G20
SOUTH AFRICA 2025

DISASTER RISK REDUCTION WORKING GROUP

Solidarity
Equality
Sustainability

Compendium of Risk Transfer Solutions to Support the Most Vulnerable

@NationalCOGTA

www.g20.org

Cooperative Governance
Traditional Affairs

A NATION THAT WORKS FOR ALL

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

NATIONAL DISASTER MANAGEMENT CENTRE - SOUTH AFRICA

Joburg
a world class African city

ETHEKWINI MUNICIPALITY

G20
SOUTH AFRICA 2025

DDM
DISTRICT DEVELOPMENT MODEL

2030 NDP

Content:

Acknowledgement

UNCDF gratefully acknowledges the support and contributions of G20 countries, knowledge partners, and technical experts in the development of the G20 Compendium of Risk Transfer Solutions for Climate and Disaster Resilience. This work reflects the collaborative spirit of the G20 Disaster Risk Reduction Working Group and the leadership of the Government of South Africa as G20 Presidency 2025, which has prioritized finance as a cornerstone for resilience.

We also extend our sincere gratitude to the knowledge partners and technical organizations whose insights and expertise enriched the document. In particular, we recognize the valuable contributions of the Centre for Disaster Protection (CDP), the World Bank, the World Food Programme (WFP), the World Health Organization (WHO), the United Nations Development Programme (UNDP), the United Nations Office for Disaster Risk Reduction (UNDRR), the United Nations University Institute for Environment and Human Security (UNU-EHS) and the Food and Agriculture Organization (FAO). We further acknowledge the contributions of Mr. Agrotosh Mookerjee, Consulting Actuary and Managing Director of Risk Shield Consultants who supported the development of several sections of the compendium, including relevant case studies as well as representing UNCDF in one of the Working group meetings. Appreciation is also due to Weather Risk Management Services (WRMS), India for their specific inputs on index insurance.

Special recognition is also extended to UNCDF colleagues Mr. Krishnan Narasimhan, Ms. Akata Taito, Ms. Shriya Sundaram, Ms. Shaswati Das, Mr. Premasis Mukherjee, Mr. Sheldon Chanel and Ms .Marie Suzumu, for their dedicated efforts in coordinating with collaborators and in compiling and designing the Compendium.

We also gratefully acknowledge the early contributions of Ms. Letizia Fezzi, formerly with UNCDF, who played a key role in the initial development of the Compendium.

UNCDF would like to thank Ms. Anaar Kara from the Consultative Group to Assist the Poor (CGAP) and Ms. Eileen Burns (ESB Consulting) for their valuable support in reviewing and refining the draft.

This Compendium highlights the global commitment to advancing pre-arranged financial solutions that protect vulnerable communities, address inequalities, and build stronger, more resilient societies in the face of climate and disaster risks.

EXECUTIVE SUMMARY

This compendium serves as a practical guide and call to action for G20 countries and partners to scale up the use of risk transfer solutions that enable faster, more equitable financial protection before and after climate-related events. Despite increasing innovation and availability, significant protection gaps persist in 2024, only 344 million people were covered by microinsurance products across 37 countries—representing just 11.5% of a total addressable market of nearly 3 billion people[1]. With climate- and crisis-related events becoming more frequent, intense, and complex, pre-arranged risk finance mechanisms—such as parametric insurance, micro/meso/macro-level index insurance, regional risk pooling, anticipatory-action-linked risk transfer, and shock-responsive social protection—are increasingly vital. These tools not only reduce the burden of post-crisis debt and fiscal instability but also protect vulnerable populations and promote long-term resilience.

The compendium showcases diverse global and regional models, emphasizing how these instruments function across **macro (sovereign), meso (aggregator), and micro (household)** levels. It explores **technical design, delivery pathways**, and how such mechanisms can **complement national systems** for disaster risk reduction (DRR), public finance, health systems, and social protection. A risk-layering approach—blending insurance, contingency funds, reserve financing, and credit—ensures coverage across small to large-scale shocks.

Key case examples illustrate impact at scale, including:

- **ARC Replica payouts** in Zambia and Zimbabwe, which provided anticipatory food assistance to 430,000 people.
- The **Pacific Governance for Resilience** approach, integrating climate risk into budget and investment planning.
- The **Zimbabwe Resilience Building Fund (ZRBF)**, which combined long-term resilience with a **Crisis Modifier Mechanism** triggered seven times across 18 districts;
- Community-based models like **South Africa's STOKVELS** and localized contingency frameworks.

[1] https://microinsurancenetwork.org/resources/the-landscape-of-microinsurance-2024

The compendium also emphasizes **equity and accountability**, recognizing the disproportionate risks faced by **women, Indigenous Peoples, persons with disabilities, and informal workers**. Sections have been updated to reflect challenges in index-based insurance, highlight the importance of **financial system strengthening**, and advocate for alignment with **other G20 DRR Working Group deliverables** such as the Recovery Readiness Framework and High-Level Principles on DRR Financing.

In line with recent global reports, this document reinforces the call to **increase the share of pre-arranged crisis finance tenfold within a decade** shift necessary to deliver on the commitments of the **Sendai Framework**, **Paris Agreement**, and **G20 priorities on resilient development**.

ABBREVIATIONS

- **A2ii** – Access to Insurance Initiative
- **AICI** – Agriculture Insurance Company of India
- **AfDB** – African Development Bank
- **ARC** – African Risk Capacity
- **CAT Bonds** – Catastrophe Bonds
- **CDRFI** – Climate Disaster Risk Financing and Insurance
- **CCRIF** – Caribbean Catastrophe Risk Insurance Facility
- **CGAP** – Consultative Group to Assist the Poor
- **CRP** – Catastrophe Risk Pool
- **DFI** – Development Finance Institution
- **FISP** – Farmer Input Support Programme
- **FONDEN** – Mexico's Natural Disaster Fund
- **IBLI** – Index-Based Livestock Insurance
- **IDF** – Insurance Development Forum
- **ILO** – International Labour Organization
- **IPCC** – Intergovernmental Panel on Climate Change
- **LGU** – Local Government Unit
- **MCII** – Munich Climate Insurance Initiative
- **NAFMIP** – National Agriculture and Fisheries Modernization and Industrialization Plan
- **NAIS** – National Agricultural Insurance Scheme
- **NDRF** – National Disaster Response Fund
- **OECD** – Organisation for Economic Co-operation and Development
- **PCRIC** – Pacific Catastrophe Risk Insurance Company
- **PES** – Payment for Environmental Services
- **PICAP** – Pacific Insurance and Climate Adaptation Programme
- **PMFBY** – Pradhan Mantri Fasal Bima Yojana
- **SCCI** – Seychelles Sovereign Catastrophe Insurance
- **SA** – Social Assistance
- **SDRF** – State Disaster Response Fund
- **SPV** – Special Purpose Vehicle
- **SSN** – Social Safety Nets
- **TIAA-CREF** – Teachers Insurance and Annuity Association of America-College Retirement Equities Fund
- **UNCDF** – United Nations Capital Development Fund
- **UNDRR** – United Nations Office for Disaster Risk Reduction
- **VAT** – Value Added Tax
- **WBCIS** – Weather-Based Crop Insurance Scheme
- **WFP** – World Food Programme

- **WRMS** – Weather Risk Management Services
- **iOnboard** – Digital client onboarding solution by PICAP

INTRODUCTION

Disasters are no longer rare, isolated events—they are escalating in frequency, severity, and economic cost, pushing vulnerable nations and communities into cycles of crisis and recovery. The current reliance on slow-moving humanitarian aid, government relief, and reactive financial mechanisms is inadequate to meet the urgency of these shocks. Without pre-arranged, scalable, and efficient financial solutions, millions will continue to suffer from preventable economic collapse, food insecurity, and stalled recovery efforts.

Disasters severely disrupt health systems, impacting infrastructure and service delivery. While millions of people are already unable to access services due to cost constraints, disasters exacerbate existing health inequities. Catastrophic out-of-pocket payments force many vulnerable groups to choose between seeking care and meeting basic needs such as food and shelter. National and international disaster financing strategies must therefore be inclusive of the health sector to address these disparities.

The health sector is among the hardest hit during disasters. Infrastructure failures, service disruptions, and overwhelmed systems leave communities without essential healthcare. Over 60% of health facilities in LDCs are vulnerable to disasters, and post-disaster disease outbreaks account for nearly half of deaths. While millions already struggle to afford healthcare, disasters exacerbate these inequities—forcing people to pay out of pocket for subpar services or forgo treatment altogether. Well-structured risk transfer solutions can prevent systemic collapse, ensuring that essential services, particularly healthcare, remain functional when they are needed most.

Parametric health insurance provides fixed payouts based on predefined triggers—such as disease outbreaks or hospital stays—rather than actual medical expenses. For instance, ARC's Ebola insurance pays governments when epidemiological thresholds are met, enabling quicker public health responses. In countries like India, Bangladesh, and the Philippines, hospital cash products offer daily payments upon hospitalization, benefiting informal workers through simplicity and rapid disbursement. Additionally, new pilots are exploring index-based payouts for malaria prevention based on climate indicators like rainfall and

temperature. These innovations enhance financial protection and health system resilience.

Risk transfer solutions offer a decisive shift from disaster response to resilience-building. By embedding financial preparedness into national systems, these mechanisms provide rapid liquidity, stabilize economies, and protect the most vulnerable from disasters. Governments, businesses, and individuals must no longer bear the full burden of disasters alone—financial risk must be shared and mitigated. Through parametric insurance, catastrophe bonds, risk pooling, and social protection-linked instruments, we can create a financial safety net that acts before, not after, disaster strikes.

Pre-arranged finance plays a critical role in advancing anticipatory action and disaster preparedness. This proactive approach not only shortens response and recovery times but also enables predictable planning, fairer allocation of resources, and reduced fiscal strain on national budgets. As a collective, there is a need to promote shock-responsive systems that scale both financial instruments and the delivery infrastructure required to ensure timely support for those most at risk.

While this compendium highlights financial tools that help manage and transfer risk, it is essential to emphasize that **reducing the risks themselves must remain the foundation of any disaster resilience strategy**. Risk transfer can only be effective when complemented by sustained investments in disaster risk reduction (DRR), including resilient infrastructure, early warning systems, and risk-informed development. The governance capacity of each country—particularly the ability to allocate domestic budgets toward DRR—is central to achieving long-term resilience. Risk transfer mechanisms must not replace DRR investments but serve as part of an integrated approach.

It is important to recognize that **there is no one-size-fits-all approach** to disaster risk financing. Insurance and risk transfer mechanisms—whether for governments, sub-national entities, or individuals—are most effective when applied as part of a **broader risk layering strategy**, complementing tools such as contingency funds, reserve financing, or concessional credit. The selection and design of instruments must be **context-specific and policyholder-driven**, reflecting risk profiles, institutional capacity, and vulnerability levels.

This compendium is a call to action for donors, governments, and financial institutions to invest in risk transfer solutions on a scale. A stronger shift toward pre-arranged financing is essential. As emphasized in recent global financing reports, only a fraction of crisis funding is currently pre-arranged, resulting in preventable humanitarian, economic, and equity losses. Future action must scale up this proportion significantly—such as by tenfold over the next decade—if the resilience of low-income communities is to be meaningfully supported. The cost of inaction is far greater than the cost of preparedness. Every dollar invested in pre-arranged financing reduces economic losses, prevents humanitarian crises, and strengthens long-term resilience. The time for incremental change is over—climate risk transfer must become a cornerstone of global resilience strategies.

CDRFI instruments in pre- and post-disaster scenarios

Disaster risk finance instruments can be broadly categorized in ex-ante (pre-disaster) or ex post (post-disaster) instruments depending on their timing and the preparation needed. Ex ante instruments are pre-arranged and provide more rapid and reliable access to funds when a disaster strikes. Ex-post instruments of disaster risk finance, on the other hand, are reactive measures taken after a disaster occurs. While the latter can provide necessary funds in the immediate aftermath of a disaster, they often come with delays and unfavourable terms for the national governments. Hence, having ex-ante disaster risk finance instruments in place represents a strategic move away from national governments relying on post-disaster aid and prioritizes preparedness by establishing plans, systems and finances before a disaster strikes.

Ex-ante financing, utilized before a disaster, supports risk assessments, capacity building, mitigating infrastructure, regulatory improvements, early warning systems, and risk transfer mechanisms. Risk transfer mechanisms also ensure continuity in healthcare delivery before and after disasters. For example, following Hurricane Maria (2017), parametric insurance enabled key hospitals in Puerto Rico to reopen within weeks. During droughts in 2020, African Risk Capacity disbursed $36 million to sustain public health programmes. These cases illustrate how timely liquidity through pre-arranged instruments supports frontline health responses.

Ex-post financing, deployed after a disaster, covers emergency response, infrastructure reconstruction, and logistical costs. These financial strategies help

ensure timely intervention and long-term resilience. A balanced approach integrating both financing mechanisms is essential for effective disaster risk reduction and recovery. For example, Cyclone Idai (2019) left 2 million people without healthcare access. As previously noted, the African Risk Capacity (ARC) disbursed US$36 million in response to the 2020 droughts to finance public health programmes. These cases highlight the role of pre-arranged financing in protecting health systems during disasters.

Risk transfer products

Risk transfer involves shifting the financial burden of adverse events to a third party through premium payments before a disaster occurs. This allows governments and stakeholders to access liquidity and mitigate financial strain during response and recovery phases.

Special attention to People in vulnerable situations

Disasters hit marginalized communities hardest—not just due to exposure, but due to financial fragility. Without reliable financial protection, post-disaster relief often arrives too late to prevent long-term loss of livelihood or asset erosion.

