

# Managing the water 'megacity' – Flood risk and resilience in Lagos

Briefing note  
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# Flood risk and resilience in Lagos

As the largest and most dynamic city in the largest economy on the continent, Lagos is the engine driving Africa's economic powerhouse forward. Yet climate change, particularly flood risk, poses a threat to this uniquely vibrant megacity of 15mn people.

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Lagos has flooded annually from 2000, at a significant cost.



For example, the 2011 floods resulted in \$200 million of damage, while in 2012 heavy rainfall affected 7.7 million people and caused the destruction of assets worth \$9.5 billion.

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In a country susceptible to pluvial flooding (caused by extreme precipitation), fluvial flooding (triggered by overflowing rivers) and coastal flooding (driven by storm surges and extreme tides), Lagos stands on the frontline of the climate adaptation and mitigation effort – a reality made obvious to any visitor entering the city via the landmark Third Mainland Bridge, a 12 kilometer eight-lane highway suspended over water which casts views back across the Lagos lagoon.

Image: Third Mainland Bridge in Lagos



# Africa's 'water city': A multi-dimensional flood risk profile

Lagos is known by some observers as Africa's 'water city' and experiences annual flooding. The Lagos metropolitan area forms part of a group of several large islands separated by creeks on a lagoon, bordered by the Atlantic Ocean. The entire region lies 100m below sea level and the city sits on swampy mangrove and largely water-logged soils, with a high water table. Water bodies, lagoons, creeks and wetlands cover over 62% of the total land area, with an additional 12% subject to seasonal flooding. Since 2000, the frequency, magnitude and spatial extent of flooding generated by rains and storm surges has increased in the city. However, there are data gaps – particularly around small floods – due to poor flood monitoring and tracking; as such, the full extent of flood events is unknown.

## Key categories of flood risk:



**Rainfall-led flooding:** Lagos has experienced a rise in both high-intensity short-duration and low-intensity long-duration rainfall events, especially during the April-October rainy season.



**Pluvial flooding:** surface water floods have become more widespread (also known as 'urban' flooding).



**Fluvial flooding:** river floods also occur due to excessive rainfall or water being released from dams, causing rivers to overflow.



**Coastal flooding:** Lagos also faces exposure to coastal flooding due to tidal effects and ocean incursion into the low-lying parts of the city during storms. Sea-level rise and the removal of mangrove environments are likely to exacerbate this.



**Exposure to multi-hazard events** is a growing concern, particularly during tropical storms where storm surges may result in coastal flooding at the same time that increased precipitation results in pluvial or fluvial flooding.

## Lagos' multi-category flood risk profile has been exacerbated by four factors:



**Climate change:** causing heavier and more frequent storms.



**Poor urban planning:** leading to poor drainage systems, poor land use planning, destruction of wetlands and development in flood prone areas, and a lack of creativity around how to build a 'water-city'.



**Rapid urbanisation;** causing land cover modifications (impervious surfaces), ecosystem depletion which has damaged the land quality (subsidence), and infrastructure shortfalls.



**Anthropogenic activities (pollution):** including blockage of drains, violation of building codes and poor urban waste management (a combination of poor infrastructure and poor education on how to dispose of waste effectively).

# Flood resilience in Lagos: Progress to date, critical gaps and future opportunities

Both Nigeria's federal government and the Lagos state government have taken steps over the past two decades to manage the known flood risk in the city, as the following timeline illustrates:

**1999:** To improve coordination and management of disasters, the Federal Government and the National Emergency Relief Agency (now NEMA) established Emergency Management Agencies at the national, state and local level (NEMA, SEMA and LEMA). NEMA then developed the National Disaster Management Framework (NDMF) in 2010.

