capacities, increased understanding of climate risk exposures, improved transversal action between municipal departments, and generation of expertise that can be useful for a range of other policies and prioritizing investment needs.
- **Incentives for risk reducing behavior:** Insurers can incentivize risk reducing behaviors from individuals and governments. Directly, insurers can create products that are tied with specific resilience building actions. For instance, climate-proofing specifications and enabling adoption of building codes may be a precondition to insurance policy provision. Insurance products may also incentivize resilience measures by linking such actions to reduced premiums.
- **Support economic growth and capital mobilization:** Studies have shown that growth of insurance markets has a significant positive relationship for economic growth, through channels such as improving financial stability, mobilizing savings for investment, and relieving pressure on public budgets (Insurance Information Institute, 2018). Innovative risk-sharing and financing mechanisms can also help leverage private capital in insurance solutions to invest in upfront risk reduction measures.

As outlined throughout this analysis, **insurance is a useful tool to manage climate risk in cities, but it is just one element of the larger toolbox of solutions necessary in cities to address increased climate-related risk.** Insurance instruments are intended to serve as the backstop for any residual risk that cannot be eliminated through risk reduction

measures; risk reduction must occur alongside insurance, and policymakers must ensure that insurance mechanisms do not replace other investments in physical climate resilience building.

The combined impacts of Covid-19 and the current onslaught of climate shocks and stressors emphasizes the need for a vision of protection systems for the future – where people are better protected from extreme risk. Insurance is a part of that protection system in cities to respond to climate risks as extreme heat and other urban climate shocks and stressors force us to build protection systems for the future.

2.2 INSURANCE MECHANISMS AND PRODUCTS RELEVANT TO URBAN STAKEHOLDERS

To assess the landscape of insurance products available to address urban risk, it is necessary to assess the universe of actors, assets, and activities operating in the urban space that require protection. Insurance policyholders can be broadly categorized across three categories (Insurance Index Forum, 2021):

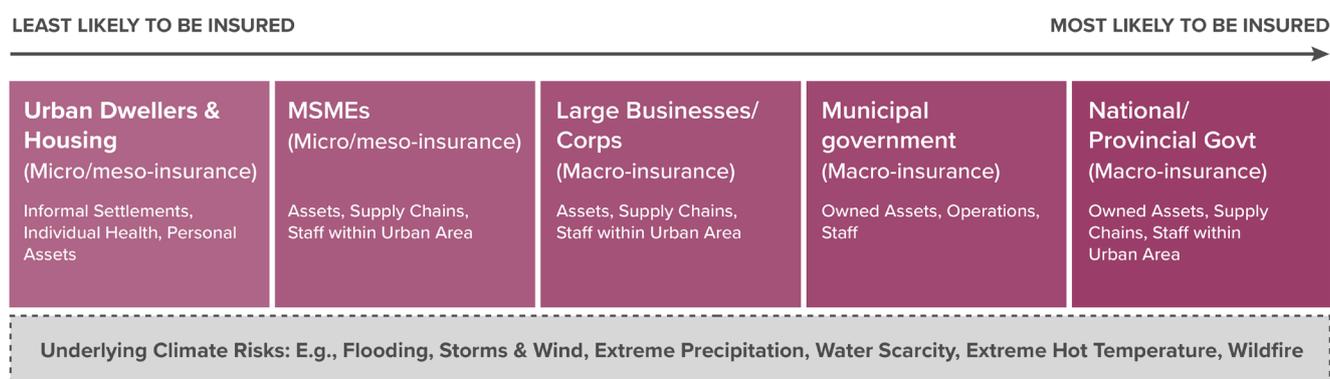
- **Micro-insurance:** direct insurance of individual or small business policyholders. Micro-insurance has increased especially in developing countries but remains modest in its reach relative to its potential.
- **Meso-insurance:** insurance through an aggregation of individuals (for example an organization supporting a farmer collective), where individuals are indirect beneficiaries, receiving payments through the organization.
- **Macro-insurance:** insurance where the policyholder is a public entity or large private entity paying premiums for payout in the case of an event. In this instance, payouts go towards large-scale recovery and reconstruction efforts.

Individuals tend to underprepare and are liable to underestimating their exposure to climate-related physical risk in part due to near-term and optimism bias. In some cases, individuals may also not fully understand the coverage provided by their current insurance policies and thus may be unknowingly unprotected. For example, many standard homeowners' insurance policies do not cover flood damage. City governments and entities can play a critical role both in helping individuals understand their level of exposure and in encouraging them to take out an insurance policy against climate-related physical risks, as well as invest in risk reducing measures.

Figure 2 illustrates the categories of insured groups that could receive micro-, meso-, or macro-insurance and aligns them from least to most likely to currently have access to insurance to address climate risks in urban areas. Actors operating within an urban setting noted in this analysis include urban dwellers, micro-, small-, and medium enterprises (MSMEs), large businesses and corporations, municipal governments ('cities'), and provincial and national governments. Cities may directly sponsor insurance programs to expand coverage to vulnerable groups, undertake resilience measures to reduce insurance premiums for policyholders, or collaborate with insurance providers

to develop innovative and affordable products and launch campaigns to raise risk awareness.

Figure 2. Insurance Spectrum for Actors Operating in Urban Areas



Across the spectrum of actors operating in urban areas who are potential insurance policy holders, Table 1 summarizes the type of insurance instruments available in cities.

Table 1. Overview of Insurance Instruments and Providers Relevant to Urban Climate Risk

Insurance Instrument	Insurance providers
<p>General Insurance: Offers property, assets, and liability coverage. An insurance company guarantees compensation for losses or damages sustained by a policyholder. General insurance is more suited for the expensive reconstruction phase.</p>	<ul style="list-style-type: none"> • Corporate insurers • National governments • Re-insurers
<p>Parametric Insurance: Offers pre-specified payouts based upon a trigger event. Parametric insurance can cover property, assets, and operations. Parametric insurance is more suited for immediate disaster response.</p>	<ul style="list-style-type: none"> • National governments • Development finance institutions • Government coalitions (e.g., the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and African Risk Capacity (ARC)) • Re-insurers
<p>Disaster liquidity product: Contingent financing line for immediate liquidity. For example, Catastrophe Deferred Drawdown Option – Cat DDO is a disaster liquidity product.</p>	<ul style="list-style-type: none"> • Development finance institutions
<p>Government-owned insurance schemes: Some countries have publicly owned institutions offering property catastrophe insurance or have government-owned insurance to provide agricultural insurance.</p>	<ul style="list-style-type: none"> • National governments
<p>Risk pooling: Smaller, vulnerable countries such as island states may form multi-sovereign risk pools to collectively purchase insurance-based products. Risk pools include the CCRIF and ARC.</p>	<ul style="list-style-type: none"> • National governments • Development finance institutions

Box 1. Manila, Philippines & RISCO (Climate Finance Lab, 2020)

The Philippines is at risk of earthquakes and volcanic eruptions as well as climate-related hazards including typhoons, floods, droughts, and landslides. The national government has recognized the impact of these disasters and has created financial preparedness strategies at the national, local, and individual levels. Several insurance products are available to actors in the city of Manila in the Philippines including an insurance-linked product to capitalize on mangrove benefits discussed here and a city-level insurance pool discussed in Section 2.B.I.