Vulnerable communities— such as women, youth, persons with disabilities, indigenous Peoples, and displaced populations —face heightened risks due to **systemic inequalities** and **barriers to access**. These risks include severe healthcare inequities. Maternal mortality rises by 30% post-disaster, and children under five are 20% more likely to contract diseases. In the Philippines, microinsurance provided 200,000 women with access to health services during typhoons. Inclusive financial protection mechanisms are vital to addressing these disparities. Catastrophic out-of-pocket payments are a major driver of health inequity. In disaster contexts, many are forced to choose between paying for care or securing food and shelter. Without financial protection—such as health insurance or social cash transfers—these costs deepen poverty and limit access to life-saving services.

These populations often have limited social protection, constrained mobility, or fewer economic options, leaving them especially at risk when disasters strike.

Marginalized groups also experience disproportionate health risks during disasters. Maternal mortality rises by 30% post-disaster, and children under five are 20% more likely to contract diseases. In the Philippines, microinsurance provided 200,000 women with timely health access during typhoons. Financial

protection—through inclusive insurance or social assistance—can prevent these disparities from deepening.

To address these disparities, **targeted risk transfer mechanisms**, such as **parametric insurance**, must be designed with inclusivity and equity at their core. Such instruments not only provide **timely financial relief** but also help reduce the long-term impacts of disaster-related shocks on vulnerable livelihoods.

Examples:

- **Pastoralists in Kenya** benefit from the Index-Based Livestock Insurance (IBLI) programme, which safeguards small livestock owners—especially women and youth—against drought-induced losses (Index Insurance Innovation Lab, 2019).
- **In Colombia, refugees living in** temporary shelters receive climate risk insurance, enabling rapid payouts for floods and landslides (World Bank, 2019).
- **In India Informal workers are covered under** parametric insurance that protects against income loss from heatwaves and floods. (The Micro-Insurance Academy, 2018).
- The **Philippines' microinsurance programme** helped provide health access to 200,000 women during typhoons, mitigating the impacts of disaster-related healthcare disruptions (ILO, 2020).

○ Addressing Healthcare Inequity:

Disasters can amplify existing vulnerabilities—**post-disaster maternal mortality rises by 30%**, and **disease incidence in children under five increases by 20%** (WHO, 2018). When vulnerable communities lack insurance, they are forced to choose between accessing basic healthcare and meeting essential survival needs, deepening cycles of inequality.

○ Inclusive Practices in High-Income Contexts:

In Australia, the Disability Inclusive Emergency Management (DIEM) project demonstrates how accessibility and inclusion can be embedded in preparedness and response planning. In parallel, reforms to Australia's Disaster Recovery Funding Arrangements (DRFA) are designed to enhance the speed, targeting, and governance of post-disaster funding—ensuring that recovery mechanisms reach the most affected and promote equitable outcomes.

Policy Framing:

As noted by the Centre for Disaster Protection, inclusive risk transfer must be understood not just as a tool for protection, but as a corrective instrument for structural inequalities. The term “vulnerable individuals and communities” better reflects this framing, as it captures social, institutional, and economic barriers rather than attributing risk to individual capacity.

The World Bank defines “vulnerable individuals or groups” as those who, by virtue of age, gender, disability, economic disadvantage, or social identity, may be disproportionately affected by disaster impacts or less able to access recovery benefits.

CLIMATE AND DISASTER RISK INSURANCE

To better understand the architecture of disaster risk financing presented in this compendium, it is important to distinguish between macro, meso, and micro levels of risk transfer instruments. This classification helps clarify the roles of different actors—governments, intermediaries, and individuals—in financing and benefiting from disaster insurance. It also underpins a layered risk financing strategy, where each level corresponds to different scales of risk, frequency of events, and payout needs.

At the **macro level**, risk transfer instruments are held by national governments or sovereign entities to protect public budgets, critical infrastructure, and essential services. These include sovereign insurance policies, such as those offered through regional risk pools like the Caribbean Catastrophe Risk Insurance Facility (CCRIF), African Risk Capacity (ARC), and the Pacific Catastrophe Risk Insurance Company (PCRIC), as discussed in this Section. Other macro instruments include catastrophe bonds, contingency credit facilities, and government-managed reserve funds. These tools are designed to ensure large-scale liquidity immediately after a disaster, enabling timely response and recovery operations without disrupting national budgets.

The **meso level** refers to instruments held by intermediary entities—such as cooperatives, local governments, NGOs, or financial institutions—that purchase insurance on behalf of a defined group of beneficiaries. These arrangements facilitate risk pooling and enable quick distribution of payouts at the community or sectoral level. Meso-level instruments include weather index insurance for producer cooperatives and ARC Replica models, where humanitarian actors hold parametric policies aligned with national disaster plans. These are described in this and following Sections, illustrating how such models bridge macro-level financing and household-level needs.

At the **micro level**, individuals or households directly purchase insurance coverage, often for agricultural, health, or property-related risks. Products at this level are typically simplified through parametric or hybrid designs and are often bundled with loans, savings, or social assistance. Examples in this section include parametric crop insurance, takaful (Islamic microinsurance), and mobile-based microinsurance linked to financial services. These instruments are particularly

important for informal workers, smallholder farmers, and low-income populations who face limited access to formal safety nets.

By understanding and integrating these levels of insurance across policy, programming, and institutional strategies, governments and partners can create a comprehensive financial protection system. The classification not only supports more equitable and efficient delivery of resources but also allows for better alignment with broader development goals, such as those outlined in the Sendai Framework, the Paris Agreement, and G20 DRR working group's ambition.

Indemnity based insurance

Indemnity-based insurance compensates policyholders based on actual losses incurred, as defined in Swiss Re's "*Comprehensive Guide to Parametric Insurance*". Claims are assessed individually, requiring detailed evaluations before payouts are made. While this approach ensures accuracy, it is time-consuming and resource intensive.

According to the UNCDF and Access to Insurance Initiative's (A2ii) "*Index Insurance Training for all stakeholders*", indemnity insurance is particularly challenging for climate risks, especially for microinsurance customers. A key limitation is the lack of comprehensive historical data, making risk assessment difficult. Additionally, adverse selection and moral hazard contribute to higher costs and complex pricing structures.

The claims process presents further challenges. Verifying and disbursing payments requires on-site inspections and extensive documentation, delaying much-needed post-disaster funds. Reinsuring indemnity-based products is also difficult due to the unpredictability of individual loss patterns. These factors lead to higher premiums, reducing accessibility for vulnerable communities.

Some categories of indemnity insurance include:

I. Crop Indemnity Insurance: Crop indemnity insurance compensates farmers when crop yields or revenues fall below a set threshold due to risks like drought, floods, pests, or disease. It ensures income stability by covering losses through named or multi-peril policies. Claims are assessed through field inspections and yield evaluations, with payouts based on the difference between actual and insured yields.

Example: In Zimbabwe and Zambia, this insurance is mainly available to commercial farmers growing crops like wheat, tobacco, and soybeans, with no successful implementation reported for smallholder farmers.

II. **Livestock Indemnity Insurance:** Livestock indemnity insurance protects farmers from financial losses due to livestock mortality caused by accidents, diseases, and theft. A project in Southern Zambia, supported by Mayfair and FSD Zambia, has implemented comprehensive livestock insurance, integrated digital enrolment and claimed processing. Vision Fund and Zanaco have also explored livestock insurance, particularly for dairy farmers using cattle as loan collateral.

III. **Comprehensive Agricultural Assets Insurance:** This insurance covers agricultural assets, including crops, livestock, farm buildings, machinery, and irrigation systems. Some policies also include liability coverage. In Zambia, Natsave offers an Asset Plus Loan requiring insurance coverage for financed agricultural equipment.
Example: In Zambia, Natsave offers an Asset Plus Loan requiring insurance coverage for financed
agricultural equipment.

IV. **Hybrid insurance product:** Hybrid insurance combines weather index and yield index components for broader coverage. The hybrid model integrates weather indices to anticipate and address the immediate impacts of adverse weather, while the yield index addresses the longer-term effects on crop production. This hybrid product provides broader coverage by addressing immediate weather impacts and overall yield outcomes, serving as a safety net for farmers.

Example: Risk Shield piloted a hybrid index insurance product in Zambia's LDC Mechanisation scheme, integrating satellite-based early drought detection with final yield assessments. However, challenges arose due to farmers expecting indemnity-based settlements, leading to disputes. Hybrid models have since expanded, including FISP-linked insurance in Zambia and AFC Insurance's Pfumvudza-linked scheme in Zimbabwe.

Case Studies

1. India: National Agricultural Insurance Scheme (NAIS)

Implemented by the Agriculture Insurance Company of India (AICI), NAIS provides indemnity-based crop insurance against climate-related risks such as droughts and floods. Payouts are based on crop-cutting experiments that assess actual yield losses. The programme, subsidized by the government, aims to make coverage affordable for smallholder farmers. However, challenges include slow claims settlement and low farmer enrolment due to delays in payouts.

2. Vietnam: Vietnam Crop Insurance Programme

This programme insures rice farmers against floods, droughts, and typhoons by compensating them based on observed yield losses. Government subsidies reduce premium costs, and the Ministry of Agriculture collaborates with insurers to streamline claims processes (Vietnam Ministry of Agriculture and Rural Development, 2019). However, farmer participation remains low due to cost concerns, limited awareness, and delayed payouts.

While indemnity-based insurance is essential in certain contexts, its challenges—such as high costs, slow payouts, and complex assessments—necessitate complementary solutions like parametric insurance. By integrating both models, countries can enhance financial resilience against climate related risks and improve disaster recovery mechanisms

Note: Hybrid insurance models, combining index and yield components, may exhibit characteristics of both parametric and indemnity insurance. Their classification may vary based on design. In this compendium, they are discussed under indemnity insurance due to their yield-based validation processes.

Parametric Insurance

Parametric insurance is a type of insurance in which a payout is automatically triggered when certain predefined parameters (e.g., duration of a dry period, amount of precipitation, wind speed) are reached or exceeded. This type of insurance can also be referred to as "index-based insurance" as the triggers are thought of as indexes. These terms are used somewhat interchangeably2. Some types of parametric insurance are based on a modelled loss approach in which a payout is triggered when the value of modelled losses, calculated based on the hazard parameters, exceeds a given threshold.

However, despite its promise of affordability, simplicity, and rapid payouts, index-based insurance has not consistently delivered value to clients. Uptake has remained low in many regions, and high basis risk—where payouts do not reflect actual losses—has undermined trust in the product. Effective parametric insurance requires careful calibration, participatory design, and transparent communication

[2] More explanations on the key terms on Climate Disaster Risk Financing and Insurance you can find in this factsheet:*https://climate-insurance.org/wp-content/uploads/2023/07/CDRFI_25KeyTerms_Factsheet_June2023.pdf*

of how triggers are set and adjusted. Its integration with other financial tools and social protection systems is essential to improve relevance and impact.

Product categories:

Parametric insurance (or index-based insurance) aims to cushion the hardship of insured after loss of income or earning opportunity due to adverse weather conditions like excess rainfall, high wind speed, cyclones, etc. The key benefits of parametric insurance are the faster payout process, since no loss assessment is carried out. Payment is purely based on a pre-defined trigger event (certain wind speed or rainfall level being reached) in a set of agreed geographical locations.

Advances in technology, such as satellite imagery, drones, and improved weather stations, have made monitoring triggers more efficient. Combined with policyholder data, like precise site locations, these innovations have enhanced the precision and responsiveness of risk assessment and insurance models.

Some categories of parametric insurance include:

I. **Weather Index Insurance (WII):** WII protects farmers and agribusinesses against climate risks such as droughts, floods, and excessive rainfall. Unlike traditional insurance, it relies on a predetermined index (e.g., rainfall or temperature) to trigger payouts, eliminating the need for individual loss assessments. This model is particularly beneficial for smallholder farmers reliant on rain-fed agriculture.
Examples:
a) Organizations like the World Food Programme (WFP) have supported weather index insurance in Zimbabwe and Zambia through the R4 initiative.
b) The Zambian government also integrates this product into its Farmer Input Support Programme (FISP).
c) Agora Microfinance Zambia, bundles its agriculture loan product with weather index insurance developed by Risk Shield and underwritten by Mayfair Insurance Company

II. **Area Yield Index Insurance (AYII):**
AYII provides protection against substantial yield losses within a defined area by using aggregated yield data instead of individual loss assessments.

Example: Risk Shield continues to develop area yield index insurance for One Acre Fund in Malawi, Kenya, and Rwanda. One Acre Fund has also offered its farmers Area Yield Index developed by Risk Shield in Tanzania. Like many smallholder farmers in Africa, One Acre Fund farmers face significant agricultural production risks that impact their produce. To address this, One Acre Fund offers Yield Index Insurance in all countries where they extend input financing to help alleviate the financial pressures their farmers face during bad seasons. They also provide funeral

insurance for the farmers they work with, allowing the farmer to include one additional co-insured of his choice on the funeral insurance

III. **Livestock Index Insurance:** Livestock index insurance uses satellite data on rainfall and pasture conditions to trigger payouts. This eliminates the need for on-site loss assessments, enabling faster claim settlements.

Example: In Zambia, Risk Shield developed an index-based livestock insurance product for Magoye Dairy Cooperative, while Mayfair Insurance collaborates with the Ministry of Fisheries and Livestock and IFAD to expand coverage nationwide.

IV. **Flood Index Insurance:** Flood index insurance provides automatic payouts based on predefined flood parameters such as river levels and rainfall intensity.

Example: Farmers use flood index insurance to protect against crop losses due to flooding, which helps stabilize income and supports agricultural sustainability. Governments and humanitarian organizations use flood index insurance to fund disaster response efforts, enabling rapid mobilization of resources following a flood event. Municipalities and infrastructure projects employ flood index insurance to safeguard against damage to public assets and services.

