Forging the Governance - Finance Nexus: Leveraging the Mumbai Climate Budget Model to Scale Green Insurance for Climate-Resilient Indian Cities

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Abstract: This study examines how governance transparency, fiscal reform, and financial innovation work together for strengthening climate-resilient urban financing in India. The researchers have analyzed the interaction between Mumbai Climate Budget Model (MCBM) and the Green Insurance Model (GIM) under the Insurance-Linked Resilient Urban Financing (IRUF) framework. The three pillars of governance reform (Pillar I), regulatory and technical insurance readiness (Pillar II), and blended finance (Pillar III) collectively improve the creditworthiness of Urban Local Bodies (ULBs). The study links fiscal transparency to better credit access and insurance participation by using a qualitative case-based approach. The findings show that MCBM builds trust and provides reliable financial data. Furthermore, the researchers proposed blended finance to make GIM adoption affordable. The study concluded that there is a requirement of a coordinated system, connecting governance, finance, and insurance for scaling climate resilience across cities in India.

Keywords: Climate Budgeting, Green Insurance Model, IRUF framework, Urban Local Bodies, Fiscal Transparency.

1. INTRODUCTION

India's urban centers are increasingly vulnerable to climate-related shocks, from recurrent flooding to heat stress across major cities. There has been an increase in financial impact of climate change on cities in India. Estimated annual losses from storm or pluvial water related flooding is likely to increase from $4 billion in 2023 up to $14-30 billion by 2070 (World Bank, 2025).

Urban Local Bodies (ULBs) in India remain underfunded.

Since, the early 2000s, municipal revenues have stayed at approximately 1% of GDP. This is lower in comparison to other comparable economies where municipal revenues contribute 4-6% of the GDP on average.

The Mumbai Climate Budget Model (MCBM) was launched in year 2023. It integrates climate action into municipal budgeting. Concurrently, performance-linked insurance incentives tied to verified climate investments were introduced by the Green Insurance Model (GIM) under the Insurance-Linked Resilient Urban Financing (IRUF). This study examines how governance transparency created by MCBM will enhance creditworthiness and support adoption of GIM. The study through a multi-pillar framework combines institutional reform, technical insurance design, and blended finance.

2. SCOPE AND SIGNIFICANCE OF STUDY

The scope of this study is conceptual. It advocates that MCBM will help in the adoption of GIM within the broader IRUF framework. Through the synthesis of governance (MCBM) and financial dimensions (GIM under IRUF), the researchers propose a policy framework to strengthen urban climate resilience.

The study will highlight the importance of governance transparency in improving financial creditworthiness, in adopting parametric insurance, and in using blended finance as a market enabler. The policy insights provided will help to scale the MCBM and GIM under IRUF framework across cities in India.

3. RESEARCH OBJECTIVES

To explain how the Green Insurance Model (GIM) functions within the Insurance-Linked Resilient Urban Financing (IRUF) Framework.

To examine the financial and institutional barriers preventing Urban Local Bodies (ULBs) from accessing long-term climate finance.

To study the working of Mumbai Climate Budget Model (MCBM) and how it helps integrate climate action into regular governance.

To explain how the governance transparency created by the MCBM improves the creditworthiness and supports parametric insurance implementation needed to adopt the GIM under the IRUF framework (Pillar I and Pillar II).

To examine how blended finance and concessional funding mechanisms will improve the financial feasibility of ULBs in adopting the GIM under the IRUF framework (Pillar III)

4. LITERATURE REVIEW

Previously, climate risk finance was seen as a reactive and post disaster mechanism. Now, climate risk finance has evolved to a proactive risk reduction tool for building systemic resilience. Earlier studies by Swiss Re (2022) and United Nations Office for Disaster Risk Reduction (UNDRR, 2023) focused on providing rapid financial relief after catastrophic events. These post disaster financial relief mechanisms neither incentivized preventive instruments nor strengthened institutional capacity for long term resilience.

Recent research has shifted towards preventive financial mechanisms. Kraussmann (2022) introduced the concept of Insurance-Linked Resilience Finance (ILRF). The researcher argued that insurance products can be used as financial incentives to reward proactive climate action. This concept of risk reduction was further developed through the Green Insurance Model (GIM) under the Insurance-Linked Resilient Urban Financing (IRUF) framework.