[The Restoration Insurance Service Company](#) (RISCO) is a first-of-its-kind social enterprise that overcomes existing barriers to mangrove protection. RISCO connects the adaptation and mitigation values of mangroves to the beneficiaries of these values, most of whom do not have the knowledge or resources needed to protect mangroves—including insurance companies. RISCO engages in mangrove conservation and restoration in partnership with local communities, including in urban settings, selecting sites based on modeled values of where mangroves are likely to provide high flood reduction benefits. RISCO aims to generate revenues based on modelled flood reduction benefits, with one option being insurance companies paying an annual fee for these services. RISCO will also generate and sell blue carbon credits to organizations seeking to meet voluntary or regulatory requirements.

2.3 THE ROLE OF CITY GOVERNMENTS IN ADDRESSING CLIMATE RISK AND UTILIZING INSURANCE-BASED FINANCING MECHANISMS

Municipal governments serve in a variety of roles to protect government assets, residents, and businesses from the impacts of climate hazards. By pursuing insurance solutions, cities can not only build resilience to climate change-related physical risks but also reduce climate-related losses, reduce the risk of credit rating downgrades, and even reduce the cost of borrowing (McKinsey, 2021). Moreover, because climate-related physical risks are highly context dependent, municipal governments are more likely to understand the needs of their communities and the potentially adverse impacts that climate hazards can have on such communities than other national entities. Many municipal governments also have experience engaging communities and city stakeholders that gives them an advantage in designing policies directed at behavior change.

Cities can play multiple roles that can be divided into ‘cities as providers’ and ‘cities as stewards.’² As providers, city governments can primarily purchase insurance as policy holders. As stewards, cities and/or parallel subnational governmental authorities can manage risk through policy, planning, and regulation, and convene and build stakeholder coalitions to encourage insurance provision.

² Authored by the World Bank, Part 2 of the 2021 State of Cities Climate Finance report analyzes enabling frameworks and presents solutions for mobilizing climate finance for low-carbon, climate-resilient urban development pathways. Cities can impact climate outcomes by leveraging their roles both as providers of infrastructure and services (what cities pay for) and as stewards with their capacity to plan, regulate, convene, and champion (what cities influence). Available at: <https://www.citiesclimatefinance.org/wp-content/uploads/2021/06/2021-State-of-Cities-Finance-Part-2.pdf>.

Figure 3. The Key Roles that Cities Play to Mitigate Risk and Encourage Insurance Provisioning

CITY AS PROVIDER	CITY AS STEWARD	
Consumers of Insurance	Manage Risk: Policy & Planning	Convene and Champion
<ul style="list-style-type: none"> • Pool risk • Purchase parametric insurance • Insure public assets • Raise funding for risk management 	<ul style="list-style-type: none"> • Measuring risk and hazards • Adaptation/resilience planning • Reform land use and building codes 	<ul style="list-style-type: none"> • Convene experts • Leverage outside support to measure and manage risk • Lobby other spheres of government for improved insurance uptake

Although there are varying factors between cities in their capacities to play all of these roles, cities of all types are uniquely suited to engage various stakeholders on the challenges presented by climate-induced risks and the opportunities to address those by using insurance. Various case studies will be highlighted to demonstrate progress by a range of cities, with key barriers articulated in section 4 of this report.

2.3.1 CITIES AS INSURANCE CONSUMERS AND FUNDERS OF RISK MANAGEMENT

Cities can pool their risk to enhance recovery financing. Risk pooling is one of the most effective methods for hedging risk among various entities that have differing characteristics of vulnerability to climate hazards. Often designed with the coordination of a regional or national-level authority, disaster risk pooling is utilized by many sub-sovereign authorities and insurance providers.

For example, the Philippine City Disaster Insurance Pool is part of a ‘local’ level strategy to address the need for rapid access to early recovery financing. The design of this insurance pool was led by the Philippines Department of Finance and supported with technical assistance from the Asian Development Bank. Ten cities participated in the design of the pool and were selected based on factors including disaster risk and risk management governance, geographic location, and data availability. The pool is designed to provide post-disaster financing based on an insurance model and features payouts determined by the physical features of the natural hazard event (i.e., wind speed). The Pool is part of a broad local level strategy to address the need for rapid access to early recovery financing after a hazard event and can function in parallel with additional instruments including RISCO (ADB, 2018).

Cities can purchase parametric insurance. Among the numerous risk-transfer insurance products on the market, parametric insurance is increasingly being seen as an effective mechanism to address climate risks (MMC, 2018). This model of insurance is particularly germane to cities given its relatively simple structure, quick payouts when risk

thresholds are reached, and effectiveness at focusing on specific hazards (i.e., flood or typhoon) given the complexity of multi-hazard risk modelling. Such schemes would likely be most successful with support from a regional or central government authority given the need for multi-governmental coordination. In low-and middle-income countries, concessional finance support can also effectively help cover associated premiums.

As the owner of critical infrastructure and other public assets, municipal governments must insure their own assets against climate risks. Holding insurance policies for critical assets and services allow cities to rebuild and recover quickly without incurring huge losses that would strain the operating or expense budget of a city. Many cities do not have a comprehensive asset registry nor understand the status of exposed and vulnerable infrastructure, which also means that insurance policies may not cover the full extent of damages incurred. For instance, the Rim Fire in California in 2013 cost the City & County of San Francisco (CCSF) USD 31.5 million in damages, of which CCSF was only able to recover USD 3.5 million in insurance claims and USD 5.1 million in eligible disaster assistance (CCSF, 2016).³

Municipal governments can pursue catastrophe bonds. Catastrophe bonds are high-yield bonds, sponsored by municipal governments and issued by reinsurance companies. These bonds pay out in the event of a catastrophe and are triggered when specific parametric triggers are met by a disaster. Catastrophe bonds can be an attractive option for cities because they fill the temporal gap left by traditional insurance companies' focus on assessing risk on an annual basis. For municipal governments seeking to establish long term resilience strategies, catastrophe bonds can provide long term protection against risks by filling this gap.