**2006 – 2013:** The Lagos State Government and its partners undertook several structural initiatives to manage flooding over a multi-year period commencing in the mid-2000s. Key projects included: building 69km of concrete secondary stormwater drainage to manage coastal flooding; construction of the 'Great Wall of Lagos' (with Royal Haskoning Marine Engineers from the Netherlands) which commenced in 2009 and remains ongoing; multiple shoreline protection projects; drainage of 100,000 hectares of land; dredging and maintenance of 32 rivers; delivery of five channelisation projects; citywide de-flooding and de-silting of drainage systems and maintenance of the existing drainage network; and demolition of houses in selected flood-prone areas.

**2007 – 2011:** To boost capacity within the Lagos state government to improve flood mitigation and planning, the Ministry of the Environment increased the number of engineers and staff in the office of drainage services (from 5 to 57) and assigned structural engineers to all local government areas to oversee the condition of drainage channels at the local level.

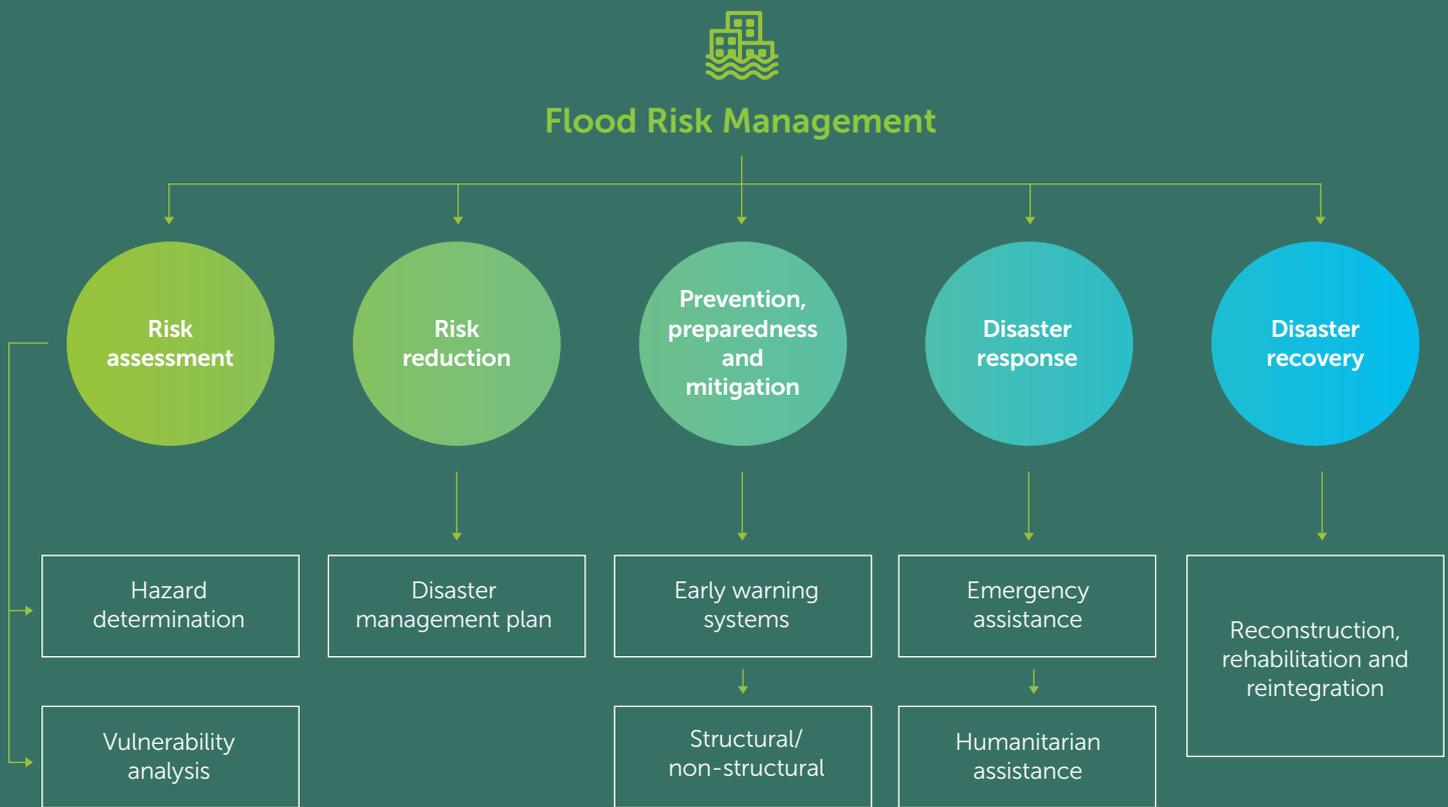
**2009:** To enhance data quality on flood risk trends, topographic mapping with LiDAR (Light Detection and Ranging) and GIS-based analysis (data) was undertaken by the Lagos State Government. This built on the growing role of three agencies: the National Space Research and Development Agency (NASDRA), founded in 2001 to collect satellite and other data; the Nigerian Meteorological Agency (NIMET), established in 2003; and the Nigeria Hydrological Services Agency (NIHSA), created in 2010.