Considerations about basis risk

Basis risk is the gap between actual losses and insurance payouts, occurring when the insured event does not align precisely with the insurance trigger. This can result in either missed payouts (under-compensation) or excess payouts (over-compensation). For instance, a farmer may experience severe drought-induced crop loss, yet the weather index insurance may not trigger if the predefined drought threshold is not met. Conversely, a payout may occur despite no significant loss.

Types and Sources of Basis Risk

- **Data Source Basis Risk:** Occurs when modeled data (e.g., CHIRPS rainfall datasets) does not fully capture extreme weather patterns compared to ground-based measurements.
- **Product Basis Risk:** When an index (e.g., cumulative rainfall over 5–7 days) fails to capture flash floods that occur over a few hours.
- **Spatial Basis Risk:** Arises when weather station data does not reflect actual conditions at the insured location due to geographic distance.
- **Temporal Basis Risk:** **Occurs when an insurance trigger is based on monthly averages, but crop damage results from short-lived extreme events.**

- **Idiosyncratic Basis Risk: Localized farming practices (e.g., irrigation use) may not be factored into regional indices, leading to payout mismatches.**

Factors Influencing Basis Risk

- **Weather Variability:** Rainfall and temperature fluctuations across short distances increase risk.
- **Distance to Measurement Stations:** The farther an insured farm is from a data source, the greater the potential mismatch.
- **Contract Design:** Narrow indices (e.g., rainfall in a critical crop-growing week) pose higher risks than broader, averaged indices.
- **Geographical Diversity:** Heterogeneous landscapes (coastal, mountainous, or urban areas) complicate risk assessment.

Key Strategies to Reduce Basis Risk

- **Improved Product Design:** Combining satellite and weather station data enhances accuracy. Adapting indices to match specific event patterns.
- **Risk-Pricing Awareness:** Policyholders must understand that lower premiums come with higher basis risk.
- **Aggregated Coverage:** Group-level policies (e.g., for cooperatives) help distribute risk.
- **Hybrid Models:** Blending weather index and yield index insurance improves precision.
- **Localized Data Use:** GPS-based farm data minimizes spatial discrepancies.
- **Enhanced Data Quality and Sources:** High-resolution **satellite imagery** and **IoT sensors** provide real-time, localized data, reducing payout mismatches.
- **Tailored Triggers:** Developing **region-specific indices** improves accuracy. For example: A flood index may use rainfall data from both **upland and lowland areas** to predict downstream flooding more effectively.
- **Multiple Indices and Datasets:** Using **combined triggers** (e.g., rainfall + temperature for crop insurance) improves correlation with actual losses.
- **Continuous Testing and Index Refinement:** Regular **back-testing** ensures indices remain relevant amid changing climate conditions.
- **Micro and Meso Insurance Models:** **Microinsurance** targets individuals, while **meso-level insurance** covers groups (e.g., farmer cooperatives) to

reduce spatial basis risk. For example: In cooperative models, claims are pooled and distributed based on real localized damage assessments (UNCDF, 2022).

- **Detailed Risk Assessments:** Understanding localized disaster vulnerabilities.

Managing basis risk is crucial for trust, sustainability, and effectiveness of parametric insurance. Through technological advancements, refined contract structures, and regulatory oversight, insurers can enhance the accuracy, fairness, and credibility of index-based insurance solutions, ensuring better resilience for vulnerable communities.

Macro or sovereign insurance

Macro-insurance refers to sovereign or government level insurance in which payouts are made to states or governments.

Insuring public assets and critical infrastructure

These parametric insurance products help governments protect public infrastructure from climate-related disasters, ensuring rapid recovery and reconstruction and provide governments with immediate liquidity, reducing fiscal strain and accelerating recovery after disasters.

1. **Caribbean Catastrophe Risk Insurance Facility (CCRIF):** Covering multiple Caribbean nations (e.g., Haiti, Jamaica, Bahamas), CCRIF provides quick payouts for hurricanes, earthquakes, and floods. Payouts, triggered by predefined weather parameters like wind speed or rainfall intensity, are used to repair critical infrastructure such as roads, schools, and hospitals. Since 2007, CCRIF has helped countries like Haiti and Jamaica access immediate funds within 14 days after disasters (CCRIF, 2020). In 2017, Dominica received a payout of **US$19.3 million** within days after Hurricane Maria, used to repair roads, bridges, and hospitals. Fast liquidity enabled immediate repairs to critical infrastructure before external aid arrived[3].

2. **Pacific Catastrophe Risk Insurance Company (PCRIC):** Designed for Pacific Island nations like Fiji, Tonga, and Samoa, PCRIC offers parametric insurance for cyclones, earthquakes, and tsunamis. Policies linked to weather data ensure that governments receive quick financial support to restore essential services and rebuild damaged infrastructure. Countries like Tonga and Fiji have used PCRIC payouts to rebuild schools, hospitals, and roads (Asian Development

[3] CCRIF SPC. (2018). *Annual Report*

Bank, 2019). Tonga received **US$3.5 million** in 2018 after Cyclone Gita, supporting immediate road clearance and utility restoration. Quick disbursement complemented delayed humanitarian funding, facilitating **continuity of critical services[4].**

3. **Indonesia's DRFI Strategy and State Asset Protection Framework:** Indonesia implements a State Asset Risk Management Scheme through a pooling fund mechanism designed to insure public infrastructure and assets, supported by a legal framework under the Ministry of Finance. In 2018, Indonesia launched its Disaster Risk Financing and Insurance (DRFI) Strategy, announced by the Vice President during the IMF–World Bank Annual Meetings in Bali. This comprehensive strategy integrates multiple financial instruments, including risk pooling, contingency budgeting, and sovereign insurance—to ensure disaster funding is timely, sustainable, and transparent. Additionally, a Presidential Regulation on the Disaster Pooling Fund has been issued to provide pre-arranged financing for all disaster phases: pre-disaster, emergency response, and recovery. The regulation aims to protect public services and the national budget from financial disruption due to disasters.

4. **Mexico's Natural Disaster Fund (FONDEN) & Catastrophe Bonds:** FONDEN, Mexico's disaster relief fund, integrates catastrophe bonds and parametric insurance to finance infrastructure repair after disasters. The programme links payouts to disaster triggers like earthquake magnitude or hurricane wind speed, ensuring rapid funds for rebuilding roads, bridges, and public buildings. As an early adopter of catastrophe bonds, Mexico continues to refine its disaster risk financing approach (World Bank, 2017).

5. **Philippines' Parametric Insurance for Public Infrastructure:** The Philippines' programme protects public infrastructure from cyclones, floods, and other natural disasters. Managed by the Department of Finance, the insurance triggers payouts based on weather data, ensuring rapid recovery funding for roads, schools, and government buildings. The funds support both immediate disaster response and long-term reconstruction (**Philippine Department of Finance, 2019).**

These examples demonstrate the scope of Parametric insurance to provide rapid liquidity to repair critical infrastructure before humanitarian aid or budget reallocation processes. Such speedy payouts can be used for the repair of assets such as bridges, roads, hospitals, clinics, schools, utilities and other critical public infrastructure. The success of such a risk transfer approach depends on robust trigger design, clear payout use plan, timely payouts and integration of parametric insurance with contingency planning.

[4] PCRIC. (2018). *Annual Report*

MESO- AND MICROINSURANCE

Microinsurance provides affordable protection to low-income individuals against specific risks in return for low premium payments that are proportionate to the likelihood and cost of the risk involved. It primarily caters to people with limited access to traditional insurance services and other resources to manage risks effectively.

Meso-insurance refers to insurance in which policyholders are associations or organizations. Those entities can include banks, small and medium-sized enterprises and also farmers' associations or cooperatives that purchase insurance policies to protect their member farmers.

Inclusive insurance: focus on low-income households, small-scale farmers

The Intergovernmental Panel on Climate Change (IPCC, 2023) reports that vulnerable communities—those least responsible for causing climate change—are bearing its most severe impacts. Poor communities face structural barriers to accessing climate risk insurance, including the absence of an insurance market, a lack of an enabling environment, and limited trust in financial institutions. In addition, to affordability, perceptions of insurance value and trust in institutions significantly influence uptake, particularly in rural and culturally diverse settings. Research suggests that willingness to pay is often shaped by prior experience, delivery mechanisms, and the extent to which products are seen to reflect community needs and risks. Tailoring outreach and education strategies to local contexts is therefore essential to increase insurance adoption among smallholder farmers and low-income households.

As climate risks intensify, they may become uninsurable, particularly for smallholder farmers and fishers, who are highly exposed to climate hazards **(Schaefer and Waters, 2016)**. At the macro level, the uninsured portion of the population is known as the "**protection gap" .** Without inclusive climate risk transfer mechanisms, extreme weather events deepen poverty cycles, widen the protection gap, and impede sustainable development.

To address these challenges, the **Munich Climate Insurance Initiative (MCII)** identified **seven "Pro-Poor" principles** based on an assessment of 18 insurance schemes **(Schaefer and Waters, 2016)**:

1. **Comprehensive, needs-based solutions** – Insurance must be embedded in broader risk management strategies tailored to local needs.

2. **Client value** – Reliable coverage that delivers real benefits is crucial for uptake.
3. Affordability – Financial support and pricing models must ensure access for poor and vulnerable populations.
4. **Accessibility** – Efficient, cost-effective distribution channels adapted to local contexts are essential for scaling.
5. **Participation, transparency, and accountability** – Involving beneficiaries and stakeholders in product design fosters trust, local ownership, and policy buy-in.
6. **Sustainability** – Economic, social, and ecological sustainability is key to long-term success.
7. **Enabling environment –** Policymakers must create conditions that support pro-poor insurance solutions.

As climate risks escalate, applying these principles can help ensure that climate risk insurance is an effective tool for protecting the most vulnerable while promoting resilience and sustainable development.

Importance of digitalization for financial inclusion

Financial inclusion ensures that individuals and businesses have access to affordable financial services, including transactions, credit, and insurance **(World Bank, 2022)**. In parametric insurance, digitalization enhances affordability and efficiency.

- **Lower premiums:** High-risk areas lead to expensive policies, but digital sales via web or mobile apps reduce costs, making insurance more affordable **(MCII, 2020).**
- **Quick payouts:** Direct transfers to mobile phones or bank accounts enable faster disbursement, ensuring families receive funds when needed most **(PICAP, 2023).**

Digitalization strengthens financial resilience by making parametric insurance more accessible and responsive to climate risks.

Case study: The Pacific Insurance and Climate Adaptation Programme's iOnboard platform

The Pacific Insurance and Climate Adaptation Programme (PICAP) was designed to improve the financial preparedness and resilience of Pacific households, communities, small businesses, organizations and governments towards the

economic impacts of climate change-induced disasters through the development and deployment of meso- and microinsurance products.

In the Pacific, the challenges posed by the geographical spread of the many archipelagos underline the need to leverage digital solutions for onboarding and claim payment to keep costs low. PICAP therefore uses iOnboard, a digital client onboarding solution developed by the software company ITGalax. Partner organizations use iOnboard to link their members to the parametric insurance products rolled out through PICAP. This is particularly useful for MSMEs, as they often lack basic and structured database applications, and therefore use spreadsheets or manual registers to store information about their members. To these institutions, iOnboard serves as an entry level record-keeping system. Details of their members/customers can be stored in a secure private database on the cloud and accessed through the internet. This allows insurers to enroll customers to the parametric insurance scheme with ease and make the payments to beneficiaries efficiently following a disaster. (PICAP, 2021).

The table below highlights some case studies where digitization has added value to the efficiency of parametric insurance products and processes:

Case Study	Location	Digitisation Approach	Key Learnings
1. Kilimo Salama (Syngenta Foundation & UAP Insurance)	Kenya	Mobile-based enrolment, premium payment via M-PESA, automated weather station data triggering payouts, SMS notifications for claims and payouts	Digital enrolment and payouts increased accessibility for smallholders; trust improved due to transparency; mobile literacy training was essential
2. Oxfam R4 Rural Resilience Initiative	Ethiopia & Senegal	Satellite rainfall data linked to mobile payout systems, local agents using tablets for enrolment and education	Digital triggers reduced basis risk concerns; combining digital insurance with savings and food security interventions increased impact
3. IBISA Mutual Parametric Insurance	India, Nepal, Niger	Blockchain-based mutual parametric insurance; remote	Blockchain increased trust and reduced admin costs;

		sensing data triggers payouts; community governance on digital platforms	community participation via digital mutual governance platforms enhanced ownership
4. ACRE Africa	Kenya, Rwanda, Tanzania	Digitised enrolment through agri-input suppliers with USSD code registration; automated weather data triggers payouts to mobile wallets	USSD enrolment accessible to farmers without smartphones; critical to maintain accurate farmer data to avoid payout errors
5. Global Parametrics & VisionFund – CIRIS Product	Myanmar, Philippines	Parametric insurance for microfinance institutions using remote sensing for typhoon and flood triggers; digital funds transfer for rapid liquidity to MFIs	Digitisation enabled MFIs to receive payouts within days, protecting microborrowers; integration with MFIs' existing systems was crucial for efficiency
6.InsuResilience Solutions Fund – Gramcover	India	Digitally distributed parametric insurance via Gramcover's online platform and partner app, integrated with weather data APIs	Digital platforms reduced distribution costs; combining with agent-based education-built trust and improved uptake

Digital payments (mobile money) significantly improve payout speed and user satisfaction. Simple enrolment mechanisms (USSD, apps, agent tablets) are critical for scale among low-income populations with limited digital literacy. Integration with existing digital ecosystems (MFIs, agri-input suppliers, government registries) enhances efficiency and reach. Blockchain and remote sensing enhance transparency, trust, and reduce administrative costs but require strong capacity building and connectivity infrastructure.