However, catastrophe bonds can introduce a moral hazard into the ecosystem and disincentivize investment in resilience. To mitigate this risk, firms like Swiss Re have begun to tie cat bonds with rebate programs that reward cities that invest in building resilience. Swiss Re and Re:partners' instrument, Re:focus, assesses the degree of risk reduction for a given protection measure and then reduces the rates that a municipality must pay its bondholders, reflecting the reduced likelihood that payout from these bonds will be triggered (Re:focus, 2017).⁴

Cities can draw on revenue streams to establish funds for risk management. In Medellin, Colombia, the Municipal Fund for Emergency and Disaster Risk Management was created in 2020 under the Department for Disaster Risk Management. The Fund will be replenished through 1% of property tax and industry and commerce tax, equivalent to around USD 4 million per year. While the drafting of the action plan is still underway, funds are expected to go towards knowledge sharing and risk reduction measures, as well as intentionally reserved for financial protection. The fund will also be used to enable Medellin to become a policyholder in a parametric flood and earthquake product and indemnity landslide protection launched by the Insurance Development Forum (IDF, 2021).

³ The Insurance Development Forum published a comprehensive guide, which identifies the process and key practical considerations for insuring public assets. Available at: <http://www.insdevforum.org/wp-content/uploads/2020/08/Practical-Guide-to-Insuring-Public-Assets.pdf>

⁴ In many cases, cities are not the largest asset holders with infrastructure at risk within an urban area, yet have a responsibility to protect businesses and communities at risk. Damages to privately held utilities or other assets under public-private partnership arrangements are inevitably linked to the city's economic and fiscal stability. Cities can plan a key role as intermediaries or sponsors of instruments like catastrophe or resilience bonds, bringing in other risk-exposed authorities. In other cases, the city may be less directly involved in the bond issuance themselves, but play a critical role in the bonds' rating, indirectly benefiting the city's long term fiscal stability.

Box 2. Quintana Roo, Mexico: Mexican Reef Protection Program: Parametric Insurance and Nature-based Solutions (InsuResilience, 2020)

Key actors in the program:

- **Demand-side:** Subnational government of Quintana Roo and Coastal Zone Management Trust (Formed by The Nature Conservancy and local hospitality)
- **Supply-side:** Hannover Re; Global Parametric Natural Disaster Fund; Swiss Re

Private, public, and international stakeholders established The Mexican Reef Protection Program in 2018. It is the world's first product to support a nature-based solution by protecting a coral reef. The Program provides the funds for rapid restoration post-disaster, enhancing and protecting an environmental asset, while also mitigating the impact to the local economy in the state of Quintana Roo on the Yucatán Peninsula in Mexico; a heavily tourist-dependent region.

The renewal of the landmark Mexican Reef Protection Program was led by Global Parametrics alongside Grupo Financiero Banorte and Hannover Re. It structured a parametric solution that pays out to support the rapid restoration of a key section of the Mesoamerican Reef following a tropical cyclone event. Hannover Re acted as the reinsurer for the solution and shares the risk with the Global Parametrics Natural Disaster Fund (NDF).

2.3.2 CITIES AS STEWARDS OF RISK MITIGATION THROUGH POLICY AND PLANNING

Cities have various policy and planning instruments at their disposal to lower exposures and vulnerabilities to climate risk and enhance systemic resilience in the face of climate hazards. The first step in a city's process to engage with insurance is to measure its risks and understand its vulnerabilities.

Cities can play a central role in measuring risks and hazards. In a recent survey of 812 cities by CDP, nearly half of the cities surveyed have not undertaken a climate risk and vulnerability assessment, demonstrating a lack of knowledge regarding climate hazard risk to public and private assets, lives, and livelihoods (CDP, 2020). Notably, the lack of risk modeling, public asset registries, and general knowledge of climate vulnerability was noted as a consistent obstacle to insurance coverage by several of the insurance sector representatives interviewed for this report.⁵

Beyond insurance, comprehensive appraisals of climate risk are needed to adequately respond with actionable policies and plans. In some cases, hazard and vulnerability assessments can unlock access to funds to support climate resilience. For example, New York City developed a Hazard Mitigation Plan which must be updated every five years to access Federal Emergency Management Authority (FEMA) funds for future recovery from impact (Lloyd's, 2020).

Climate adaptation plans are an effective way for cities to concretely enhance resilience and an opportunity to incorporate insurance solutions into a wider adaptation and resilience framework. Long term adaptation planning requires understanding of both singular and interdependent hazards, prioritization of such risks, and a valuing of the benefits and costs of reducing those risks. Out of the 800+ cities

⁵ In developing this report, the authors interviewed various insurance industry representatives and other stakeholders engaging with insurance companies including AON, ICEYE, AXA Climate, and IDF.

surveyed by CDP, approximately 450 cities have created adaptation plans that both recognize and plan for climate risks (CDP, 2020). While this demonstrates considerable foresight by many of the surveyed cities, 43% of the cities still have no adaptation plan despite over 90% reporting that they face growing climate hazards. Beyond the adaptation plans themselves, most cities are still not putting forth explicit insurance-based solutions. As discussed further in Box 4, insurance solutions were mentioned in less than 40% of City Resilience Strategies developed in the Resilient Cities Network despite the critical role they play in both fiscal and physical urban resilience.

One key opportunity in adaptation planning is incorporating findings into the long term spatial and strategic planning of a city. For example, since 2009, Johannesburg has been utilizing its climate adaptation plan to further integrate known risks into strategic planning development. This has helped identify various means of financing adaptation investments and an integrated Information Management System that is consistently updated to create climate-informed risk assessments and cost-benefit analyses (Lloyd's, 2020).

Such planning can also strengthen the fiscal capacity of cities and enhance their creditworthiness which in turn supports a better enabling environment for insurance provision and resilient infrastructure investment. For example, the city of Norfolk, Virginia had its credit rating upgraded to AAA by S&P, citing its resilience strategy and actions as part of the reason. S&P explicitly stated in the ratings upgrade that it “applauded the City’s resilience efforts to address sustainability, climate change and sea level risk in its long-term financial and capital planning efforts and its development regulation” (Norfolk, 2020).