Concurrent to financial innovation, the governance side of urban climate resilience was emphasized by a growing body of literature. The Organization for Economic Co-operation and Development (OECD, 2023) and C40 Cities (2023) emphasize the importance of climate budgeting frameworks. These organizations emphasize that fiscal transparency, departmental coordination, and climate mainstreaming within city governments can be improved through climate budgeting frameworks. To attract climate linked capital, climate budgeting framework should be institutionalized. This will help in providing the required data and accountability for credit rating.

In the Indian context, the Ministry of Housing and Urban Affairs (MoHUA, 2023) has mentioned

that major hindrance to climate finance are weak balance sheets of ULBs and limited fiscal autonomy. Studies by Jain (2023) and World Bank (2022) confirm that ULBs don't have standardized financial reporting and institutional credibility which are needed for insurance linked financing or accessing long term debt.

Prior research studies have treated governance as an administrative reform and insurance as a purely financial tool without examining their mutual interdependence in the urban Indian context. Specifically, there is a lack of analysis on how MCBM can improve ULBs' creditworthiness and adoption of GIM under the IRUF framework. This research addresses these gaps through a three-pillar framework that integrates governance, insurance, and finance. The three-pillar framework consist of governance reform (Pillar I), insurance taxonomy and GIM (Pillar II) and blended finance (Pillar III)

5. RESEARCH METHODOLOGY

The researchers adopted a qualitative, prescriptive, and case based research design for developing a conceptual framework linking transparency in governance to climate risk finance. The framework adopted in this study is based on three analytical pillars, namely, governance reform using MCBM (pillar I), insurance taxonomy and GIM (Pillar II), and blended finance (Pillar III). The study is based on secondary sources such as municipal budget reports, policy documents, and industry studies. The study mapped MCBM's governance outputs (fiscal transparency and accountability) to GIM's financial requirements (creditworthiness and risk pricing) using thematic synthesis. Thus, the study conceptualizes a governance–insurance-finance nexus within the three-pillar IRUF framework. The below chart 1 shows the conceptual framework of this study.

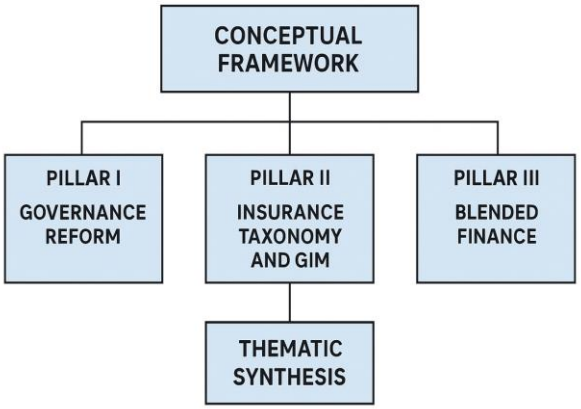


Chart 1 The Conceptual Framework of the Study
Source: Author's Work

Analysis and Discussion

The study's five research objectives are discussed in this section.

Research Objective 1

To explain how the Green Insurance Model (GIM) functions within the Insurance-Linked Resilient Urban Financing (IRUF) Framework

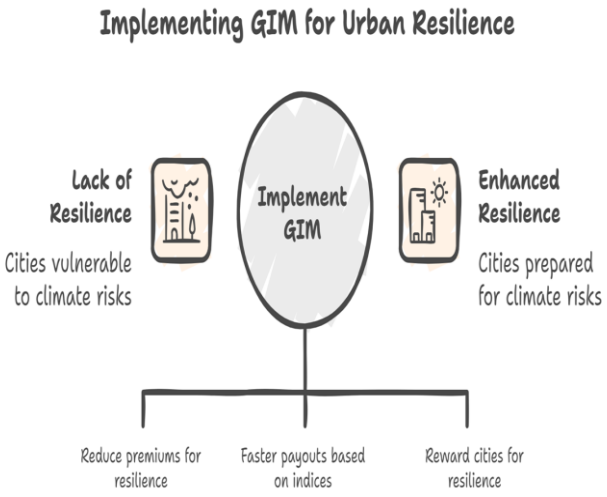
Traditional, climate risk insurance products provide compensation only after the disaster occurs (Swiss Re, 2022). The GIM within the IRUF framework goes a step further by linking insurance incentives to resilience improvements. GIM uses long term contracts (10-20 years) that reduce insurance premiums when verified resilience measures are implemented by cities (Kraussmann, 2022). To avoid bureaucratic delays and allow faster payouts, the model uses parametric triggers that is payments based on climate indices like rainfall or temperature (Allianz, 2023). The key feature of the model is rewarding cities with premium discounts for actions such as flood barriers, green roofs, and