In summary, innovative technologies add significant value by simplifying and streamlining processes, as well as reducing the insurance premium as they digitize

processes members registration, premiums collection and the channelling of payouts. However, it is important to consider the country-specific context with regards to the national digital infrastructure and the level of digital literacy. It should be noted that exclusively relying on digital solutions can lead to the exclusion of certain target populations, such as the elderly or lower income groups who may not regularly use these technologies or have access to internet services. It is therefore imperative to provide trainings to partners and policyholders to increase their digital literacy and fully harness the benefits of technology. (MCII, 2020).

Ensuring affordability: premium financing and VAT exemptions

Despite the increasing availability of affordable climate risk insurance options over the last two decades, a large insurance protection gap persists, especially for the most vulnerable and poor populations. Reasons for the persisting protection gap are complex and context-specific and affordability concerns about climate risk insurance play an important role. Premium support can help address and overcome insurance market inefficiencies and affordability concerns, as well as reduce existing inequalities in protection through and improve access to climate risk insurance. In doing so, premium support contributes to the resilience-building effect of Climate and Disaster Risk Finance and Insurance solutions in general.

There is a range of concessional support tools available. These include not only direct premium support or premium financing but also the provision of concessional capital for insurance providers, the payment of reinsurance premiums, subsidizing operational costs, technical support, capacity strengthening, financing risk reduction measures, tax reductions or waivers and concessional credit.

Examples from multiple countries show how such policies can be implemented to improve coverage and equity:

- In **Fiji**, supported by UNCDF's Pacific Insurance and Climate Adaptation Programme (PICAP), the government introduced a VAT exemption in 2021 on climate and disaster risk parametric insurance premiums. This measure reduced costs and facilitated uptake among low-income households, especially farmers and market vendors, thereby enhancing pre-disaster financial resilience.

- In **South Africa**, agricultural insurance premiums are tax-deductible in drought-prone provinces (Eastern, Western, and Northern Cape), helping smallholder and emerging commercial farmers better manage climate risks. Public-private partnerships further support subsidized insurance options, including parametric components.

- **India and the Philippines** have implemented tax exemptions on premiums for crop and index-based insurance under national agricultural modernization plans (e.g., PMFBY in India, NAFMIP in the Philippines), promoting resilience in rain-fed farming areas.

- **Mexico** offers tax incentives for catastrophe insurance—including parametric options—as part of its national disaster risk reduction strategy. These incentives encourage wider private sector participation in financial risk management.

- In **Rwanda**, weather-based index and area yield index products are VAT-exempt and eligible for up to 40% premium subsidies. In addition, tax holidays and reduced income tax rates are offered to investors contributing to agro-insurance expansion.

- In **Vietnam**, under its revised VAT law (effective July 2025), agricultural insurance—including livestock and crop insurance—and microinsurance services are exempt from VAT to enhance affordability and accessibility.

- In **Malaysia**, microinsurance and agricultural insurance products, including those under the Perlindungan Tenang (PT) initiative, are VAT-exempt. These measures aim to increase insurance penetration among low-income groups through simplified, affordable coverage.

- In the **Philippines**, Microinsurance Mutual Benefit Associations (Mi-MBAs)—non-profit cooperatives offering low-cost insurance to poor households—are exempt from corporate income tax, gross premium receipts tax, and documentary stamp duties, allowing them to serve marginalized communities more efficiently.

- In **Kenya**, a 2021 High Court ruling reinstated VAT exemptions for insurance intermediaries (agents, brokers) following a legal challenge. The judgment protected the affordability of agricultural insurance by preventing tax cost pass-through to farmers.

Beyond tax policy, premium pre-financing by aggregators—including governments, NGOs, and financial institutions—has emerged as a critical mechanism to increase insurance affordability at scale:

- In **Kenya**, the Index-Based Livestock Insurance (IBLI) Programme, backed by USAID and the World Bank, pre-finances premiums for pastoralists in arid regions. This has enabled insurance uptake without upfront costs, benefiting over 100,000 livestock.

- In the **Philippines**, the Philippine Crop Insurance Corporation (PCIC), with support from local governments and donors, pre-finances premiums for smallholder farmers in high-risk areas prone to typhoons and drought.

- In **Senegal**, the government and partners—including the World Bank and USAID—pre-finance La Niña and drought parametric insurance for over 10,000 smallholder farmers, ensuring quick payouts based on weather triggers.

Across these examples, VAT exemptions and premium financing mechanisms serve four key policy objectives: reducing the cost burden for smallholder farmers, incentivizing insurance distribution by aggregators and insurers, mitigating systemic agricultural risks crucial to national food security, and promoting financial inclusion among climate-exposed populations.

Takaful insurance

Takaful-based climate risk and parametric insurance are emerging as Shariah-compliant alternatives in Muslim-majority countries, where conventional insurance is prohibited. Takaful operates on mutual cooperation, risk-sharing, and collective responsibility, ensuring ethical financial protection.

In the Maldives, a Takaful-based natural disaster insurance programme protects vulnerable coastal communities from cyclones and rising sea levels. Designed in collaboration with the government, local Takaful operators, and the World Bank, it provides rapid payouts based on parametric triggers, such as wind speed or rainfall levels (World Bank, 2020).

Indonesia has introduced **Shariah-compliant (**Takaful) **insurance models** to expand financial protection for climate-vulnerable populations, especially in rural and underserved communities. These efforts include the deployment of **takaful-based crop insurance**

In support of this strategy, the government has issued a **Ministerial Regulation on Agricultural Insurance**, which formalizes protection for farmers against losses caused by natural hazards, pests, and climate-induced risks. This regulatory framework strengthens Indonesia's broader approach to **inclusive and ethical risk transfer**, particularly for low-income farming households.

By aligning Shariah principles with national risk financing strategies, Indonesia is contributing to the diversification of insurance solutions that are socially and culturally appropriate, while also enhancing resilience in the agricultural sector.

In Pakistan, Takaful flood insurance supports communities frequently affected by floods. Parametric triggers linked to rainfall indices and flood markers enable swift compensation, helping affected families rebuild quickly. The programme is expanding through government and private sector partnerships with local Takaful operators (Pakistan Insurance Association, 2019).

By aligning with Islamic finance principles, Takaful parametric insurance enhances financial inclusion, disaster resilience, and rapid recovery in climate-vulnerable regions. The following table summarises additional examples and key lessons from Takaful compliant parametric insurance products:

Case Study/ Product	Country/ Region	Hazard Covered	Design Implementer	Key Lessons Learned
1. Salam Takaful – Weather Index Crop Takaful	Pakistan	Excess or deficit rainfall, temperature extremes	Salam Takaful Ltd launched Pakistan's first weather index-based crop Takaful product. Uses parametric triggers with payouts into cooperative Takaful pools.	First parametric Takaful in Pakistan; Shariah compliance ensured by using mutual risk-sharing pool model; farmer trust built via integration with agri-extension services; challenge remains in managing basis risk communication.

2. Malaysia Agricultural Takaful Feasibility	Malaysia	Flood and drought risks for paddy farmers	Feasibility studies by Bank Negara Malaysia, AgroBank and Malaysia Takaful Association assessed parametric options for agricultural Takaful.	Found parametric Takaful feasible within existing Shariah frameworks; recommended strong government support and subsidies to make premiums affordable.
3. Islamic Development Bank (IsDB) & ARC Takaful	OIC Member States in Africa	Drought and food security risks	IsDB partnered with African Risk Capacity to explore a **sovereign-level Takaful window** for its drought insurance products, compliant with Islamic finance principles.	Important innovation to extend risk pooling to Shariah-compliant member states; showed potential for expanding sovereign parametric Takaful; implementation progress has been gradual due to regulatory and structuring complexities.
4. Indonesia – Takaful Agricultural Microinsuranc	Indonesia	Excess rainfall and drought	Piloted parametric Takaful insurance for	Highlighted need for simplified payout

e Pilot (Mandiri AXA & MFI)			smallholder farmers via MFIs; included Shariah advisory board certification.	communicatio n; religious acceptability improved uptake in Muslim-majority farming communities.
5. Global Parametrics – Takaful Structured Products Feasibility	Multiple OIC countrie s	Cyclone, drought, and flood risks	Feasibility studies to structure Takaful-compliant parametric climate risk products, e.g. for humanitarian agencies and Islamic financial institutions.	Demonstrated that parametric structures fit well within Takaful risk-sharing frameworks; practical deployment requires Shariah board engagement from design stage.

Parametric triggers fit well with Takaful principles, as both emphasise transparency, pre-agreed terms. and mutual risk-sharing (Tabarru'). Religious acceptability increases product trust and adoption in Muslim-majority contexts. Shariah board involvement from design stage is essential to certify compliance and build confidence. Managing basis risk and product simplicity remains critical to user satisfaction, similar to conventional parametric insurance. Government subsidies or premium support may be needed to scale agricultural climate risk Takaful products for low-income populations.

Nature positive insurance

Insurance plays a crucial role in protecting natural ecosystems and the communities that depend on them by providing financial mechanisms to manage risks and enhance resilience. By transferring capital to nature-positive activities, it

supports biodiversity conservation and mitigates climate change impacts. Insurance can fund the restoration of coral reefs, mangroves, and forests, ensuring these ecosystems continue providing essential services. Additionally, insurance products covering environmental liabilities hold polluters accountable, making funds available for remediation. Integrating nature-related risks into insurance strategies drives investments toward sustainability, strengthening the relationship between human activities and the natural world.

The **MAR Insurance Programme** enhances the resilience of the Mesoamerican Reef (MAR) and its dependent communities through parametric insurance. It provides rapid financial resources for reef restoration following hurricanes, ensuring quick ecosystem recovery. Built on governance, capacity building, and pre-positioned funding, the program protects both ecological and economic benefits for millions in the region.

AXA Climate Insurance, in collaboration with Blue Finance and Howden, safeguards marine protected areas (MPAs) in Belize and the Philippines from tropical cyclones. This parametric model ensures swift payouts based on meteorological data, enabling immediate restoration of marine reserves, including Turneffe Atoll (132,000 hectares) in Belize and North Oriental Mindoro (5,200 hectares) in the Philippines. The funds support debris removal, coral care, and infrastructure repair, strengthening resilience.

Brazil's **Sustainability-Linked Insurance for Forests** protects the Amazon from deforestation, fires, and climate-related risks. Payouts are triggered by deviations from a baseline forest health index, providing financial incentives for conservation and supporting reforestation efforts when degradation occurs (Nature Conservancy, 2020). Similarly, the **Amazon Rainforest Protection Insurance Programme** leverages parametric insurance to mitigate climate impacts on the rainforest, with payouts triggered by rainfall deficits or temperature anomalies. Funds from this insurance finance conservation and restoration activities to preserve one of the world's most vital ecosystems (Environmental Defense Fund, 2021).

In **India, Parametric Insurance for Water Resource Management** helps safeguard groundwater and surface water systems essential for agriculture. Linked to rainfall thresholds, this insurance provides payouts when droughts or floods impact water availability, supporting water infrastructure restoration and farmers' livelihoods. Likewise, India's Mangrove and Coastal Ecosystem Insurance protects mangroves from cyclones and floods, ensuring quick recovery through climate-triggered payouts (The Micro-Insurance Academy, 2018).

Costa Rica's Payment for Environmental Services (PES) integrates parametric insurance to support forest conservation. Landowners receive financial incentives for maintaining forests that provide carbon sequestration and biodiversity benefits,

with payouts triggered when climate related events like droughts disrupt ecosystem services (The World Bank, 2020).

In **Senegal, La Niña and Drought Insurance** pre-finances premiums for smallholder farmers, helping them manage prolonged drought risks. Supported by the government, World Bank, and USAID, the scheme ensures timely financial relief, enhancing resilience in drought-prone regions (World Bank, 2018).

The **Seychelles' Coral Reef Insurance Scheme** provides rapid financial support to restore coral reefs damaged by cyclones or bleaching events caused by rising sea temperatures. This parametric model helps sustain marine biodiversity and supports fisheries and tourism, key pillars of the local economy (Seychelles Government and The Nature Conservancy, 2020).

Ecosystems can be insured under parametric models if clear triggers correlate with ecosystem damage (e.g. storm intensity for reefs or mangroves). Pre-agreed restoration action plans and governance structures are essential to ensure rapid and effective use of payouts. Combining insurance with ecosystem-based adaptation (EbA) investments can reduce long-term risks and potentially lower premiums. Stakeholders buy-in – including local communities, governments, private sector, and conservation organisations – is critical for sustainability and funding. Practical challenges include basis risk, defining measurable damage triggers for ecosystems, and clarifying who holds the policy and manages payouts (public, community trust, or private asset owners).

Through these initiatives, parametric insurance is emerging as a powerful tool for ecosystem conservation, climate adaptation, and disaster resilience, ensuring natural assets and livelihoods remain protected.

Macro-to-micro insurance mechanisms

Microinsurance offers affordable coverage to low-income individuals against specific risks, ensuring financial security for those with limited access to traditional insurance. **Macro insurance**, on the other hand, is sovereign-level coverage where governments act as policyholders, using payouts to maintain services, fund disaster response, and support affected communities.

While macro programs help governments manage disaster risks, their ultimate goal is to protect vulnerable populations. **Macro-to-micro insurance** bridges this gap by ensuring that payouts directly reach those most in need, such as smallholder farmers and social welfare recipients **(CGAP, 2024).**

Governments can implement macro-to-micro mechanisms in two ways:

- **Direct Premium Support:** The government funds insurance premiums for individuals, who receive payouts directly.

- **Sovereign Risk Pools:** The government purchases insurance acts as the policyholder, and channels payouts to affected households.

A key example is the **Pacific Insurance and Climate Adaptation Programme (PICAP)**, which, in partnership with the **World Food Programme (WFP)** and **Fiji's Ministry of Children, Women, and Social Protection**, introduced a **climate risk insurance product for social welfare beneficiaries**. This initiative aims to expand coverage across Fiji's social protection system, ensuring payouts are **directly transferred** to those in need.

By integrating macro and micro approaches, governments can enhance financial resilience, ensuring rapid, targeted relief for vulnerable communities.