**2010s:** The Lagos State Government discontinued physical development in many areas liable to flooding and wetlands.

**2019:** The Lagos State Resilience Office (LASRO) was launched as a partnership between the State Government and the Rockefeller Foundation via the 100 Resilient Cities (100RC) programme. LASRO is a multidisciplinary unit tasked with developing a City Resilience Strategy as a requisite framework to strengthen the capacity of stakeholders within the State to survive, adapt and grow in the face of all forms of chronic stresses and acute shocks. The unit is able to provide resources to support flood risk management activities, including in the areas of funding, research and policy development.

# Snapshot: Stakeholder landscape for flood risk management

Today, a decade after its publication, the NDMF continues to serve as the guiding document for managing flooding. As per the NDMF, it is the responsibility of the National, State and Local Emergency Management Agencies to identify relevant stakeholders under each flood risk management activity and to set out their roles and responsibilities. The key activities and stakeholder groups are summarised below:



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|                                                                          |                                                                                                                                                                                                                 |                                                                                                                 |                                                                                                                                        |                                                                                            |
| <b>Stakeholders:</b>                                                                                                                                        | <b>Stakeholders:</b>                                                                                                                                                                                                                                                                               | <b>Stakeholders:</b>                                                                                                                                                                               | <b>Stakeholders:</b>                                                                                                                                                                                                        | <b>Stakeholders:</b>                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• Academia/research institutions</li> <li>• Private sector</li> <li>• Federal, state and local ministries</li> </ul> | <ul style="list-style-type: none"> <li>• NEMA, SEMA and LEMA are responsible for developing a Disaster Risk Management Plan</li> <li>• Federal, state and local ministries</li> <li>• Private sector (esp. developers)</li> <li>• Community, NGOs, FBOs</li> <li>• Development partners</li> </ul> | <ul style="list-style-type: none"> <li>• Community</li> <li>• federal, state and local ministries</li> <li>• Police and military</li> <li>• Public and private sectors</li> <li>• Media</li> </ul> | <ul style="list-style-type: none"> <li>• Stakeholders at the community level are the first responders in every disaster situation</li> <li>• federal, state and local ministries</li> <li>• Development partners</li> </ul> | <p>Disaster reconstruction shall be undertaken by the government at all levels, with support from international organisations, development partners and the private sector.</p> |

# Limitations of existing flood risk management approaches

Despite the public sector-led investments in physical infrastructure and institutional capacity building outlined above, Lagos remains inadequately prepared to manage or finance urban flood risk. Limited coordination, lack of technical skills and expertise, and inadequate data and models have all impacted the public and private sectors' ability to adequately manage and transfer flood risks. Efforts to date have largely excluded the business and financial sectors, and risk finance in particular has not played a significant role. Sustained joint action between government, climate experts, development partners, NGOs and the private sector to address the growing scale of urban flood risk in Lagos has also been absent.