upgraded drainage. Insurance risk falls leading to lower premium as cities invest in resilience. This creates a financial incentive for preventive measure. Transferring risk to stabilize fiscal shocks and enhancing credit by lowering perceived financial risk are the two main purposes of GIM. The successful implementation of the GIM within the IRUF requires transparent fiscal data, creditworthy institutions, and standardized resilience certification.

However, many Indian urban local bodies currently lack in transparent fiscal data and standardized resilience certification. Furthermore, these ULBs are not considered creditworthy institutions.

The below Chart 2 provides a visual summary of the GIM under IRUF framework.

Chart 2 GIM within the IRUF framework



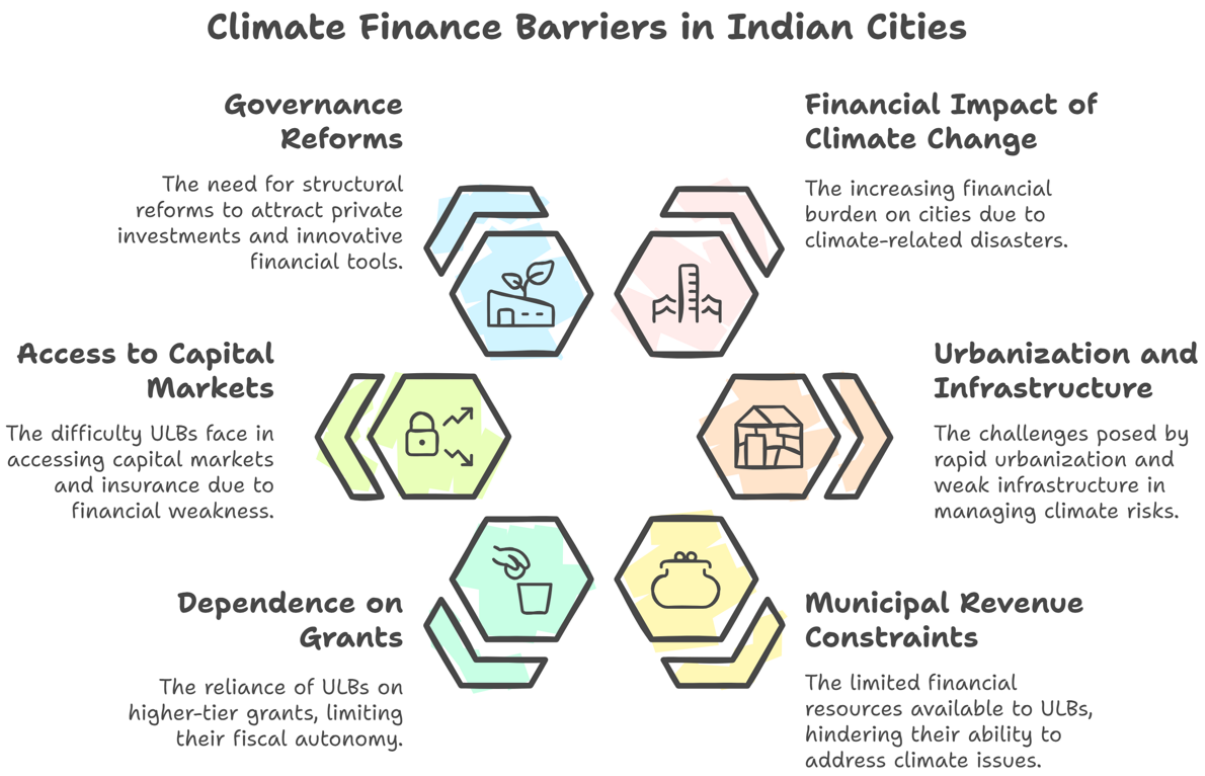
Source: Author's Work Based on Research Objective 1

Research Objective 2

To examine the financial and institutional barriers preventing Urban Local Bodies (ULBs) from accessing long-term climate finance.