Public-private insurance partnerships

Public-private partnerships, or PPPs, are collaborative arrangements between public-sector entities and

Public-private partnerships (PPPs) harness private sector expertise and investment to strengthen disaster resilience, particularly in critical sectors like infrastructure and healthcare. By combining public resources with private innovation, PPPs enable sustainable financing for risk reduction and faster recovery from climate-related disasters.

A key example is climate risk insurance in healthcare, where PPPs ensure uninterrupted medical services after extreme weather events. In 2020, climate disasters disrupted healthcare for 74 million people globally (WHO, 2021). Following Cyclone Winston, Fiji's parametric insurance, developed through PPPs, disbursed $1 million for rural clinic repairs, restoring care for 10,000 patients (PICAP, 2021).

For further insights, explore Watson et al., "Finance for Reducing Disaster Risk: 10 Things to Know[5]" and **UNISDR's report on PPPs in East Asia (2009)**[6].

Below table summarises case studies of some PPPs applied for disaster risk insurance:

[5] https://www.undp.org/sites/g/files/zskgke326/files/publications/Finance%20for%20reducing%20disaster%20risk-10-Things-to-know-report.pdf

[6] https://www.unisdr.org/files/12080_TheDevelopmentofPublicPartnershipFr.pdf

Case Study/ Product	Country/ Region	PPP Structure	Key Challenges	Key Successes
1. CCRIF SPC (Caribbean Catastrophe Risk Insurance Facility)	Caribbean (16+ countries)	Regional pooled parametric insurance facility – governments as policyholders; capital from multilateral donors and private reinsurers	- Ensuring affordability for small island states with tight budgets - Limited payouts for medium-severity events (basis risk) - Complex governance with multiple sovereign stakeholders - Difficulty in maintaining donor and member premium contributions over time	Enabled rapid payouts post-disaster (e.g. Haiti, Dominica) for emergency response; successful model of regional risk pooling with private reinsurance market leverage
2. African Risk Capacity (ARC)	Africa (30+ member states)	Government-led parametric insurance with private reinsurers and donor premium support	- Low uptake due to competing budget priorities - Premium affordability without sustained donor subsidies - Political	Provided fast payouts to Senegal, Niger, Malawi for drought relief; strong technical assistance model; incentivised early action planning

			reluctance to allocate limited budgets to premiums - Complex product understanding at government level, delaying purchase decisions	
3. PCRIC (Pacific Catastrophe Risk Insurance Company)	Pacific Islands	Regional parametric insurance PPP – governments, World Bank, private reinsurers	- Very small premium pools; high relative premium costs - Governments viewed it as competing with budgetary disaster funds - Complex negotiation and understanding of triggers by policymakers - Sustainability dependent on donor premium subsidies	Enabled rapid payouts for Tonga, Vanuatu, supporting immediate infrastructure and livelihood recovery

4. Index-Based Livestock Insurance (IBLI) Public-Private Scheme	Kenya, Ethiopia	Research-public sector-private insurer partnership to provide drought index insurance for pastoralists	- Basis risk from limited satellite data calibration - Difficulty in sustaining subsidies post-donor pilot funding - Private insurers wary of low profit margins; public sector wary of long-term subsidy dependence	Improved pastoral household resilience; scalable model integrating insurance with public extension services
5. CADENA (Agroasemex Mexico)	Mexico	Federal and state governments purchasing parametric drought/flood insurance from Agroasemex (public reinsurer) and private reinsurance markets	- Distribution challenges: payouts to municipalities did not always reach individual farmers equitably - Complex coordination between federal and state agencies - Political turnover disrupting continuity	Timely payouts enabled municipal governments to implement emergency relief and agricultural rehabilitation programs
6. India Weather-Based Crop	India	Government-subsidised parametric	- Basis risk due to poor weather	Large-scale coverage (>30 million

Insurance Scheme (WBCIS)		crop insurance scheme delivered by private insurers	station coverage - Data manipulation risks at local weather stations - Low farmer awareness and trust in parametric payouts - Delays in government premium subsidy payments to insurers, impacting sustainability	farmers); improved access to insurance for weather risks compared to indemnity crop insurance alone

Some of the key challenges with such PPPs include the following:

1) **Affordability and Budget Competition:** Governments struggle to prioritise premium payments over immediate development needs; donor subsidies often required for viability.
2) **Complex Governance and Coordination:** Multi-stakeholder PPP structures involve lengthy negotiations, conflicting objectives, and complex accountability.
3) **Basis Risk and Product Understanding:** Technical complexity of parametric triggers leads to misunderstandings by policymakers and insured parties; basis risk undermines trust.
4) **Sustainability and Dependence on Donor Subsidies:** Many PPP parametric schemes remain heavily reliant on external funding, threatening long-term continuity.
5) **Distribution and Equity Challenges:** Where payouts go to governments or municipalities, reaching intended vulnerable populations transparently and equitably is difficult.

6) **Private Sector Profitability Constraints:** Limited margins and high reputational risks of basis risk make private insurers cautious unless PPP structures adequately share risk.

Despite these challenges, PPPs have enormous potential for scaling up climate risk insurance through rapid liquidity for emergency response; Improved resilience of vulnerable populations indirectly; Leveraged private reinsurance market capacity and innovative regional risk pooling models (e.g. CCRIF, ARC, PCRIC) demonstrate feasibility.

REINSURING DISASTER RISK

Reinsurance enables insurers to transfer a portion of their risk to reinsurers, ensuring financial stability during catastrophic events. By enhancing insurers' capacity, reinsurance supports disaster risk management, particularly in the Global South, where limited insurance penetration exacerbates vulnerability.

Key Benefits of Reinsurance:

- **Expanded Capacity**: Enables local insurers to underwrite more policies, including innovative parametric insurance.
- **Financial Stability**: Shields insurers from catastrophic losses, ensuring solvency.
- **Economic Resilience**: Facilitates timely post-disaster claims, minimizing economic disruption.
- **Innovation**: Reduces risk exposure, encouraging insurers to develop parametric and hybrid products.
- **Claims Management**: Provides expertise for efficient claims settlement.

Reinsurance strengthens disaster resilience by enhancing risk-sharing, financial stability, and insurance innovation. However, challenges like high costs, limited data, and regulatory gaps must be addressed through risk pooling, blended finance, and PPPs. By leveraging tailored solutions like parametric insurance and sovereign risk pools, the Global South can expand insurance access and build climate resilience. Financing is essential for the sustainability of health-related

disaster insurance. While low-income countries allocate only 3% of disaster budgets to preparedness, they face over 50% of disaster-related deaths. For instance, CCRIF paid $40 million post-Hurricane Dorian to restore healthcare and infrastructure—underscoring how risk pooling and reinsurance can protect critical services.

In countries without formal health insurance, Community-Based Health Financing (CBHF) models pool resources to reduce out-of-pocket costs. While they foster community solidarity, the poorest are often excluded due to affordability barriers. Integrating CBHF with social assistance and unconditional cash transfers during disasters can improve access to healthcare and reduce financial vulnerability.

Challenges in Securing Reinsurance in the Global South

- **Limited Data**: Inadequate historical and real-time data hinders accurate risk pricing.
- **High Costs**: Reinsurance premiums are often unaffordable in low-income countries.
- **Risk Aversion**: Reinsurers hesitate to engage in high-exposure regions.
- **Regulatory Barriers**: Weak frameworks and political instability deter investments.
- **Market Fragmentation**: Small, uncoordinated programs prevent efficient risk pooling.
- **Lack of Scale**: Small-ticket programs struggle to attract global reinsurers.
- **Limited Technical Expertise**: Local insurers lack capacity to design and manage parametric insurance.

Strategies to Overcome Barriers

1. **Risk Aggregation**: Pooling risks across multiple regions increases program size and attractiveness. **Example**: **African Risk Capacity (ARC)** pools drought risks across multiple countries, securing better reinsurance terms.

2. **Blended Finance**: Governments and **development finance institutions (DFIs)** provide funding to scale small programs. **Example**: **InsuResilience Global Partnership** blends donor and private capital to expand insurance in emerging markets.

3. **Capacity Building**: Training for insurers enhances underwriting, pricing, and claims management. **Example**: **Insurance Development Forum (IDF)** supports emerging market insurers.

4. **Public-Private Partnerships (PPPs)**: Governments create national insurance schemes to expand market size. **Example**: **India's Weather-Based Crop Insurance Scheme (WBCIS)** used government subsidies to attract reinsurers.

5. **Alternative Risk Transfer (ART)**: Instruments like **catastrophe bonds (CAT bonds)** diversify risk transfer mechanisms. **Example**: **Mexico's CAT bond program** provides sovereign disaster coverage for earthquakes and hurricanes.

Reinsurance solutions

Reinsurance ensures affordability, sustainability, and rapid financial response, strengthening disaster resilience in climate-vulnerable regions.

Facultative reinsurance covers specific high-risk cases, such as cyclones or floods, that exceed an insurer's capacity. Treaty reinsurance enables insurers to cede a portion of their risk portfolio automatically, commonly used for parametric insurance to manage exposure to catastrophic events. Stop-loss reinsurance protects insurers by capping their losses on individual claims or over time, ensuring financial stability in disaster-prone regions.

Some of the best practices to consider in the reinsurance of parametric insurance include the following considerations:

- **Design Transparent and Objective Triggers:** Use clear, **verifiable third-party data sources** (e.g. satellite, rainfall gauges, seismic data) to reduce disputes. Ensure triggers have **minimal basis risk** to maintain credibility with primary insurers and insured clients.
- **Engage Reinsurers Early in Product Design:** Co-develop triggers and payout structures with reinsurers to ensure **alignment with their risk appetite and pricing frameworks**.
- **Structure Layering Appropriately:** Retain manageable risk layers locally (deductibles/retentions) while transferring **tail risks** to reinsurers to optimise premium costs.

- **Use Data Sharing Agreements:** Share robust historical hazard and exposure data to enable accurate pricing and adequate capital provision.
- **Ensure Regulatory Alignment:** Comply with local reinsurance regulations, especially where parametric products are still emerging in legal frameworks.
- **Integrate with Portfolio Diversification:** Bundle parametric reinsurance with other insurance portfolios to achieve diversification and improve pricing.
- **Establish Clear Claims Settlement Protocols:** Pre-agree calculation, validation, and payment procedures to ensure **rapid and dispute-free payouts**.
- **Build Long-Term Relationships:** Develop strategic partnerships with reinsurers for continuous product improvement and innovation (e.g. new triggers, blended finance structures).
- **Combine with Risk Financing Instruments:** Use reinsurance alongside **contingent credit, reserves, and catastrophe bonds** for comprehensive risk management.

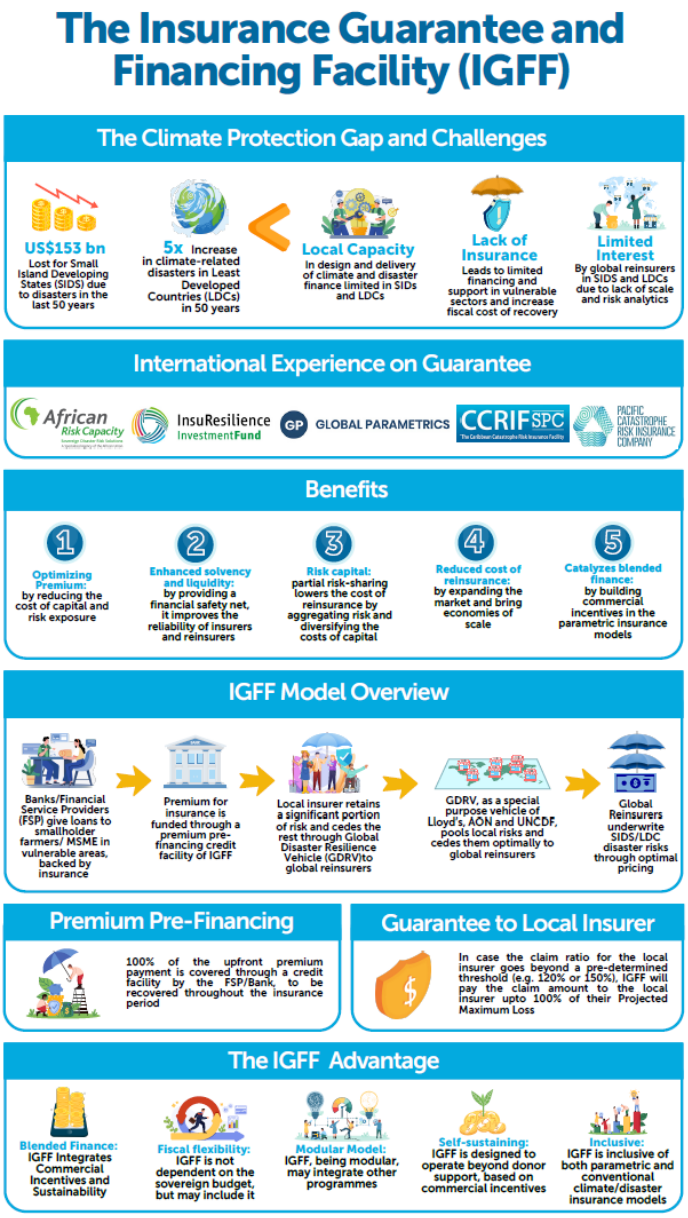
Major challenges related to reinsurance includes the following:

- **Basis Risk:** Reinsurers remain cautious of significant basis risk undermining payout legitimacy and reputation of the product.
- **Limited Historical Data:** Scarcity of long-term, high-quality hazard data in many developing regions limits accurate pricing and capital modelling.
- **Complexity in Product Structuring:** Designing appropriate triggers and payout structures requires strong technical capacity and time.
- **Regulatory Uncertainty:** Many insurance regulators lack specific guidelines for parametric products and reinsurance, creating legal ambiguity.
- **Market Size Limitations:** Small premium volumes for many parametric products (especially microinsurance) may be unattractive unless pooled.
- **Mismatch in Expectation:** Insurers or governments may expect full indemnity coverage while reinsurers provide parametric payouts based on pre-agreed triggers, leading to misalignment.
- **Reputation Risk:** Basis risk-induced dissatisfaction can create reputational risks for reinsurers, especially when payouts do not match perceived losses.