Against this backdrop, there is a clear requirement to unlock the power and innovation potential of Nigeria's dynamic financial sector to help address the flood management needs of the country's commercial hub. Currently, insurance underwriters are not specifically included in the NDMF, despite the clear value addition they can bring in terms of expert risk assessment and in the prevention, preparedness and mitigation, and recovery phases of flood risk management. To identify how this largely untapped opportunity can best be captured going forward, the following section dives deeper into the role the insurance sector can play in managing flood risks.

## Insurance sector role in managing flood risks

Currently, insurers play a limited role as few insurance products that manage flood risks exist in the Nigerian market beyond typical personal household or business property insurance which covers multiple perils. To a significant extent, this is due to data issues which hinder insurers' ability to price the risk, as well as a lack of technical expertise in this space and current low demand for standalone flood products.

Additional challenges include relatively low levels of trust in the insurance sector overall in Nigeria, concerns about 'concentration risk' when underwriting flooding in a particular area, and the fact that flooding is only just starting to be fully recognised a key risk for many private sector companies and individuals (for the most part, flooding has only been incorporated into product offerings in the last few years). Indeed, some non-life general insurers still do not view flooding as a major problem requiring bespoke products, even though other insurers interviewed for this study mentioned that there was demand from banks and investors for tailored products to protect their loan books and investments from flood risk (a key barrier to addressing this demand for the moment is that the premium is perceived as too high). As such, there is a need for greater awareness-rising in the market on all sides.



## Existing risk transfer solutions for flood risk in Lagos

Insurance type	Description	Providers
<b>Personal insurance</b>		
Household insurance	Home and household contents covered against risks like fire, flood, burglary, etc.	Leadway, AXA, Custodian and Allied, NEM, Royal exchange
Fire and special perils insurance	Covers damage to insured property caused by fire and certain associated risks (storm, tempest and flood).	Leadway, AXA, NEM, Royal exchange
Auto insurance	Protects vehicles against flood (but additional premium sometimes necessary)	Custodian and Allied
<b>Business insurance</b>		
Property insurance; fire and allied perils	Covers loss or damage to business premises or any other tangible property from fire and other allied perils such as storm, earthquake, etc. at an additional cost	AXA Mansard, NEM (also covers floating assets, such as stocks), Leadway (offered specifically for SMEs)
Multi-peril insurance	Covers crop loss or damage resulting from drought, hail damage, fire, windstorm, excess rain and uncontrollable outbreak of pests and diseases. Targeted at SMEs, commercial farmers, farm plantations, agro-processors	Royal Exchange Insurance
Industrial all risks	Covers property damage and business interruption as a result of named perils (specified by client)	AXA Mansard

## Barriers to uptake of flood risk management and transfer insurance products

In the figure below, we summarise the current challenges and market infrastructure gaps precluding the insurance sector from playing a greater role in flood risk management in Lagos:



The key challenges facing a currently immature market ecosystem can be divided into two groupings: demand-side and supply-side challenges. Turning first to the demand-side, uptake of flood risk solutions remains low – despite the presence of clear needs and use cases – due to the inability of most potential insurance product buyers to quantify and adequately understand flood risk exposure. This is compounded by limited consideration of, and willingness to invest into, future resilience. Other – often interrelated – contributory causes of limited active demand include:

- 1 The lack of incentives for stakeholders to factor flood risks into decisions (for example, when calculating lending risks banks only consider whether businesses can repay).
- 2 A pessimistic status quo in which people manage floods themselves and have ‘accepted’ them as a part of living in Lagos.
- 3 The difficulty, in an immature floor risk insurance market, of highlighting the business case for products, given that flood risk maps may not be sufficient to guide businesses on the types or level of risk reduction measures that should be considered. Indeed, at the heart of the private sector and governments’ low ability to quantify their exposure lies the current dearth of fit-for-purpose flood risk data and modelling.
- 4 It is not only the data itself that is missing: methodologies to assess flood risk across at the portfolio level are also underdeveloped in Nigeria.
- 5 Businesses also typically lack appropriate flood impact models to understand how flood exposure affects their underlying business performance as well as where physical assets within their portfolios lie (FSPs).
- 6 Finally, the MSMEs and small-scale traders that make up the majority of all enterprises in Lagos lack the technical capacity to assess the potential impact of floods on their business operations. There is a lack of products tailored for MSMEs and informal traders, who often engage in risky business practices which limit their ability to qualify for or purchase microinsurance. Affordability also remains a critical issue, as typical indemnity insurance focused on flood is often too expensive for MSMEs. (Interviewees for this study also highlighted that flood microinsurance may not be available for MSMEs and informal traders in Lagos owing to the intense FRP needs, unproven demand and generally low insurance penetration which limits the development of products by insurers).