There has been an increase in financial impact of climate change on cities in India. Global disaster losses now exceed US$300 billion annually (UNDRR, 2023). Due to rapid urbanization and weak infrastructure, cities in India bear a disproportionate financial share of climate change (World Bank, 2022). Growing fiscal and human costs of unmitigated urban risk is being highlighted through repeated floods in Mumbai, Chennai, and Hyderabad. Urban Local Bodies (ULBs) can play an important role but remain underfunded. Since, the early 2000s, municipal revenues have stayed at approximately 1% of GDP. This is lower in comparison to other comparable economies where municipal revenues contribute 4-6% of the GDP on average (MoHUA, 2023). These ULBs are dependent on higher-tier grants which in turn limit their fiscal autonomy and capacity for capital investment. Hence, only a few ULBs have the financial strength or creditworthiness for accessing capital markets or purchasing long-term insurance (Jain, 2023). Hence, there is a need for structural governance reforms so that ULBs are able to attract private investments or use tools like resilience bonds, public-private partnerships (PPPs) or parametric insurance (C40 Cities, 2023). The below Chart 3 provides a visual summary of hindrances to accessing long term climate finance.

Chart 3 Hindrance to Accessing Long Term Climate Finance



Source: Author's Work Based on Research Objective 2

Research Objective 3

To study the working of Mumbai Climate Budget Model (MCBM) and how it helps integrate climate action into regular governance.

The MCBM was launched in year 2023. It integrates climate action into municipal budgeting.

It classifies all expenditures based on climate relevance into mitigation and adaptation goals. For financial year 2024-25, Mumbai has allocated 32.18% (approximately ₹10,224.24 crore) of its total capital expenditure budget to climate relevant

activities (All India Radio News, 2024). MCBM builds strong governance based on five main mechanisms as follows:

a) **Climate Tagging:** Each department labels its spending as climate relevant, partly relevant, or neutral.

b) **Accountability:** Each department is given specific climate targets (For instance: enhancing urban drainage systems). At the end of year, departmental performance is evaluated not only on budget utilization but also on the achievement of these climate objectives. This makes climate action as an integral responsibility within municipal governance.

c) **Data integration:** All spending and emissions data are collected in one shared dashboard. This dashboard is jointly managed by the Environment and Finance departments.

d) **Transparency:** Key climate budget summaries is made public to build trust and involve citizens into climate action.

e) **Policy feedback:** Results are reviewed every year for shifting funds toward projects that have the biggest climate impact.