India's PMFBY Scheme – India's Pradhan Mantri Fasal Bima Yojana (PMFBY) provides parametric crop insurance, backed by global reinsurers like Munich Re and Swiss Re. These arrangements absorb financial shocks from floods, droughts, and cyclones, ensuring insurers can cover large-scale agricultural losses (Indian Ministry of Agriculture, 2019).

The Philippines' Catastrophe Risk Pool (CRP) – The Philippine government uses treaty reinsurance with Swiss Re, Munich Re, and TIAA-CREF to manage widespread disaster risks. The CRP employs parametric triggers (wind speed, rainfall) to enable swift payouts, preventing depletion of reserve funds and protecting vulnerable communities (Philippine Department of Finance, 2018).

Insurance guarantee facilities



An **insurance guarantee facility** ensures financial commitments by providing a guarantee on behalf of an individual or business. If obligations are unmet, the insurer covers losses up to the agreed limit. These facilities **enhance trust, mitigate risk**, and support market stability.

Mechanisms like **quota share and excess loss** help local reinsurers build capacity while managing exposure. Additionally, **premium pre-financing** offers a flexible alternative to traditional payments, stimulating demand and expanding access to insurance solutions.

The UNCDF's PICAP is working on an insurance guarantee facility to pilot for parametric insurance solutions.

The Insurance Guarantee and Financing Facility (IGFF), developed by UNCDF, builds on these pilots to provide a scalable mechanism that addresses affordability and solvency barriers in climate and disaster risk insurance. By offering premium pre-

financing guarantees and de-risking reinsurance arrangements, the IGFF enables smallholder farmers, MSMEs, and vulnerable households in SIDS and LDCs to access timely and affordable insurance products. This model combines local risk retention with global reinsurance through the Global Disaster Risk Vehicle (GDRV), creating fairer pricing and more sustainable insurance markets. IGFF bridges protection gaps by making insurance affordable, accessible, and inclusive for those most at risk.

NON-INSURANCE SOLUTIONS

Catastrophe bonds

Catastrophe bonds (cat bonds) are insurance-linked securities (ILS) that transfer the financial risk of natural disasters from sponsors—such as governments or insurers—to capital market investors. Emerging in the 1990s to address growing disaster losses (Cummins, 2007; Mahul & Cummins, 2009), cat bonds provide immediate liquidity post-disaster, reducing reliance on public funds and external aid.

Financing for Shock-Driven Food Crisis (FSFC)

A global financing facility has been established to improve anticipatory action in the context of food insecurity, designed to address the delay between early warnings and humanitarian response. The facility supports rapid fund disbursement using pre-agreed scientific triggers—such as forecasts for droughts, floods, and conflicts—and relies on pre-developed action plans. It includes blended finance and risk transfer tools, engaging public and private investors to address previously uninsurable risks like political instability and locust outbreaks. By integrating early warning data and structured action planning, it enables timely and scalable crisis response, targeting structural gaps in access to financial support for the most food-insecure populations.

Following the 2004 Indian Ocean tsunami, Indonesia implemented **debt relief and debt-swap mechanisms** as part of its recovery strategy for Aceh and Nias, coordinated through the BRR Aceh-Nias agency. This experience—enabled through international partnerships—highlighted the value of accessible and

flexible financial instruments in post-disaster recovery and laid the groundwork for today's integrated risk transfer strategies.

Functioning

How Cat Bonds Work:

Cat bonds involve **four key steps**:

1. **Issuance** – A sponsor (e.g., government, insurer) issues a bond through a **Special Purpose Vehicle (SPV)**.
2. **Collateralisation** – Investors buy the bond, and funds are held in secure accounts.
3. **Trigger Events** – Payouts occur if predefined conditions are met:
    - **Indemnity-based:** Linked to actual losses.
    - **Parametric:** Based on measurable thresholds (e.g., wind speed).
    - **Modelled loss:** Uses predictive modelling.
4. **Payout or Return** – If no disaster occurs, investors get their capital plus interest. Otherwise, funds are used for recovery (Pughe, 2024; Artemis, 2025).

Benefits Of Cat Bonds:

- **Risk Transfer** – Offloads disaster-related financial risks (Cummins et al., 2007).
- **Liquidity** – Enables **rapid recovery financing** after disasters.
- **Diversification** – Attracts institutional investors seeking **uncorrelated assets**.
- **Innovation** – Advances **predictive modelling** and **parametric triggers** (Mahul & Cummins, 2009).

Challenges And Barriers:

Despite their advantages, cat bonds face hurdles:

- **High Costs** – Legal, administrative, and regulatory expenses make them inaccessible to smaller nations (Cummins, 2007).
- **Complexity** – Requires specialized expertise in structuring and risk modelling.

- **Basis Risk** – Parametric and modelled-loss triggers may not fully align with actual damages, affecting payout accuracy (Pughe, 2024).

Notable examples of CAT bonds being used for risk transfer and successes and challenges are summarised below:

Case Study/CAT Bond	Country/Region	Hazard Covered	Key Successes	Key Challenges	References
1. Mexico CAT Bonds (FONDEN)	Mexico	Earthquake and hurricane	- First sovereign CAT bond issued in 2006, renewed multiple times (latest $485 million bond in 2020) - Provided rapid liquidity to FONDEN for disaster response - Reduced reliance on ex-post borrowing or budget reallocation	- Basis risk: triggers based on earthquake magnitude or hurricane parameters sometimes did not match localised damage - Political changes risked discontinuity of premium funding	World Bank (2020). *Mexico CAT Bond Factsheet.*
2. Caribbean Catastrophe Risk Insurance Facility (CCRIF) CAT Bond (IADB	Caribbean	Hurricanes and earthquakes	- Issued in 2014 ($30 million) to capitalise CCRIF parametric insurance pool -	- Small size limited risk transfer benefits; cost of issuance high relative to premium base	CCRIF SPC (2014). *Annual Report.*

& World Bank)			Enhanced CCRIF's capacity to pay out rapidly to member states		
3. World Bank Pandemic Emergency Financing Facility (PEF) CAT Bonds	Global (IDA-eligible countries)	Pandemic outbreaks (e.g. Ebola, COVID-19)	- First pandemic CAT bond ($320 million) issued in 2017 - Innovative parametric trigger based on outbreak size and spread; paid out partially during Ebola outbreaks	- Widely criticised for failing to payout timely for COVID-19 due to narrow triggers; highlighted challenges of designing appropriate triggers for complex risks	World Bank (2020). *PEF Final Report.*
4. Philippines CAT Bond (IADB & World Bank)	Philippines	Earthquake and tropical cyclone	- $500 million CAT bond issued in 2019 - Largest sovereign CAT bond in Asia; provided quick access to funds for national disaster response	- High transaction costs; challenges in ensuring continuity beyond bond term	World Bank (2019). *Philippines CAT Bond Press Release.*

5. New Zealand Earthquake Commission CAT Bonds	New Zealand	Earthquake	- Issued CAT bonds since 2014 to diversify reinsurance; $225 million bond renewed in 2017 - Reduced reinsurance costs and provided multi-year certainty of cover	- Requires sophisticated legal, actuarial, and modelling capacity for structuring	EQC NZ (2017). *Annual Report.*
6. World Bank CAT Bond for Chile	Chile	Earthquake	- Part of multi-country CAT bond issuance ($1.36 billion) in 2018 including Mexico, Peru, Colombia, Chile - Largest sovereign risk transfer for earthquakes at issuance time	- Political commitment needed for multi-year premium payments; exposure concentration risk remained	World Bank (2018). *Multi-country CAT Bond Factsheet.*

CAT bonds have been successful due to the following features:

1. **Rapid liquidity:** Provides immediate post-disaster funding, bypassing slow humanitarian or budget reallocation processes.

2. **Diversification of risk transfer sources:** Access to capital markets diversifies beyond traditional reinsurance.
3. **Multi-year coverage:** CAT bonds often lock in coverage and pricing for 3-5 years, reducing premium volatility.
4. **Innovation catalyst:** Encourages development of better risk models, data collection, and sovereign disaster risk management strategies.
5. **Regional pooling opportunities:** E.g. CCRIF leveraged CAT bonds to enhance pooled resources.

However, CAT bonds have also some drawbacks, such as the following:

- **High transaction and issuance costs:** Legal, structuring, and modelling expenses make CAT bonds viable mainly for large-scale risks.
- **Basis risk:** Parametric triggers may not match actual losses, undermining political and social acceptability.
- **Complexity:** Requires high technical, legal, and financial capacity to structure, negotiate, and manage.
- **Market capacity and pricing volatility:** Investor appetite can fluctuate, impacting pricing and availability.
- **Political continuity risks:** Maintaining premium payments over multiple years despite government changes is challenging.
- **Limited suitability for smaller countries or risks:** High fixed costs make CAT bonds less viable for low-premium or highly localised risks.

Special purpose vehicles (SPVs)

Special Purpose Vehicles (SPV) are independent legal entities used to structure and operationalize **catastrophe bonds**, providing a trusted intermediary between the sponsor (typically a government or agency) and investors. Their core role is to manage issuance, ensure risk isolation, and hold investor funds in collateral accounts until specific, **predefined disaster triggers** are met.

SPVs enhance **transparency**, **governance**, and **financial security** in capital markets by separating catastrophe risk from the sponsor's balance sheet and guaranteeing that funds are used solely for disaster response. This risk isolation feature builds investor confidence and is a critical requirement under regulatory frameworks such as Solvency II (Cummins, 2007).

They also provide a standardized structure for regulatory compliance, enable efficient capital management, and ensure **swift payouts** when trigger conditions

are satisfied—making them essential for the credibility and scalability of catastrophe bond markets.

The diagram below illustrates the capital flow and stakeholder roles in an SPV structure for catastrophe bonds (Pughe, 2024).

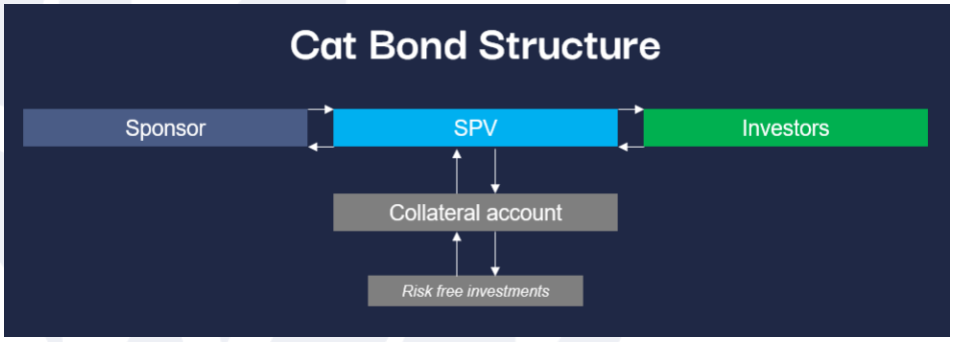


Diagram by Pughe (2024)

SPVs are essential in structuring catastrophe bonds, ensuring risk isolation, transparency, and investor confidence. By separating financial risks from the sponsor, SPVs safeguard investors and enhance the credibility of disaster risk financing. They provide clear governance, regulatory compliance, and efficient capital management, adhering to global standards like Solvency II (Cummins, 2007). Acting as neutral intermediaries, SPVs ensure swift, transparent payouts, reinforcing trust in cat bonds as an effective risk transfer tool.

South Africa – Lessons from Multi-Hazard Events (2015–2023)

Cape Town Drought (2015–2018): Through proactive risk governance and water-use restrictions, the city successfully avoided "Day Zero"—the shutdown of municipal water supply. This case illustrated the importance of data-driven early warning and strong policy coordination. Estimated savings from avoided crisis-related losses were approximately R20 billion.

KZN Floods (April 2022): Triggered extensive infrastructure damage in eThekwini Municipality, highlighting the need for localized contingency planning and rapid financing tools for informal and high-risk settlements.

Knysna Fires (2017): A devastating wildfire event that exposed underinsurance of urban-natural interface risks and led to renewed policy discussions on wildfire coverage and community-based insurance mechanisms.

Northern Cape Drought (2015–2023): A prolonged drought across the Namakwa District emphasized the need for scalable, climate-adaptive financial instruments for livestock and smallholder farming.

Hammanskraal Cholera Outbreak (2023): This health crisis underscored the intersection between disaster risk, infrastructure breakdown, and public health, reinforcing the case for integrated risk transfer that includes coverage for health-related shocks.

These cases demonstrate South Africa's evolving experience across multiple hazards. They point to the importance of anticipatory planning, nature-based insurance, and community-led models like **parametric STOKVELS** to improve inclusiveness, affordability, and trust in disaster risk finance.

SPVs are **critical enablers** of catastrophe bonds and disaster risk financing, ensuring **efficient fund management, risk transfer, and rapid payouts**. By fostering **risk pooling, affordability, and resilience**, they empower vulnerable nations to **mitigate financial shocks** and accelerate disaster recovery.

World Bank cat bonds

The World Bank has been a key facilitator in developing catastrophe bonds (CAT bonds) as part of disaster risk financing, enabling governments to transfer financial risks to global capital markets. As of 2024, it has facilitated 32 CAT bond transactions, providing $4.7 billion in coverage for perils such as earthquakes, hurricanes, pandemics, and droughts (World Bank, 2024; Artemis, 2025).