A few other notable examples of policy and planning levers that cities can use to incentivize resilience include:

- **Reforming zoning laws** to discourage building in high-risk areas that may be exposed to hazards like flooding (McKinsey, 2021).
- **Providing tax benefits** to incentivize risk mitigation. For example, Honolulu’s City Resilience Strategy states a policy to help fund shoreline preservation and beach nourishment at a localized scale by granting property tax relief to private property owners who pool resources to effectively manage their coastal systems (Oahu Resilience, 2019).
- **Building codes** that mandate homeowners, developers, and real-estate financiers to internalize the risks of hazard impact from things like flooding, high winds, extreme heat, and cold.

Together, these efforts can lead to a triple-win scenario in which multiple urban stakeholders benefit from strategic resilience planning, highlighted in Box 3.

2.3.3 CITIES AS CONVENERS AND CHAMPIONS TO ENCOURAGE KNOWLEDGE ABOUT RISK AND INSURANCE PROVISION

Box 3. Developing Resilience Zone Strategies (ClimateWise, 2017) and the Triple Dividend of Resilience (Surminski & Tanner, 2016)

A series of workshops developed by CERES, ICLEI, and ClimateWise brought together key public and private stakeholders to realize the shared opportunities when investing in resilience. The workshop and subsequent research helped develop a ‘Resilience Zone’ strategy with four pillars:

1. Asset-focused risk management – Mechanisms to support household and enterprise level action.
2. Local area risk management – Mechanisms for risk management and transfer at the scale of the local area.
3. Resilience upgrading – Risk reduction measures to enhance performance and benefits.
4. Communicating resilience benefits – Ensure understanding of benefits and effective use of the new ‘Resilience Zone’.

If successfully utilized, this approach could ensure the realization of the ‘Triple Dividend of Resilience.’ This holistic understanding and communication of the variety of benefits stemming from effective resilience planning builds a stronger business case for all by:

Avoiding Losses	Save lives and livelihoods, reduce damages and associated economics losses.
Unlocking Economic Potential	Reap the benefits from capital investment, land value increases, and potential for enhanced municipal credit rating.
Supporting Co-benefits	Resilience infrastructure and planning can yield co-benefits in the form of ecosystem services, public transport potential, social cohesion, and other.

The Triple Dividend of Resilience - Case Study, New Orleans (Auguste, 2018): In the aftermath of Hurricane Katrina in 2005, New Orleans became a test case for implementing resilience principles when recovering from disaster. In 2016 the Rockefeller Foundation and 100 Resilient Cities brokered a deal between Veolia, Swiss Re, and the city of New Orleans to (1) reduce the vulnerability of the city’s water infrastructure, and (2) encourage fiscal resilience by facilitating post-disaster infrastructure recovery. Together, infrastructure operator Veolia and re-insurer Swiss Re completed a financial risk assessment of the city’s ~200 water infrastructure assets, totaling around USD 1.7 billion, to eventually work towards enhancing physical resilience to water infrastructure assets and improved rate-adjusted premiums.

Municipal authorities play an important role in attracting, supporting, and convening a range of stakeholders to enhance urban resilience. These actors include insurance companies, academic institutions, SMEs, local community groups, governmental authorities, and DFIs.

Cities can bring in external partners to help measure and price risk. With the insurance sector increasingly engaged in global climate change initiatives like the [Coalition for Climate Resilient Investment](#), [Insurance Development Forum](#), and [InsuResilience](#), cities have an opportunity to participate in initiatives to help quantitatively model risk and measure the vulnerability of their public assets. Although these initiatives have

had limited direct engagement with cities so far, interviews with representatives of these coalition groups revealed an appetite for subnational collaboration. International alliances such as these can further their impact by engaging directly at the subnational level.

For example, the [Zurich Flood Resilience Alliance](#) (ZFRA) is a global, multi-sector partnership that supports communities in measuring and strengthening their resilience to flood risk. While ZFRA does not have an explicit urban focus, researchers and partners have worked with 110 communities in nine countries, including large towns and small cities, to measure resilience based on ‘the five capitals’ of human, social, physical, natural, and financial capital, along with associated indicators (Zurich, 2021).

Cities can convene a variety of experts to understand systemic risk at the local level.

Cities have complex and dynamic vulnerability profiles. The risk of climate hazards is layered on top of diverse social and economic dynamics that unevenly spread the realized impact of a given shock or stressor. While a climate disaster like a hurricane (exacerbated further because of climate change) may play out at the regional or national level, impacts can vary widely at the local level. Hence, municipal authorities play an important role in convening or elevating a variety of stakeholders that can speak to diverse risks and needs in a given community. For example, the city of London has created the London Climate Change Partnership, in which public, private, and community sectors come together to discuss adaptation and resilience to extreme weather in London. The partnership is comprised of various working groups including a food security and climate change working group, and another focused on climate resilience and social justice (Lloyd’s, 2020).

Cities are the best poised entities to help the insurance industry design products that adequately price risk and adapt to the needs of the policy holders. Climate-related physical risks are highly context dependent and so a ‘one-size’ fits all approach to designing insurance products will do little to close the protection gap.

Cities can play a role in working with the insurance industry to:

- Provide better data that can help insurers more accurately price risk.
- Build better models and adequately value adaptive measures taken by city dwellers and institutions.
- Design insurance products tailored to different types of physical risk.