The below Chart 4 provides a visual summary of five mechanisms under the MCBM

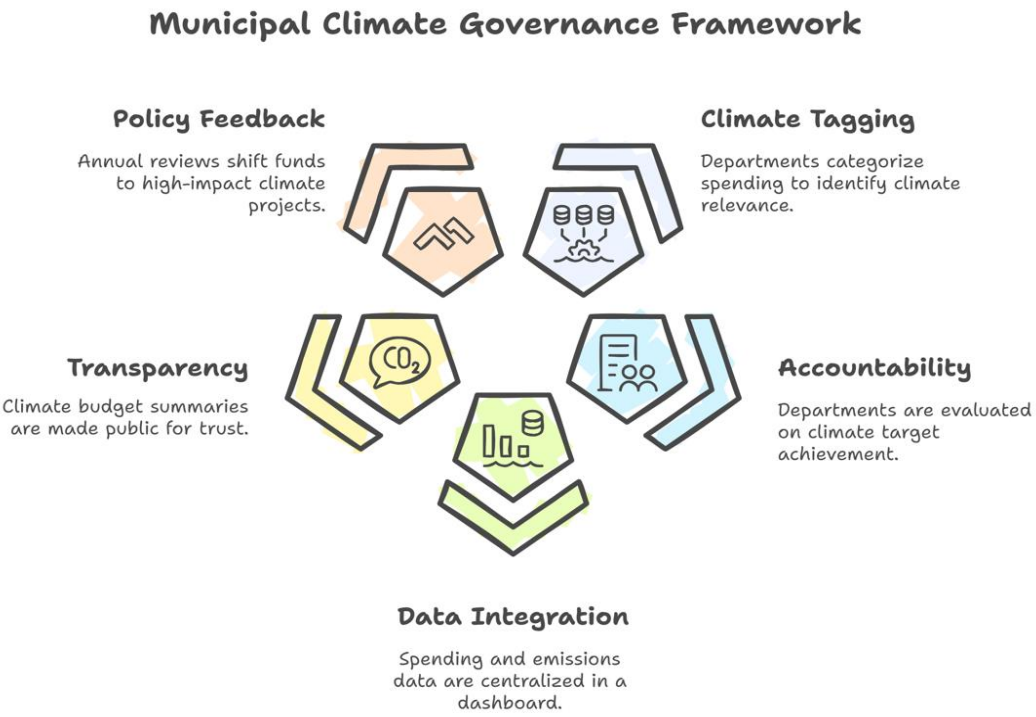


Chart 4 Mumbai Climate Budget Model (MCBM) - Governance Innovation

Source: Author's Work Based on Research Objective 3

Research Objective 4

To explain how the governance transparency created by the MCBM improves the creditworthiness and supports parametric insurance implementation needed to adopt the GIM under the IRUF framework (Pillar I and Pillar II).

Pillar I – Governance & Institutional Reform (MCBM)

The essential connection between MCBM and the IRUF framework is that MCBM gives ULBs the required trustworthiness for attracting external capital and qualifying for GIM contracts. The researcher's primary finding is that GIM model cannot be widely used unless the ULBs

adopt the governance improvements brought by MCBM (a model for reform). GIM works as a financial engine and MCBM works as an institutional fuel providing the necessary structure and reform for the engine to run.

The IRUF model requires long term, stable contracts, with verifiable commitments to city resilience (Swiss Re, 2023). MCBM's stability is essential for convincing insurers and investors that ULBs will stick to the IRUF's long term rules. This in turn will make GIM's credit enhancement feature effective. The MCBM standardizes the municipal budget. This standardization makes ULBs a predictable and auditable counterparty who can sign long term resilience contracts.

Table 1. Causal Chain Linking MCBM Governance to GIM Adoption

Step	Process/Description	Influence on GIM Adoption	Source
Initial Constraint	ULBs lack fiscal transparency and demonstrable long-term climate commitment.	Low credit rating, no access to capital markets, and inability to commit to long-term GIM premiums.	(World Bank, 2016)
I. Governance Reform	ULBs adopts and implements the Mumbai Climate Budget Model (MCBM) to standardize climate spending	Climate-related expenditures become formalized, trackable, and auditable across all departments	(Government of Maharashtra, 2024)
II. Transparency & Credibility	The MCBM generates transparent, auditable fiscal data demonstrating consistent resilience investment	Credit rating agencies and investors recognize improved financial management and reduced institutional risk	(Government of Maharashtra, 2024; World Bank, 2016)
III. Financial Access	Improved credit rating enables access to Capital Mobilization instruments (e.g., Resilience Bonds, blended finance).	ULB secures initial debt financing for GIM-mandated adaptation measures.	(World Bank, 2016)
IV. GIM Engagement	ULB attains sufficient creditworthiness and fiscal commitment to purchase a long-term GIM policy.	Successful entry into GIM loop, leveraging GIM as credit enhancement and earning premium discounts upon resilience completion.	(Swiss Re, 2023)

Source: Adapted from Government of Maharashtra (2024); World Bank (2016); Swiss Re (2023).

Pillar II – Multi-Scalar Regulatory and Technical Imperative (Insurance Taxonomy & GIM)

Pillar I (MCBM) resolves micro-level ULBs fiscal constraints. Pillar II includes both the regulatory framework and the technical/data mechanisms required for GIM adoption.

Regulatory Framework

In year 2023, the global parametric insurance market was valued at USD 18 billion and projected to reach at USD 34.4 billion by the year 2033 (Allied Market Research, 2023). India has started to experiment with parametric insurance. Pilot parametric insurance programs in Gujarat State have expedited claim payouts in comparison to traditional indemnity insurance payouts. (Mongabay India, 2024).