The World Bank's involvement began with Mexico's CatMex in 2006, the first sovereign CAT bond under FONDEN, covering earthquakes and hurricanes. Subsequent initiatives include the Turkish Catastrophe Insurance Pool (2013), the Caribbean Catastrophe Risk Insurance Facility (2014), and the Pacific Alliance bond (2018) for earthquake risks in Mexico, Chile, Peru, and Colombia. More recently, it supported CAT bonds for the Philippines (2019), Jamaica (2021), and Chile (2023) (Plichta et al., 2023).

By engaging institutional investors, including pension funds and asset managers, the World Bank enhances private sector participation, attracting capital due to CAT bonds' low correlation with traditional financial markets. This public-private collaboration strengthens financial resilience and accelerates post-disaster recovery (World Bank, 2024).

Case Studies of World Bank-Facilitated Cat Bonds:

- **Mexico: The First Sovereign CAT Bond** (2006)
  - **Structure:** $160 million bond providing immediate liquidity for earthquake and hurricane response.
  - **Trigger:** Wind speed (hurricanes) and earthquake magnitude.
  - **Impact:** The bond strengthened Mexico's **disaster recovery fund** and set a precedent for sovereign CAT bonds worldwide (World Bank, 2006).
- **Philippines: CAT Bond for Typhoon Risk** (2017)
  - **Structure:** $205 million parametric bond covering typhoon risks.
  - **Trigger:** Wind speed and meteorological factors.
  - **Impact:** Provided **quick post-typhoon relief and reconstruction funding**, reducing reliance on government reserves (World Bank, 2017).
- **Caribbean: Regional CAT Bond via CCRIF**
  - **Structure:** Regional risk pool issuing parametric CAT bonds for hurricanes, earthquakes, and floods.
  - **Trigger:** Wind speed (hurricanes), earthquake magnitude, rainfall thresholds.

- **Impact:** Enabled **Jamaica, Haiti, and St. Lucia** to access rapid liquidity for disaster relief, supported by the World Bank (World Bank, 2007).

- **Turkey: Earthquake CAT Bond** (2019)
  - **Structure:** $100 million bond under the **Catastrophe Risk Financing Initiative.**
  - **Trigger:** Earthquake magnitude and impact thresholds.
  - **Impact:** Ensured **immediate liquidity** for emergency response and reconstruction, reducing fiscal strain (World Bank, 2019).
- **Indonesia: Earthquake CAT Bond**
  - **Structure:** Seismic risk-based bond under **Indonesia's disaster risk financing strategy.**
  - **Trigger:** Earthquake magnitude and geographic impact.
  - **Impact:** Provided rapid financial response for large-scale earthquakes, ensuring faster recovery (World Bank, 2017).

Through CAT bonds, the World Bank has transformed disaster risk financing, ensuring faster, more reliable funding for vulnerable nations. By leveraging private capital and parametric triggers, CAT bonds provide efficient, scalable solutions, reducing fiscal pressure on governments while enhancing resilience to climate and disaster risks.

Regional Risk Pools

Regional risk pools—such as the African Risk Capacity (ARC), Caribbean Catastrophe Risk Insurance Facility (CCRIF), and the Pacific Catastrophe Risk Insurance Company (PCRIC)—are categorized as macro-level risk transfer instruments. Though technically structured as pooled financial entities, their function is to serve national governments, which aligns them with sovereign-level insurance discussed in Section 2.3. They are included here to elaborate on their unique structure and multilateral design.

Risk pools are cooperative financial mechanisms designed to manage and mitigate the economic impact of disasters by pooling risks across multiple

participants. These pools enhance financial resilience, ensuring rapid funding access when disasters strike, reducing reliance on unpredictable post-disaster aid, and enabling faster recovery.

- **Caribbean Catastrophe Risk Insurance Facility (CCRIF)** – Established in 2007, CCRIF provides parametric disaster insurance to Caribbean nations against hurricanes and earthquakes. It pools regional risks and enables member governments to access affordable catastrophe insurance. Rapid payouts—often within 14 days—allow countries to respond quickly and reduce reliance on emergency aid.
- **African Risk Capacity (ARC)** –Launched in 2012, ARC offers parametric climate risk insurance to African governments for droughts, floods, and cyclones. ARC uses satellite-based triggers to disburse funds and supports countries such as Senegal, Mauritania, and Malawi in financing early response and contingency planning.
- **Pacific Catastrophe Risk Insurance Company (PCRIC)** – Founded in 2013, PCRIC enables Pacific Island nations to access parametric insurance coverage for cyclones, earthquakes, and tsunamis. It aggregates risk regionally, making coverage more affordable and ensuring post-disaster liquidity through timely disbursements.

Types of Risk Pools:

- **Domestic Risk Pools** operate within a single country, involving national and subnational governments alongside private insurers.
- **Regional Risk Pools** cover multiple countries, leveraging economies of scale to **reduce costs and diversify risks.**
- **Replica Risk Pools** adapt successful models for broader application, expanding access to risk-sharing mechanisms.

Risk pools integrate blended finance models, parametric insurance triggers, and early warning systems to enhance effectiveness. While challenges such as limited financial capacity and governance concerns persist, these mechanisms offer scalable solutions for disaster resilience.

Aligned with the G20 resilience and sustainable development goals, risk pools support climate adaptation and align with frameworks such as the Sendai Framework for Disaster Risk Reduction and the Paris Agreement, emphasizing financial preparedness and proactive risk management.

Domestic Level

Domestic risk pools are national-level mechanisms designed to mitigate the financial impact of climate and disaster risks within a specific country. These pools enable governments to prearrange funding for disaster response and recovery, ensuring timely and efficient resource mobilization after a disaster. By centralizing financial resources and risk management strategies, domestic pools reduce dependency on slow and unpredictable external aid, improving resilience at the national level.

Domestic pools function by aggregating risk within a country's borders, often focusing on public assets, social protection systems, and vulnerable communities. They typically combine public funding, insurance mechanisms, and international financial support to establish financial buffers that can be activated when disaster thresholds, or triggers, are met.

- **Seychelles Sovereign Catastrophe Insurance (SCCI)** –Introduced in 2015, SCCI is a sovereign risk transfer mechanism designed to provide Seychelles with rapid financial protection against tropical cyclones and floods. It forms part of a national resilience strategy and is supported by partners including the World Bank and African Development Bank. *Note: SCCI is not structured as an SPV.*
- **Andhra Pradesh Catastrophe Risk Pool** – Established in 2016, this mechanism helps India's Andhra Pradesh state manage cyclone, flood, and drought risks using parametric triggers. It allows the state government to purchase insurance and access pre-arranged funding, reducing reliance on post-disaster relief budgets.
- **Morocco's FSEC -**Morocco's **Fonds de Solidarité contre les Événements Catastrophiques (FSEC)** is a sovereign disaster risk financing mechanism that provides financial coverage for victims of catastrophic events. It combines insurance and solidarity mechanisms to expand protection to underserved groups.

Regional level

Regional risk pools are cooperative financial mechanisms designed to address climate and disaster risks across multiple countries. By aggregating risks from diverse geographies, these pools enhance financial resilience and provide member states with pre-arranged funding in the event of a disaster. Their structure allows

governments to reduce dependency on unpredictable post-disaster aid, ensuring rapid liquidity for emergency response and recovery efforts.

One of the most significant advantages of regional risk pools is their ability to foster cross-border solidarity. By encouraging burden-sharing, these pools ensure that countries with limited financial resources can still access financial protection in times of disaster. This collaborative approach strengthens economic stability across member nations, reducing overall vulnerability.

Additionally, regional pools benefit from economies of scale, allowing them to accumulate larger financial reserves and negotiate better terms with reinsurers. This cost-efficient model lowers premium costs, improves affordability, and enhances financial sustainability, ensuring that payouts can be delivered promptly after disasters.

A defining feature of these pools is their reliance on parametric insurance mechanisms, where payouts are triggered based on pre-defined thresholds such as wind speed, rainfall levels, or modelled economic losses. This rapid-response funding mechanism is especially beneficial for low- and middle-income countries, which often lack the fiscal space to absorb large financial shocks. By fostering cross-border cooperation, these pools enable member states to collectively manage disaster risks and enhance long-term resilience.

Replica solutions, involving civil society organizations

Replica solutions in disaster risk financing are innovative mechanisms that allow humanitarian and civil society organizations (CSOs) to purchase insurance policies that mirror sovereign-level coverage, ensuring faster and more coordinated disaster response. These solutions serve as a critical financial safety net for vulnerable populations, particularly in regions where government-led disaster response mechanisms may be insufficient or slow to mobilize.

One of the most well-established replica models, pioneered by the African Risk Capacity (ARC), enables humanitarian organizations to purchase parametric insurance policies that replicate those held by sovereign governments. When a government's policy triggers based on predefined disaster thresholds the corresponding policy held by a humanitarian organization pays out simultaneously. This ensures that relief efforts receive immediate financial backing,

reducing reliance on slow, post-disaster humanitarian appeals and enabling rapid intervention.

A key feature of replica solutions is their alignment with sovereign disaster risk financing frameworks, allowing CSOs to provide an additional layer of coverage beyond government resources. This approach ensures greater financial resilience, particularly in low-income and climate-vulnerable nations. Moreover, parametric triggers, which determine payouts based on specific disaster conditions (e.g., wind speed, rainfall levels, or drought intensity), enable anticipatory action, ensuring that relief operations begin before disasters escalate.

By integrating CSOs into structured risk financing mechanisms, replica solutions enhance disaster response in areas where governments have limited operational capacity. Civil society organizations, with their strong local networks and direct access to communities, are uniquely positioned to rapidly convert insurance payouts into life-saving interventions such as food distribution, healthcare services, and emergency shelter. This flexibility and efficiency make replica solutions a vital component of modern disaster risk financing, strengthening the ability of humanitarian organizations to act swiftly, mitigate suffering, and support long-term resilience in disaster-prone regions.

Example: ARC Replica Payouts for El Niño Drought in Zambia and Zimbabwe
In 2023–2024, as an El Niño-induced drought severely impacted agricultural production in Zambia and Zimbabwe, replica insurance played a critical role in delivering fast, life-saving assistance. Through a parametric insurance policy purchased under ARC Replica, payouts of US$3.3 million and US$6.09 million were triggered for Zambia and Zimbabwe, respectively. These funds enabled humanitarian actors to provide immediate food and cash assistance to over 430,000 people across both countries—strengthening national drought responses and preventing communities from falling deeper into crisis.
The Zambia case supported 160,000 households across drought-prone regions, while Zimbabwe's allocation enabled food assistance for over 270,000 people across three districts. These examples illustrate how replica insurance—aligned with national disaster financing frameworks—can rapidly channel liquidity to scale shock-responsive social protection and build long-term resilience.

Contingency funds

Contingency and reserve funds are essential components of a government's disaster risk financing strategy, providing crucial financial resources for managing various hazards.

Contingency vs. reserve funds

Contingency funds, established at the national level, serve as a primary financial buffer for frequent disasters, enabling immediate response and early recovery. Due to resource constraints, least developed countries and small island states often rely on contingency credit—loans from multilateral financial institutions. Other global mechanisms include external disaster and restoration funds. Unspent contingency funds typically revert to government budgets at the fiscal year's end (Cisse, 2021; OECD, 2022).

In contrast, reserve funds are managed at sub-national levels or by specific institutions to address severe, less frequent disasters like earthquakes and large-scale floods. These funds accumulate over time, creating a financial cushion for rapid access during crises. Built primarily from public financial sources, reserve funds form a key component of a risk-layering strategy, allowing governments to retain risk without external borrowing. They have low operational costs and ensure immediate liquidity during emergencies. National, city, or local governments can establish reserve funds with clear governance frameworks to regulate their use.

	Contingency Fund	Reserve Fund
Disaster type for which the fund is intended	Expected low-severity, high-frequency disasters, such as small floods, moderate storms, etc.	Less frequent, more severe disasters, such as large-scale floods or extreme weather events.
Timing	Immediate response and relief, accessed immediately to cover crucial response and relief efforts.	Reconstruction and rehabilitation efforts, accessed after a disaster declaration.
Funding amount	Small sums, catering to initial needs.	Large, accumulating sums for long-term recovery (e.g., by rebuilding infrastructure).

Management	Included in a government's annual budget and equipped with quick disbursement procedures.	A dedicated fund outside of a government's regular annual budget and directed by a strict governance structure.

Table 1: Key differences between contingency and reserve funds.

Use in climate and disaster risk scenarios: triggers and disbursement

Both contingency and reserve funds play a critical role in enhancing resilience to disasters. To ensure effective utilization, clear and pre-defined triggers are essential. These triggers can be based on various factors, including meteorological data (e.g., rainfall intensity, wind speed), early warnings from meteorological agencies and disaster early warning systems, and rapid assessments of damage and needs following an event.

Disbursement mechanisms for both types of funds are crucial. Contingency funds often require a formal declaration of a state of emergency and may involve a multi-tiered approval process to ensure funds are used effectively and efficiently. Reserve funds typically have streamlined disbursement procedures, enabling quicker access to resources for rapid response.

A structured national contingency funding model has been implemented through a legislative framework that allocates a fixed percentage of the local subsidy budget—1.5%—to enhance the financial capacity of subnational governments and support both disaster recovery and prevention initiatives. These funds are disbursed across three core areas: emergency recovery, long-term rehabilitation, and proactive disaster and safety-related projects.

To ensure transparency and effective use of resources, regular reviews are conducted each quarter, and budgets are revalidated whenever project plans are revised. Planned activities include ICT-enabled monitoring systems for landslide-prone areas, improvements to child safety infrastructure, expansion of CCTV networks for public protection, flood access control installations, and the creation of wildfire response villages.

This model demonstrates how **pre-allocated, performance-reviewed subsidies** can empower local authorities to implement targeted resilience measures while

ensuring accountability and promoting proactive disaster risk management at the local level.