These demand-side issues are exacerbated by the relatively limited selection – and lack of suitability – of flood risk products on the market. Flood risk cover is often limited to traditional ‘fire and other perils’ products, covering property damage. Existing products also frequently have pricing errors due to the lack of adequate data and supporting models, and these products are unable to cover large scale flood events – thus leaving a gap in cover where people need it the most.

Turning next to the supply-side challenges, the supply of flood risk solutions is constrained primarily due to a combination of data and modelling gaps, limited sector expertise and low collaboration. Available data is currently not being shared or leveraged, due to affordability constraints and access barriers.

## Data access barriers



Accessing data is onerous: for example, a letter of request must be sent and processed, a MoU must be signed, and the specifications of the data must be agreed (NASDRA, 2021)



C40 and the UNDP have developed a flood risk map for Lagos City; however, this map is not currently available to users.



High resolution topographical data (LIDAR) is a key input in most use cases. However, key barriers include the cost of the data (which is high at approximately £90 per 500m x 500m tile) and the proprietary nature of the dataset which limits sharing to third parties.



Data is often held in different formats across different stakeholders, making it difficult to integrate. For example, government data is not held in a condensed, GIS format. Financial data held by the private sector is also often difficult to integrate into flood models.

A further issue is that insurers do not adequately understand the impacts of climate change on their businesses. Insurers and NAICOM recognise the importance of factoring climate change into their businesses, but they have not yet taken any steps towards implementing frameworks such as TCFD/ESG reporting.

This failure to incorporate climate impacts into business planning is illustrative of a broader capacity shortfall among underwriters in terms of flood risk modelling, risk reduction and product development. As the interviews for this study made clear, there is limited internal focus among underwriters on flood data and flood risk impacts specifically. Often, local institutions outsource to companies who can develop models instead. The knock-on effect of a limited ability to quantify flood risks has been a low-risk appetite among insurers and concerns of being overly exposed, which in turn has hampered innovation and product development in this area.

## Snapshot: Data and modelling gaps limit the potential for flood risk solutions to be developed

- NHISA established stations around Nigeria to gather stream flow data, but many were destroyed due to the floods in 2012 and have not been rebuilt due to lack of funding.
- NHISA tried to produce a flood vulnerability map for Nigeria but it was too large scale, and the idea was abandoned. Similarly, the quality of satellite data for Lagos is poor.
- There is no up-to-date digital database system for land administration in Nigeria, thus limiting the development of flood insurance products for businesses and inhibiting understanding of the link between planning and flood risk maps.
- There is limited mapping of informal communities in Lagos (apart from initiatives such as Code4Africa).
- Spatial datasets which cover the drainage (stormwater) network of Lagos are also limited and incomplete.
- Many underwriters don't know the location of their liabilities and thus are unable to make decisions about the pricing of products and product development.
- Data gaps make it difficult to decide on 'triggers' for parametric policies, which are often used for flood risks:
  - For example, excess rainfall is a typical trigger used. However, this may be problematic in an urban flooding context as small inputs of precipitation may result in flooding events.
  - Flood depth or inundation is the most accurate trigger for the development of loss models with parametric products. However, at present no flood sensors have been installed at a property level in Lagos that would be able to collect the necessary data for the validation of flood inundation post-disaster.