Insurance Regulatory and Development Authority of India: To enable insurers to issue GIM policies, IRDAI will facilitate domestic parametric insurance market and standardize climate risk disclosure (IRDAI, 2024).

International Financial Services Centres Authority: To transfer catastrophic tail risk transfer to global markets, IFSCA develops regulatory framework for Insurance Linked Securities (ILS). This includes the establishment of Special Purpose Insurer (SPI) entities in GIFT City.

Technical / Data Mechanism

To design localized parametric indices and reduce basis risk, a high-quality data will be generated with the help of MCBM's budget tagging, monitoring, and audit mechanisms. Table 2 summarizes the technical linkages that make parametric insurance capacity operational under the GIM.

Table 2 Technical Link Between MCBM and GIM's Parametric Insurance Mechanism

Aspect	Process/Function	Impact on GIM Mechanism	Source
Technical Foundation	MCBM institutionalizes climate-related planning and expenditure tracking across ULBs	Establishes the fiscal and data-governance base required for parametric insurance operation (audit trails, budget-tagging, verification workflows)	(UNDRR, 2022)
Basis Risk Challenge	Parametric insurance relies on pre-defined weather triggers but can misalign with local losses (basis risk)	Basis risk reduces trust in parametric pay-outs; undermines insurer/ULBs confidence and uptake	(Swiss Re Institute, 2022)
High-Granularity Data Need	Accurate parametric indices require dense sensor networks, localized modelling, and high-frequency administrative data	MCBM incentives (budgeting + procurement transparency) make ULBs more likely to invest in smart-city data infrastructure, reducing basis risk and improving pay out fidelity	(OECD, 2023)

Verification & Auditability	MCBM creates auditable expenditure records and monitoring protocols	Enables independent post-event verification that resilience investments were carried out. This is essential to trigger premium discounts and performance-based incentives under GIM	(Government of Maharashtra, 2024)
Trust & Market Development	Clear governance and verified data foster insurer and investor confidence	Facilitates parametric product design, pilot testing, and scaling of GIM within domestic markets	(Swiss Re, 2023; IRDAI, 2024)

Source: Adapted from UNDRR (2022); Swiss Re Institute (2022); OECD (2023); Government of Maharashtra (2024); IRDAI (2024).

Case Insight: Nagaland's Parametric Insurance Experience

An example of parametric insurance in India was seen in the case of Nagaland state. The state used parametric insurance to protect against extreme rainfall events (Mongabay India, 2024).

During the pilot stage (2021-2023), a key challenge of basis risk was observed when there was a mismatch in rainfall readings and actual ground damage. There were cases when flooding occurred but weather stations failed to record the rainfall beyond trigger level.

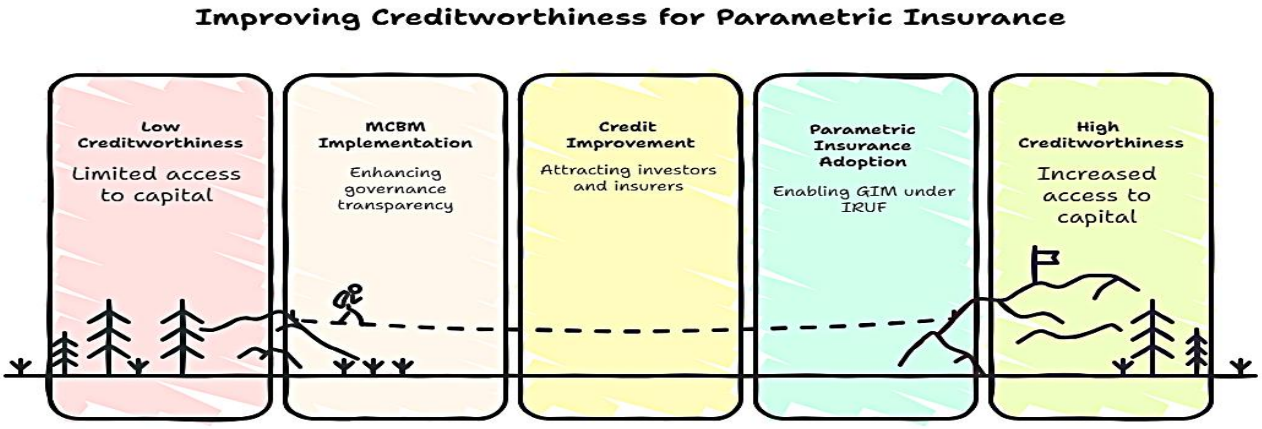
Hence, no payments were made even though real losses occurred. The state decided to improve the design in 2024 with more automatic weather stations by using gridded data from India Meteorological Department. This highlights the need for high quality local data for successful implementation of parametric insurance.