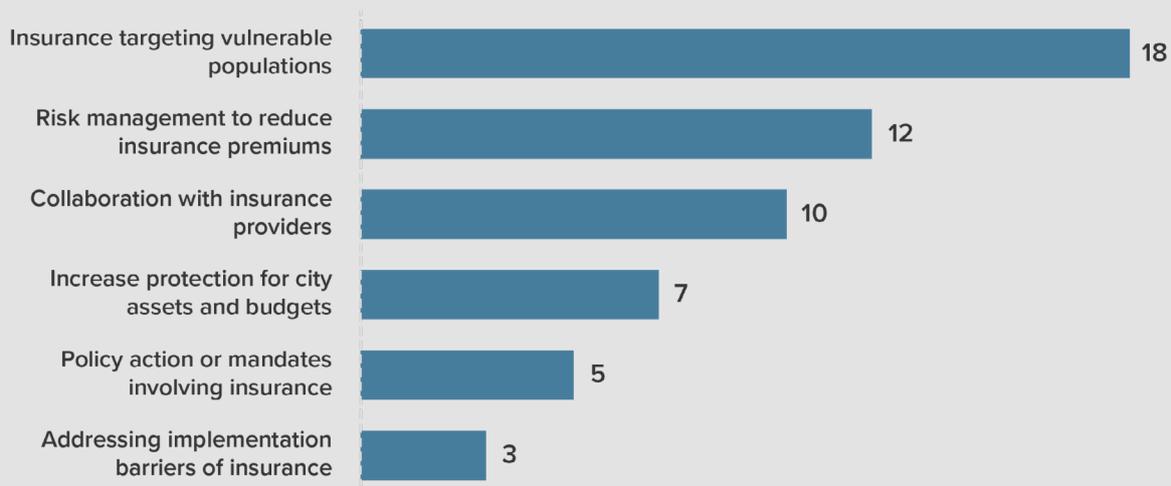
This partnership can benefit the insurance sector as city governments can be a significant source of information and should be seen as key partners. For example, when analyzing risks for private clients, insurance clients often realize that they cannot assess risks individually to their assets without understanding the broader risk landscape and understanding their jurisdictions’ risk management plans. In this case, increased data management and risk modelling can benefit multiple parties.

Box 4. City Resilient Strategies and Insurance⁶

More than 94 cities worldwide have joined the Resilient Cities Network since its launch in 2013 (initially launched as 100 Resilient Cities) and 86 resilience strategies have been published to date. These strategies are the product of multiple years of extensive stakeholder consultations across public and private sectors, involving surveys on risk perceptions and a comprehensive review of all resilience-related initiatives to identify gaps and opportunities for further resilience measures. Key findings from analyzing these resilience strategies by this report's authors include:

- Most cities demonstrated a lack of understanding of the financial risks involved with the identified climate risks, with many noting that city investments and budgets do not specifically consider the likely impact of climate disasters. Only a fifth of resilience strategies included damage estimates of climate-related disaster events or mentioned plans to investigate the cost of inaction.
- Cities are at the early stages of understanding climate hazards and vulnerabilities. All resilience strategies listed actions already taken or planned to better understand the full extent of climate-related hazards, exposures, and vulnerabilities within the city. Many of these actions involved developing risk maps to provide a comprehensive assessment of the spatial relationship between major shocks and the vulnerabilities of different groups to the shocks.
- Insurance-related solutions were explicitly mentioned in just 40% of city resilience strategies, and those mentioned focused primarily on building physical and social resilience, with limited attention to financial resilience. Where insurance-related solutions were mentioned, it was largely with respect to increasing the resilience of vulnerable groups or reducing the cost of insurance premiums for citizens, rather than promoting financial resilience of the city's own financial health. Most cities are not yet aware of the full financial impact posed by climate change and are just at the beginning stages of understanding these risks.

Figure 4. Insurance related solutions featured in City Resilience Strategies:



⁶ Authors of this report analyzed 55 city resilience strategies and interviewed the Executive Director of Resilient Cities Network to draw out these key findings.

In all, cities are well poised to engage the insurance sector at this level and both can benefit from this collaboration. Cities will benefit from more accurate risk pricing and higher coverage in the event of disasters. Insurers and underwriters will benefit from the increased transparency and clarity in their risk assessment models, which will in turn reduce their exposure to climate-change risks.

3. NON-CITY ACTORS ARE CONTRIBUTORS TO REDUCING THE PROTECTION GAP

By and large, cities have not been recognized as key actors when it comes to financing resilience and engaging with the insurance sector with regards to climate change-induced risk. There are a wide range of other actors that play a critical role in supporting diverse stakeholders in cities to protect livelihoods, lives, and assets and supporting a rapid recovery from climate impact. While there are many actors involved, this section provides a basic overview of the role of national governments, development finance institutions (DFIs), and insurance providers as investors.

3.1 NATIONAL GOVERNMENTS

National Governments play a pivotal role at the micro, meso, and macro scale of insurance by purchasing and providing insurance and setting policies and regulations to enable insurance provision - to name a few.

National governments have several tools at their disposal to protect their own financial viability and that of other subnational authorities. As significant holders of public assets and with a political mandate to protect their citizens, national governments have a vested interest in insuring their assets for damages and financing emergency disaster response. The table below, from a recent GCA report on climate insurance opportunities (GCA, 2019), highlights the four key ways in which governments can enhance their financial resilience in light of climate change.

Table 2. Tools that can be used by National Governments to Enhance Fiscal Resilience

Tool	Description
<p>Reconstruction Product</p>	<p>For reconstructing critical infrastructure (energy, hospitals, schools, water supply)</p> <p>e.g., FONDEN Mexico was a state fund that covered federally owned infrastructure and the cost of reconstruction. The fund was also used to purchase coverage from the global reinsurance market. If losses were above a pre-agreed threshold, the government received a payout to support reconstruction (World Bank, 2012).⁷</p>

⁷ FONDEN has since been dissolved, but lessons can be captured for future utilization.

Tool	Description
<p>Disaster Liquidity Product</p>	<p>Covers immediate post-disaster capital needs, rather than reconstruction. This is the entry to insurance for developing countries with high exposure to catastrophes. Payout goes to the state for allocation.</p>
<p>Publicly owned insurers</p>	<p>Some countries have publicly-owned institutions offering property catastrophe insurance, or have government-owned insurance to provide agricultural insurance (Canada, Cyprus, Greece, India, Iran, Philippines) (World Bank, 2009).</p>
<p>Multi-sovereign schemes</p>	<p>Smaller, more vulnerable countries may form multi-sovereign risk pools to collectively purchase insurance-based products. (e.g., small island economies)</p> <p>Examples (WRI, 2019): Caribbean Catastrophe Risk Insurance Facility (CCRIF), Pacific Catastrophe Risk Insurance Company (PCRIC), African Risk Capacity (ARC)</p>

Beyond these measures, national governments have other tools at their disposal to reduce climate risk and encourage insurance provision. The opportunities below are not exhaustive given this paper’s focus on the role of cities, yet they demonstrate the range of areas for national governments to play a more central role that could also be beneficial for cities.

National governments can deal with a potential insurance supply failure if insurers leave a market (GCA, 2019). This can be done by developing a public sector scheme with capital reserves to offer insurance products backed by state guarantee or developing a private sector, state-legislated scheme.