# Use cases for flood risk products

The wide range of demand- and supply-side challenges outlined above may appear daunting, but they are offset by the strength of the needs and use cases identified during the course of this study. Robust use cases emerged for the following:

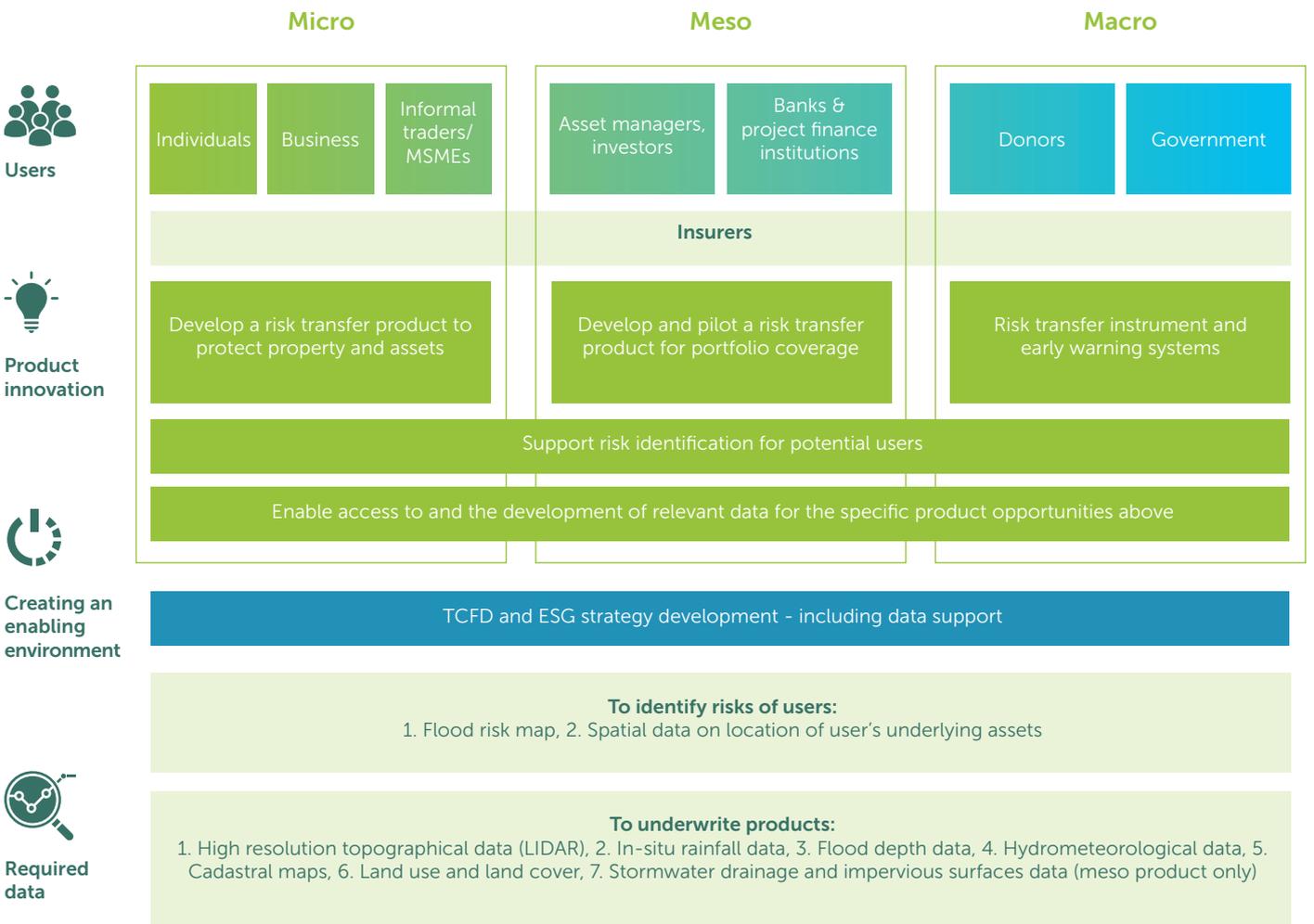
<p><b>Asset managers and investors</b> who need to protect investment returns and make informed investment decisions</p>	<p><b>Businesses in flood prone areas</b> who need to protect their property, ensure business continuity, and decide where to build or trade</p>	<p><b>Banks or other project finance institutions</b> who need to protect their loan books and make informed decisions about who to lend to and at which rates</p>
<p><b>Insurers</b> who need to improve pricing accuracy and understanding of liabilities</p>	<p><b>Informal traders, MSMEs and homeowners</b> who need to protect their property, ensure business continuity and decide where to trade</p>	<p><b>Donors and government</b> who need to protect individuals, businesses and infrastructure</p>