This research paper's argument are directly supported by lessons learnt from the case of Nagaland. MCBM through its climate tagging, budget tracking, and annual performance reports will create a trustworthy data system that will monitor cities' spending on resilience and assess the outcomes achieved.

Hence, parametric insurance solutions such as the GIM will be financially and technically feasible with strong governance and data systems.

The below Chart 5 shows MCBM as a tool for Parametric Insurance adoption and High Creditworthiness.

Chart 5 MCBM as a tool for Parametric Insurance Adoption and High Creditworthiness



Source: Author's Work Based on Research Objective 4

Research Objective 5

To examine how blended finance and concessional funding mechanisms will improve the financial feasibility of ULBs in adopting the GIM under the IRUF framework (Pillar III)

Pillar III – Blended Finance as a Market Enabler

Persistent fiscal constraints are faced by ULBs in India. Most of the ULBs rely on state transfers with limited own source revenue. Furthermore, most ULBs provide essential services such as water supply, solid waste management, and sanitation. This providing of essential services keeps little fiscal space for climate-resilient investments. Many ULBs cannot afford the initial premiums required for the Green Insurance Model (GIM). A strategic solution is provided by blended finance mechanisms that combines concessional public or philanthropic capital with private investment. These blended instruments will lower the upfront financial burden, enhance creditworthiness, and make climate-resilience investments more bankable.

Following are the blended instruments: -

1. **Concessional Loans:** It acts as the first loss layer for urban climate projects. It will absorb initial risk for the urban climate project. These concessional loans will allow ULBs to implement resilience measures mandated by GIM contracts, such as flood mitigation infrastructure and drainage upgrades.
2. **Grants and Subsidies:** The initial premium burden for ULIPs adopting GIM policies will be reduced through grants and subsidies. These grants and subsidies link funding with governance goals and help cities keep budget transparency to comply with MCBM reporting rules.

Credit Enhancement and Investor Confidence

Blended finance strengthens the creditworthiness of ULBs. Commercial investors will perceive reduced exposure as concessional capital will absorb the early risk. As, a result, commercial investors' confidence in municipal resilience projects will increase. Insurers will now be able to price the premium more precisely because the financial risk is lower and more predictable. Thus, blended finance will facilitate the functioning of GIM mechanism.

Self-Reinforcing Governance–Finance Loop

Blended finance links all the three IRUF pillars by creating a self-reinforcing cycle

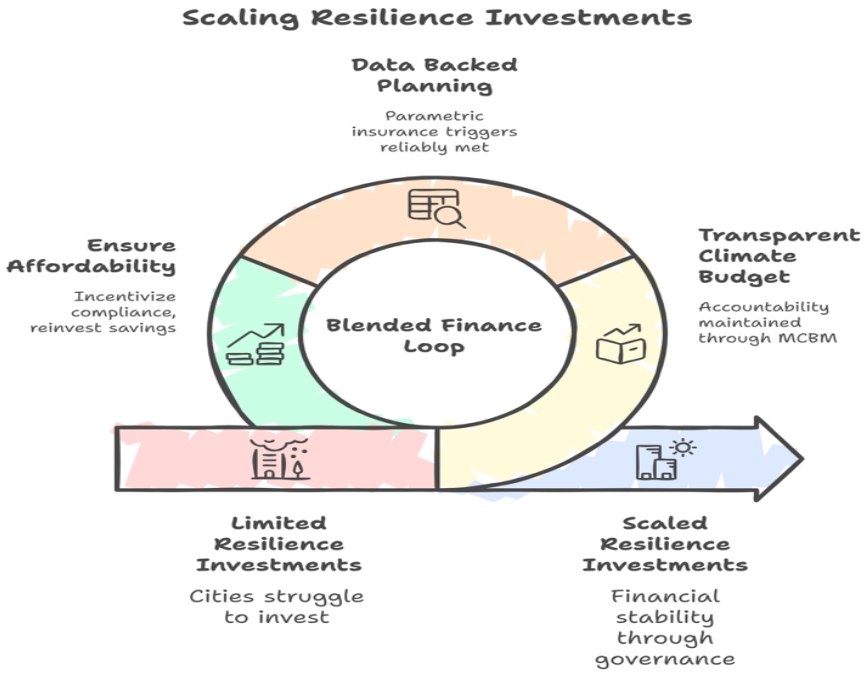
Governance (Pillar I): A transparent climate