National governments are uniquely suited to guarantee the ‘top layer’ of risk that would not be covered by the private market to provide a backstop or become a provider of insurance. Alternatively, central governments can encourage risk-pooling through legislation to spread the true cost of highest-risk cover across a wider pool of insurers. Examples include mandatory insurance through New Zealand’s Earthquake Commission and Floor Re in the UK (GCA, 2019).

Simultaneously, central governments need to balance this role with the moral hazard of discouraging resilient infrastructure investments. They can conduct physical and financial risk assessments to present a plan of investment that could inform conditions for accessing national funds. It should be noted that this will require significant technical expertise. Alternatively, central governments can develop a clearly defined formula for cost-sharing between national and subnational governments (Goldman Sachs, 2019). Federal governments can also release conditional recovery funds wherein disaster and

rebuilding funds are contingent upon stronger climate defenses and risk-informed land use policies.

3.2 DEVELOPMENT FINANCE INSTITUTIONS

Development Finance Institutions (DFIs) play a significant role, particularly in low- and middle-income country contexts. This is largely because insurance markets are less developed and municipal governments often have less regulatory and fiscal power, in addition to the broader macroeconomic and development challenges such cities face. However, DFIs often are limited by their mandates to support cities directly, and their financing processes are generally designed at the national level (ODI, 2019). In addition to international DFI barriers, National Development Banks (NDBs) commonly lack a clear mandate to promote climate change programs and have limited resources and capacity to assess climate-smart urban infrastructure.⁸

The table below, based on a white paper by InsuResilience, outlines the key concessional support modalities that DFIs have at their disposal to support cities (InsuResilience, 2019). Concessional support and technical assistance are perhaps the greatest levers that DFIs can utilize to directly support cities with their climate resilience. While these devices have been noted at the national level, reformed policies and processes within multilateral and national development banks have the potential to be directly applied to cities. Alternatively, concessional finance and other resources can be distributed conditionally based on end use of municipal authorities or directed through national and subnational financing institutions which may have greater ability to support cities directly.

In terms of concessional finance and support, DFIs can directly subsidize insurance costs for municipalities or sub-sovereign authorities, or indirectly through assistance with the development of infrastructure or adaptation plans that could lower insurance premiums and make other insurance products affordable in the future.

Table 3. Key DFI Concessional Support Modalities (InsuResilience, 2019)

Type	Tool	Description
Direct insurance support	Premium financing	Insurance premiums covered or subsidized by grants or below-market rate loans
	Capitalization	Concessional equity or debt capital could be utilized to guarantee insurance vehicle solvency
	Payment of reinsurance premiums	Supporting risk pool and reinsurance coverage. Could also be utilized to cover bond coupon (i.e., catastrophe, resilience, environmental impact, etc.)

⁸ The Cities Climate Finance Leadership Alliance in 2021 released the report, [Leveraging National Development Banks to Enhance Financing for Climate-Smart Urban Infrastructure](#), which explores the mandate and capacities of NDBs in accelerating financing for local governments' climate-smart urban infrastructure.

Type	Tool	Description
Indirect insurance support	Subsidizing operational costs	Costs associated with transactions and administration
	Technical Support and Capacity Building	Legal and regulatory environment analysis for sub-sovereign entities; risk modelling; insurance product structuring; convening stakeholders; local market development
	Financing risk reduction measures	Financing resilience infrastructure and planning that can lower risk and subsequently lower potential premiums
	Concessional credit	Supporting a range of contingent credit instruments with concessional rates

Humanitarian and other development organizations can support cities in building climate resilience, particularly for the most vulnerable. One of the most significant challenges for climate change adaptation is how to build resilience for the one billion urban dwellers who are estimated to live in slums and informal settlements. In Sub-Saharan Africa alone, around 60% of the urban population lives in informal settlements that do not meet minimum standards for water and sanitation and are not serviced by the cities’ infrastructure systems. Beyond the everyday challenges that the world’s urban informal settlements face, climate change is exacerbating conditions through extreme heat, flooding, drought, and other climate disasters. Given the fact that most slums exist outside the ‘formal’ regulatory state, disaster recovery financing is slow to arrive, if at all.

Box 5. Da Nang, Vietnam: Credit and Technical Design Scheme for Housing (Rockefeller Foundation, 2013)

One of the fastest growing coastal cities in Vietnam, Da Nang, is vulnerable to typhoons and flooding. These events have weakened the city’s housing infrastructure over the years making it hard for low-income communities to recover from the damage. In 2013, the city was hit by Typhoon Nari, resulting in 7049 houses with detached roofs, 435 other homes inundated, and 221 classrooms with detached roofs among additional damage to fencing and uprooting of trees.

Under a credit and technical design scheme funded by The Rockefeller Foundation, 244 houses that received upgrades suffered no major damage. This scheme prevented significant losses for low-income households and provided these families with shelter.

3.3 THE INSURANCE SECTOR ROLE AS INVESTOR AND ASSET MANAGER

There is a significant and worrying shortfall in finance for climate adaptation in cities - less than 10% of total urban climate finance went towards adaptation in 2017-2018⁹.

⁹ The Alliance’s 2021 State of Cities estimated that a total of USD 384 billion was invested annually in urban climate finance globally, on average, in 2017-2018. Available at: <https://www.citiesclimatefinance.org/wp-content/uploads/2021/06/Part-1-I-The-Landscape-of-Urban-Climate-Finance-FINAL.pdf>

Given the Insurance sector's risks in light of climate change, there is a growing call for the sector to play a more significant role in investing in resilience. The insurance industry holds approximately USD 33 trillion in assets, making insurers some of the world's largest long-term investors. However, less than 3% of their investment portfolio (~USD 725 billion) is invested in infrastructure (UNDP, 2020). Further, less than 10% of this amount goes towards infrastructure investments in low- and middle-income countries.

Barriers to investment in sustainable and resilient infrastructure in cities in emerging and developing markets mirrors that of investment in the Global South more generally, including challenging enabling environments, credit and exchange risk, political uncertainty – in addition to the limited data on physical and climate risk in many of these geographies. However, insurers are already uniquely positioned to make infrastructure investments given their expertise in risk modeling and understanding of climate hazards. On both the investment and underwriting side, insurers can help close the loop for long term stable returns, acknowledging that the individual insurers are usually uncomfortable with providing investment and insurance associated with the same asset.