In the table below, we conclude this briefing with a summary of the needs and use cases identified in the marketplace. It is our hope that this summary can serve, alongside other complementary efforts, as a catalyst for a multi-stakeholder effort to deepen the maturity of this nascent sector – to the benefit of all Lagosians grappling with a flood risk management challenge that takes on greater urgency with each passing year.

Need	User	Flood risk exposure	Use case	Current state of products
*To protect investment returns and make informed investment decisions	Asset managers and investors	Investors are not able to adequately calculate the expected return on investment, factoring in losses due to floods, which means there are missed investment opportunities, unexpected losses, and uncertainty around profits	Insurance coverage for their portfolio of investments and risk mgt reduction integrated into investments and decisions	Does not yet exist
*To protect property; ensure business continuity and make decisions about where to build	Businesses in flood prone areas (e.g., property groups, industry parks, hospitality groups, etc.)	Increased construction and maintenance costs, plus business interrupted when floods occur	Property insurance coverage & risk mgt reduction measures	Flood risks covered as part of multi-peril policies, including fire and other perils. (But take up and value limited).
*To protect loan book and make informed decisions about who to lend to and at which rates	Banks or other project finance institutions	Floods damage assets and production, negatively impacting asset holders' ability to repay debt obligations to lenders	Insurance coverage for loan book and risk mgt reduction	Does not yet exist
To improve accuracy and understanding of liabilities and improve pricing	Insurers e.g., non-life insurers like Cornerstone, AXA Mansard, Leadway	Uncertainty around frequency and extent of claims when floods occur	Reinsurance for flood risks and improved data and models for accurate risk management and pricing	Reinsurance seemingly exists, but insurers are limited in use of risk mgt and use of data and models to predict flood risk exposure

Need	User	Flood risk exposure	Use case	Current state of products
To protect property and ensure business continuity	Informal traders and MSMEs	Assets damaged when floods (small or big) occur, which interrupts business operations	Property insurance or business interruption insurance  *Likely need for subsidy	Property flood insurance said to exist but included in multi-peril. Take up and value limited, given affordability issues.
To protect self and livelihoods	Individuals	Health, life and accident-related risks due to flooding	Life, health or personal accident insurance  *Likely need for subsidy	Exist, but are limited in take up and value
To protect individuals and businesses	Donor / Association e.g., Red Cross, Chamber of Commerce	When floods strike, they need sufficient funds to contribute to response and recovery efforts	Insurance to cover expected financial efforts required for response and recovery	Not known
To protect property and infrastructure	Government e.g., NEMA, SEMA, LEMA	When floods strike, these bodies are responsible for the cost of repairs and the continuation of public functions and services	Property and infrastructure insurance and risk reduction measures	Property flood insurance said to exist but included in multi-peril. Take up and value limited
To protect individuals and businesses	Government e.g., NEMA, SEMA, LEMA	When floods strike, these bodies are responsible for contributing financially to response and recovery. Also involved in preparedness.	Insurance to cover expected financial efforts required for response and recovery	Not known

### Opportunities to manage and transfer urban flood risk





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