budget and accountability is maintained through MCBM by ULBs.

Technical Insurance Readiness (Pillar II): Using data backed municipal planning, parametric insurance triggers are reliably met.

Financial Feasibility (Pillar III): Blended finance will ensure affordability and incentivize compliance. It will allow cities to reinvest savings into further resilience measurers.

Thus, ULBs, through the above loop will be able to gradually scale up resilience investments. Furthermore, financial stability will



be sustained through governance and insurance support.

The below chart 6 shows a visual descripting of blended Finance loop.

Chart 6 Blended Finance Loop

Source: Author's Work Based on Self-Reinforcing Governance–Finance Loop

Policy Implications through adoption of Blended Finance

The following are the policy implication of adopting blended finance in India

1. **Targeted Concessional Funding:** High risk cities with low fiscal capacity should be given priority for grants and concessional loans
2. **Integration with MCBM:** To ensure transparency and measurable outcomes, blended finance instruments should align with municipal climate budgeting frameworks.
3. **Private Sector Participation:** Reduction of initial risk through concessional loans and grants will encourage private investments and foster a sustainable urban resilience financing ecosystem.
4. **National Coordination:** A policy framework for blended finance deployment that complements GIM adoption should be provided by Central and State Governments.

Thus, a crucial enabler for the GIM under the IRUF framework is blended finance. Thus, blended finance completes the integrated **governance-insurance-finance** loop through the reduction of upfront financial burden, enhancement of

creditworthiness, and incentivization of compliance with climate governance reforms.

6. SUMMARY AND CONCLUSION

MCBM is a foundational governance reform that will enhance ULBs' fiscal transparency and accountability. This in turn will improve ULBs' creditworthiness which is a prerequisite for GIM adoption. The three interlinked pillars through which IRUF framework operates are:

Pillar I: There is an institutionalization of fiscal transparency and standardization of climate expenditure

Pillar II: To enable parametric insurance and risk transfer, there is a technical and regulatory readiness.

Pillar III: To ensure ULB participate in GIM contracts, blended finance bridges the affordability gap.

Together these three pillars, create a self-reinforcing governance finance loop. Here, improved transparency lowers insurance risk, reduces insurance premium, and increases fiscal stability.

7. RECOMMENDATION AND SUGGESTION

- **Institutionalization of Climate Budgeting:** Indian ULBs should adopt MCBM type frameworks through standardization of climate tagging.
- **Regulatory Alignment:** Joint guidelines should be issued by IRDAI and IFSCA for integrating parametric insurance with municipal budgeting data
- **Fiscal Incentives:** Conditional grants should be provided to ULBs that adopt resilience-linked insurance models.
- **Data Infrastructure Investment:** Cities should implement smart sensor systems and open data platforms for improving accuracy of parametric insurance index.
- **Capacity Building:** Strengthen municipal finance and actuarial literacy for implementation of GIM.

8. POLICY IMPLICATIONS

India's urban resilience finance will be transformed through the integration of MCBM and GIM under the IRUF framework.

1) It will mainstream climate budgeting into public financial management.
2) It will enable domestic insurers to expand into parametric products.

Ultimately, this model supports India's commitments under the National Mission on Sustainable Habitat and SDG 13 (Climate Action).

9. LIMITATIONS AND SCOPE FOR FURTHER RESEARCH

This study is limited by its reliance on a single case of MCBM. Quantitative validation through financial modelling is beyond the scope of this research paper but remains essential for empirical grounding. Further research can be carried out to check feasibility of MCBM's replicability in comparative cross-city studies.

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