Given the industry's longer-term liabilities, insurers seek risk-adjusted investment returns on predictable timelines leading to fixed-income assets such as corporate or government bonds. In an interview with one insurance industry expert, the need for equivalent and stable yields like more traditional bonds is the biggest barrier to a large-scale shift in the insurance sector's investment portfolio towards resilient infrastructure. As ESG investments, green bonds, and other climate-related financial instruments mature, this may be a significant opportunity for the insurance sector to directly invest in urban climate adaptation finance. Simultaneously, as insurers often don't know when they may have to pay out, they gravitate towards liquid investments which is less compatible with infrastructure investment.

Alternately, cities and other subnational entities can also help push the insurance sector to address climate risk, as investors, regulators, and procurers. While less relevant in developing countries, as investors in insurance companies, city and state pension funds can pressure the insurance industry to mainstream climate resilience considerations and design affordable and innovative products to address climate risks. In the United States alone, there are over 5500 locally administered pension funds (Urban Institute, 2018). Cities can participate in several actions such as voting on resolutions, writing or co-signing letters, and engaging with investor relations and fund managers.

There are several precedents of insurance regulators compelling insurance companies to reduce exposure to fossil fuels in their investments and underwriting activities, such as California's Climate Risk Carbon Initiative and Connecticut's State Bill on Fossil Fuel Investments and Premiums Disclosure (GCA, 2019). As procurers, cities may select insurers offering climate risk products when considering different insurance procurement options. For example, in Los Angeles, the City Council currently makes decisions on insurance procurement through the creation of watchlists and frameworks. While such action is germane to a small number of cities, particularly in high income countries, this power may increase in the years to come.

4. BARRIERS TO INSURANCE PENETRATION AT SCALE

Increasing risks and a more uncertain climate future have driven the development and implementation of innovative insurance policies across the world but the penetration of these solutions remains limited. Insurance as a tool continues to face multiple barriers at the government, individual, and industry-sector levels. This section of the paper highlights a few of the barriers that currently hinder the scaling of insurance products in cities.

Table 4. Overview of barriers to insurance penetration categorized by stakeholder

Stakeholder	Description
Municipal authorities	Lack of insurance knowledge and training for government officials at the city-level.
	Cities have limited fiscal autonomy/decentralization.
	Near-term priorities and political instability can create gaps for long-term strategies. Insurance coverage is unseen and intangible.
Urban dwellers	Behavioral barriers limit the uptake of insurance, both by city governments as well as individual policyholders.
	Lower degree of risk literacy combined with lower affordability of premiums are prevalent, particularly among low-income, high-risk communities.
Insurance sector	Insurance products are short-term by design, while climate change-induced risk has long term implications.
	There is limited or no data availability in many regions and difficulty in interpreting available data to understand existing risks.
	It is difficult to incorporate future climate change into catastrophe models.
	It is expensive to develop products and models are often proprietary.

4.1 CHALLENGES FACED BY MUNICIPAL AUTHORITIES

There is a lack of insurance knowledge and training for government officials at the city level and siloed strategies of government departments. City governments often lack technical capacity and data on financial risks, and when they do have the data, it is often hard for government officials or other stakeholders to interpret the data. Due to the general hesitancy of investing in insurance products, training of these officials is also a lower priority. Climate hazards affect all jurisdictions, and they often damage public assets that are controlled by various government agencies. When a disaster strikes, government agencies find it difficult to define their control over these assets, leading to a delay in addressing the economic losses the disaster may have caused. It may also be difficult to coordinate between central and local governments due to the lack of clarity on roles and responsibilities among them. This unclear control definition causes the responsibility of insurance coverage to often fall through the cracks.

Often, cities have limited fiscal autonomy/decentralization (city budget dependent on national government). City governments have limited budget space so it can be financially and politically challenging to make the case for insurance coverage when premiums compete with other priorities. Cities, especially in low- and middle-income countries, have limited or no autonomy of their funds. This limited autonomy makes it harder for city officials to request funds for insurance policies if the government at the national level is not investing in such a product. This also leaves little or no room for them to have liquidity in the funds approved as their spending budget, making it harder for them to cover the costs when a disaster strikes or in preparation for it.

Near-term priorities and political challenges can create gaps for long-term strategies. Political leaders come to power for a limited term and this time limit often forces them to implement actions that provide immediate results. City governments also have limited budget headroom so it can be financially and politically challenging to make the case for insurance coverage when premiums compete with other priorities. Moreover, politicians like to deliver visible products – e.g., assets – while insurance coverage is unseen and intangible. These actions could result in the re-allocation of funds set aside for long-term benefits or could potentially be misused. In some contexts, unstable political climates deepen the gaps that exist, impacting long-term strategies.

4.2 CHALLENGES FACED BY URBAN DWELLERS

Numerous behavioral barriers limit the uptake of insurance, both by city governments as well as individual policyholders. Governments tend to declare climate change-induced events as disasters based on the cost of damage the event has caused. Federal governments are often required to step in to cover costs at the local level as sub-national government agencies are under-insured. The at-risk insured policyholders are incentivized to engage in risky behavior, knowing costs will be covered (e.g., USA

National Flood Insurance Program subsidizing floodplain development). Experts believe reliance on national disaster aid creates perverse incentives for cities and states.

Individual policyholders are often unable to predict or evaluate the future losses they could face due to a climate hazard and are hence hesitant to use their savings in the short term to buy insurance products. In addition to enforcing the adoption of insurance products, the misallocation of relief aid and challenges of monitoring distribution often leads to general mistrust about timely and valid payouts to claims in the aftermath of disasters and results in less uptake of insurance.

Lower degree of risk literacy combined with lower affordability of premiums are prevalent, particularly among low-income, high-risk communities. Communities in urban centers, especially in the lower- and middle-income countries, often lack risk literacy and hence have limited penetration of insurance. Insurance premiums are also expensive for low-income communities, especially because risks are higher for them. While a variety of insurance products have existed for decades, insurance companies are yet to develop a mechanism in which they can provide coverage to the most vulnerable communities at affordable rates. These low-income neighborhoods often lack government support to cover the expenses for premiums.

Moreover, increasing awareness of climate risks leading to less affordable products. The climate crisis is worsening the impact it can have on communities and these increased damage costs are making insurance companies wary of providing products that have the capacity to cover such losses at an affordable rate.

4.3 CHALLENGES ON THE INSURANCE PRODUCT SIDE

Insurance products are short-term by design, while climate change-induced risk has long term implications. Insurance, particularly for property assets, is a relatively short-term product, with most renewing every 1-2 years, whereas climate adaptation necessitates long-term strategies integrating physical and financial protection.

There is limited or no data availability and difficulty in interpreting available data to understand existing risks. Insurance companies, governments and other key stakeholders lack the data they require to ensure cities are protected by coverage appropriate for the damage that could affect them. Data is currently minimally available and scattered across the world and is hard to access as it is not open source, limiting its usability. As insurance companies and other financial institutions continue to address the lack of data availability for climate hazards, it has uncovered another layer of difficulty - the usability of the data they are now tracking. The data is hard to interpret by its users and this leads to the development of ineffective insurance products.

There is difficulty in incorporating future climate change into catastrophe models. There are underlying challenges incorporating future climate change into catastrophe models. Catastrophe models are simulations created to predict and quantify the losses that will be caused by future disasters. They have been recalibrated based on recent events exacerbated by climate change. Cat bonds require longer tenors, however multi-

year contracts of sufficient duration to cover a climate adaptation window of around 10 years would be challenging to implement under a regulatory framework that also demands solvency from insurers. Specifically, to ensure they could pay claims against a longer-term and uncertain risk future, insurers would need larger capital reserves. Incorporating future scenarios represents both commercial opportunities and challenges to the design and uptake of insurance products.

It is expensive to develop products and models are often proprietary. Currently, simulation models are created at a high cost and are hence less affordable to scale. These models can be purchased by a limited number of insurance companies who charge a higher fee for the products they create based on these models as they tend to invest heavily in accessing proprietary data.

5. CONCLUSION AND FUTURE RESEARCH OPPORTUNITIES

As climate hazards continue to increase, cities will need to better understand, measure, and manage the risks associated with climate change. While there are a multitude of plans and processes that can strengthen the climate resilience of cities and urban communities, insurance is a critical mechanism to support the fiscal and physical resilience of cities. Different types and levels of insurance exist and so the use of insurance to provide resilience can be tailored to the different city contexts across the globe. Moreover, while cities themselves can take out insurance to provide resilience against climate change-related hazards, they are uniquely poised to engage the various urban stakeholders on the key challenges of addressing climate-induced risk and opportunities presented by utilizing insurance. They also play a critical role in managing risk through effective policy and planning.

It is critical to increase the understanding that urban resilience is highly complex. As the COVID-19 pandemic has readily shown, cities face overlapping and interdependent risks related to social, economic, and political situations. In most situations, addressing the built environment in and of itself won't be enough to build systemic resilience to ever-increasing climate hazards. Resilience building efforts and insurance provisioning should broaden their scope to meet the reality of multi-faceted risk and vulnerability, addressing climate-change related risk alongside economic precarity and insufficient social support systems. Doing so will support the urgently needed acceleration of adaptation and resilience investments in cities.

5.1 KEY RECOMMENDATIONS

Invest in risk assessment and technical capacity building to use risk assessments effectively. Government officials and relevant stakeholders that work with them need to be provided with the tools and knowledge to identify and assess climate-related risks facing their cities. Many cities, particularly in low- and middle-income countries, lack the full knowledge of which public and critical infrastructure assets are under their purview, the monetary value of this infrastructure, and the risk to them from climate-related hazards. Even in higher income countries, risk literacy and knowledge on the role of insurance is lacking.

Provide incentives to local governments for the assessment of these risks and understanding the broader landscape of risk management plans. While there are numerous initiatives aimed at supporting cities with risk modeling and evaluation, continued resources from DFIs, research institutions, and insurance-related stakeholders should be directed at the subnational level, especially cities with low capacity for such evaluation. At the national level, Federal governments can strengthen incentives and

conditional funds to ensure local governments (where feasible given capacity restraints) make risk-informed land use policies.

Address implementation barriers beyond the payouts. Further research in resilience planning and insurance modelling should look beyond immediate disaster recovery financing and address longer term upgrades and reconstruction. In other words, insurance products may have the capacity to address short term fiscal resilience and longer-term physical resilience.

Develop an effective resilience plan for the city along with the insurance industry. City resilience strategies reviewed for this report focused primarily on building physical and social resilience, with limited attention to financial resilience. However, there are numerous opportunities to further develop insurance-related solutions through the resilience planning process by collaborating with insurance providers. These include the piloting of new financial tools and products for resilience, involving insurers in working groups to launch risk awareness campaigns, and mobilizing insurance companies' data and expertise to identify resilient investment opportunities.

Engage the insurance sector around urban needs, capacities, and data. On the supply side of urban climate-related insurance provision, many actors in the insurance industry are unaware of the diverse needs and capacities of city governments and other urban actors, particularly in low- and middle-income countries. The insurance sector and insurance-related multi-stakeholder alliances should emphasize the role of cities and the importance of the subnational lens. This also presents an opportunity to the sector as city governments can be a significant source of information for the insurance sector and should be seen as key partners.

5.2 OPPORTUNITIES FOR FURTHER RESEARCH AND WORK

Pricing the benefits and risks to resilient infrastructure investment to address the lack of precedent for fully valuing resilience in monetary terms. Continued research should go into evaluating the full monetary value of direct and indirect benefits, also referred to as the resilience dividend. Full valuation of resilience benefits could further encourage engagement between insurers/re-insurers, insurance consumers, and infrastructure operators.

While several cases have been highlighted in this report, continued and more effective knowledge sharing on the success factors and challenges in financing insurance and urban resilience should be encouraged. There are limited updated and widely shared compendiums of cases in which insurance is being successfully utilized at the local level to address the impacts of climate change. Knowledge sharing will continue to be important given the complex and nascent stage of insurance penetration, particularly in low- and middle-income countries. A centralized database can be a very useful tool to bring together key stakeholders around this topic. Additionally, open-source modelling approaches could help encourage knowledge dissemination and collaboration, particularly amongst cities with similar risk profiles.

Given the unique set of capacities and risks facing global cities, innovation in insurance-based financial instruments is key. While more traditional approaches to tackling the protection gap deserve attention and resources, continued innovation to finance resilience and increase insurance penetration is vital. Insurance uptake can be encouraged through user-centered design of the product.

In all, insurance can be utilized successfully to manage climate risk in cities, however it is but one instrument in a broader suite of solutions needed. Risk reduction must occur alongside insurance and policymakers must ensure that insurance mechanisms do not replace other investments in building physical climate resilience. Insurance instruments are intended to serve as the backstop for any residual risk that cannot be eliminated through other measures including investments in reducing associated risk.

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