By establishing clear triggers and efficient disbursement mechanisms, governments can ensure that contingency and reserve funds are effectively utilized to support timely and effective disaster response and recovery efforts, particularly in the context of increasing climate-related risks.

SOCIAL PROTECTION SYSTEMS

As disasters become more frequent and severe, integrating climate and disaster risk financing (CDRFI) instruments—such as insurance and contingency credit—is crucial to strengthening resilience. Governments face the challenge of strategically incorporating financial tools to ensure swift, targeted assistance for vulnerable populations in disaster-prone regions.

Harnessing CDRFI within social protection systems can significantly enhance disaster preparedness and response, reducing long-term economic and social impacts. By embedding parametric insurance, contingency funds, and risk pooling mechanisms into these frameworks, governments can secure pre-arranged financing that triggers rapid disbursements, minimizing disruptions to essential services and livelihoods.

The need for innovative, climate-responsive social protection is clear. Policymakers must explore adaptive financial systems that deliver fast post-disaster assistance while promoting long-term resilience. Linking adaptive social protection with CDRFI enables systems that respond dynamically ensuring faster recovery, reduced financial strain, and greater protection for at-risk communities in the face of escalating climate-related disasters.

Indonesia's Adaptive Social Protection Framework, anchored in its **National Medium-Term Development Plan (RPJMN 2025–2029)**, offers a compelling example of this approach. It connects pre-arranged financing with inclusive disaster recovery systems through programmes such as *Disaster-Resilient Villages* and *Safe Schools*, which empower communities at risk. The **on-call budget (Dana Siap Pakai, DSP)** allows for immediate resource deployment during emergencies, reinforcing a whole-of-government strategy that integrates fiscal preparedness, local capacity, and community resilience.

Similarly, the UNCDF **Pacific Insurance and Climate Adaptation Programme (PICAP)** in Fiji has successfully embedded parametric insurance into national social protection systems. This ensures that low-income households, smallholder farmers, and informal workers receive timely financial support in the wake of climate-related disasters such as cyclones and floods. Through the leadership of Fiji's Ministry of Women, Children, and Social Protection, the country became the

first Pacific Island nation to incorporate climate risk insurance into social welfare schemes.

Building and strengthening existing social protection mechanisms to respond to shocks is central to resilience. These systems should be supported by layered financing—including reserve funds, contingency credit, and insurance—and must have digital delivery infrastructure and scalable targeting protocols in place. Investments in administrative systems and real-time beneficiary verification can make shock-responsive protection more agile and impactful.

In response to flood forecasts in Chad, Mali, Niger, and Nigeria in 2023, an anticipatory action initiative across several countries combined early warning systems with cash-for-work and unconditional transfers to protect agriculture and livelihoods. Measures included fortification of riverbanks, distribution of seeds and tools, and local awareness campaigns. The program reached over 30,000 food-insecure households and incorporated gender- and conflict-sensitive planning to ensure inclusive participation and outcomes.

These examples from Indonesia, Fiji and west Africa highlight the growing relevance of climate-responsive social protection systems. When combined with risk transfer instruments, they not only improve disaster response but also protect the most vulnerable from long-term economic shocks—ultimately advancing adaptation, equity, and resilience on a systemic scale.

In this context, the compendium shares synergies with work conducted under the UNFCCC Warsaw International Mechanism (WIM) on Loss and Damage. This Compendium aligns with the “Comprehensive Risk Management Approaches Vol.2,” developed by the WIM Executive Committee and its Technical Expert Group on Comprehensive Risk Management (TEG-CRM). That document likewise emphasizes innovative risk transfer solutions that provide rapid liquidity for the most climate-vulnerable populations. For example, case studies from Ethiopia, Malawi, and India demonstrate how localized insurance and safety nets—like livestock insurance for pastoralists or adolescent-focused climate safety nets—help mitigate both financial and social risks.

Multi-Component Resilience Fund Model

A multi-year resilience-building initiative in a Southern African country reached nearly 1 million individuals in 18 rural districts by integrating layered investments in early warning, productive infrastructure, and crisis response. The program combined long-term resilience building (through absorptive and adaptive capacity support) with a Crisis Modifier Mechanism (CMM) that enabled early response to climate shocks. The CMM was triggered seven times, delivering early action to over 130,000 households and preserving development gains. The model

also improved household income, food security, and access to water and sanitation, while contributing to institutional coordination between national ministries and development partners.

Shock-Responsive Social Protection in Conflict-Affected Regions

A social protection initiative in a conflict-affected region successfully demonstrated how pre-existing government systems can be leveraged for more effective disaster response. Through cash transfers to farmers and fishers, the program helped mitigate the impact of both typhoons and the COVID-19 pandemic. It emphasized the value of dynamic targeting, multi-modal delivery systems, and coordination mechanisms that support both immediate needs and longer-term system strengthening.

Cash Transfers and Capacity Building in Malawi and Cameroon

In regions facing droughts and floods, cash transfers have been paired with training on good agricultural practices and climate-smart agriculture. This **cash+ approach** increased input access and food security for thousands of rural households. Digital tools have been introduced to improve delivery and beneficiary tracking. In another case, multi-purpose transfers helped vulnerable households invest in both basic needs and livelihood assets.

Pre-Drought Anticipatory Cash Assistance in Uganda

Ahead of a La Niña-induced drought, a short-term project provided early warning information and unconditional cash transfers to over 140,000 individuals. Focused on women's access to and use of cash, the intervention also supported local markets and coordinated with government systems. Post-distribution monitoring showed most funds were used for food, healthcare, and school fees, with high preference for cash over in-kind support.

El Niño Preparedness through Cash Assistance in the Philippines

A drought preparedness initiative used shock triggers to activate unconditional and conditional cash transfers in a drought-prone region. Assistance included support for irrigation, farming tools, and training. Post-distribution monitoring found improved household food consumption and reduced reliance on negative coping strategies, demonstrating the value of cash in enhancing community resilience to slow-onset disasters.

The following table summarizes additional case studies of disaster risk insurance being applied for social protection schemes.

Case Study/ Product	Country / Region	Integration with Social Protection	Key Successes	Key Challenges
1. R4 Rural Resilience Initiative (Oxfam & WFP)	Ethiopia, Senegal, Kenya, Zambia	Integrates parametric weather index insurance with public safety nets and food/cash-for-work programmes ; participants work on risk reduction projects (e.g. soil conservation) in exchange for premiums or payouts.	- Improved household food security and assets resilience - Insurance acted as safety net for poorest households - Scalable model reaching >90,000 households in Ethiopia alone	- Basis risk remains a challenge - Requires strong local implementation partners and public programme alignment - Sustainability without donor support untested
2. Kenya HSNP Drought Risk Financing (Hunger Safety Net Programme)	Kenya (ASAL counties)	ARC's parametric drought insurance linked to HSNP cash transfer system; payouts trigger scalable cash transfers to	- Enabled rapid expansion of social protection to drought-affected households - Payouts (e.g. 2015 ARC payout to Kenya)	- Political delays in premium payments risked coverage lapses - Complexity in aligning ARC payouts with HSNP trigger thresholds -

		vulnerable households.	delivered quickly via existing HSNP systems	Basis risk concerns remain for spatial rainfall variability
3. Ethiopia Productive Safety Net Programme (PSNP) Risk Financing Mechanism	Ethiopia	PSNP includes contingency budgets and risk financing (including parametric drought insurance from ARC) to scale up cash/food transfers during droughts.	- Strengthened PSNP responsiveness to shocks - Improved predictability of social protection in drought years	- Government premium payments compete with development budget needs - Technical capacity to integrate insurance data into PSNP targeting remains limited
4. India Weather-Based Crop Insurance Scheme (WBCIS)	India	While not a social protection programme per se, WBCIS functions as an income support scheme for farmers, heavily subsidised by government.	- Reduced farmer income volatility from weather shocks - Large scale coverage (30+ million farmers)	- Basis risk due to sparse weather station coverage - Delays in premium subsidy payments affect scheme credibility
5. Malawi ARC Replica Programme (Start	Malawi	Humanitarian NGOs (Start Network)	- Provided NGOs with rapid funding to scale	- Replica model requires clear government-NGO

Network & ARC)		purchased ARC drought insurance in replica mode to complement government social protection during droughts.	humanitarian cash transfers in coordination with government	coordination frameworks - Sustainability of NGO premium funding uncertain
6. Mongolia Index-Based Livestock Insurance Programme (IBLIP)	Mongolia	Index insurance integrated with government livestock disaster relief programmes for pastoralists	- Reduced government post-disaster expenditure - Improved herders' income security and reduced livestock mortality due to proactive sales	- Low awareness among some herders - Requires sustained government premium support for poorest herders

Parametric climate risk insurance can **enhance social protection systems' responsiveness to shocks**, protecting livelihoods and reducing humanitarian costs. However, **basis risk management, affordability, governance coordination, and sustainability** remain critical challenges requiring careful design and long-term institutional commitment.

While scaling social protection is important, equal attention must be given to strengthening the underlying delivery infrastructure, data systems, and targeting mechanisms. Without these foundational improvements, the integration of climate and disaster risk financing instruments—such as microinsurance or contingency funds—may not effectively reach those most at risk when disasters occur. Robust systems are essential to ensure timely, reliable, and accountable payouts, particularly for informal workers and low-income households who often face the greatest barriers to access.

Strengthening social protection systems also require aligning financing and delivery with evolving risk dynamics. As climate and disaster risks become more complex and multi-dimensional, it is critical to revise and recalibrate parametric

insurance triggers to ensure they remain responsive and relevant. Simultaneously, new instruments should be developed alongside existing ones, creating a coherent system that integrates insurance with contingency funds, reserve financing, and digital social registries. Where context allows, risk transfer tools—particularly in post-disaster settings—should reinforce and scale national Social Assistance systems. This synergy strengthens delivery, enhances equity, and improves responsiveness, particularly for vulnerable groups.

A similar approach has been applied in another fragile regional context, where an adaptive social protection programme delivers cash transfers through a combination of government-led systems and coordinated non-governmental channels. The initiative is closely linked to a regional adaptive social protection platform, supporting the integration of national systems with broader climate risk financing efforts. This twin-track model enhances flexibility and responsiveness, enabling timely support while also strengthening long-term institutional capacity. It exemplifies how social protection and risk transfer mechanisms can be aligned to address both immediate humanitarian needs and deeper structural vulnerabilities in climate-exposed and conflict-affected settings.

Community-Based Health Financing (CBHF) provides a neighbourhood-based solution in countries without formal health insurance, pooling community resources to cover medical expenses and reduce out-of-pocket costs. By fostering solidarity and enabling better negotiation with healthcare providers, CBHF can protect against disaster-related health expenditures. However, affordability barriers may exclude the poorest households. Integrating CBHF with non-contributory social protection mechanisms, such as Social Safety Nets (SSN) or Social Assistance (SA) programs, can enhance accessibility. Unconditional cash transfers during or after disasters further strengthen healthcare access, alleviating poverty and food insecurity. Just as parametric insurance ensures rapid financial relief in social protection systems, CBHF can serve as a localized model of risk pooling, reinforcing community resilience against health-related shocks.

This emphasis is echoed in feedback received from the European Commission, which underscores the This emphasis is further reinforced by inputs highlighting the potential of publicly funded or subsidized universal health coverage as a more inclusive and sustainable pooling mechanism, particularly when complemented by risk transfer instruments. While Community-Based Health Financing (CBHF) offers a vital entry point for localized resilience, its integration into national health financing strategies—through mechanisms such as pre-arranged insurance and cash transfer systems—can significantly reduce protection gaps and advance health equity.

CONCLUSION

Quick liquidity for communities in Vulnerable Situations

The escalating frequency and severity of climate disasters leave millions of vulnerable people without immediate financial support, pushing them further into poverty. Traditional post-disaster funding mechanisms—such as humanitarian aid and government relief—are slow, uncertain, and insufficient to meet urgent recovery needs. Risk transfer solutions, such as climate insurance, provide pre-arranged, rapid liquidity that ensures communities can rebuild their lives without prolonged hardship. By triggering automatic payouts based on objective parameters like rainfall, wind speed, or temperature thresholds, these solutions eliminate bureaucratic delays and deliver funds exactly when and where they are needed most. With timely financial relief, affected households can secure food, restore livelihoods, and repair homes—preventing an immediate disaster from turning into a long-term crisis.

Resilience Toolbox for Context-Specific Programming

An applied resilience toolbox has been developed to guide programming across varying local contexts. It supports selection of interventions based on scientific evidence and adaptive learning from impact evaluations. Interventions are grouped into solution frameworks and designed to target both geographically and demographically vulnerable groups, aligned with a humanitarian-development-peace (HDP) nexus approach. The toolbox promotes multi-year strategies that bridge short- and long-term resilience building.

Reduction of long-term economic impacts

The economic cost of disasters is staggering, often wiping out years of development gains in a matter of hours. Without reliable financial protection, small businesses shut down, infrastructure remains damaged, and governments are forced to divert essential funds away from education, healthcare, and other critical sectors. Risk transfer solutions provide a financial buffer that prevents systemic collapse, allowing economies to recover faster and with greater stability. For instance, sovereign risk pools enable governments to access emergency funds, ensuring they can maintain public services and avoid heavy debt burdens. For

farmers, fishers, and small businesses, climate insurance protects against income loss, enabling them to resume operations immediately after a disaster. Healthcare is among the first sectors to collapse during disasters. Without insurance, health system recovery is often delayed, resulting in increased mortality and poverty. Risk transfer solutions for health—like those seen in post-Dorian CCRIF payouts—are essential to ensure uninterrupted service delivery and mitigate long-term social impacts.

The faster financial assistance is provided, the lower the long-term economic fallout—ensuring that climate shocks do not translate into generational poverty.

An equitable approach to disaster recovery

Climate change disproportionately affects those least responsible for it—small island developing states, low-income farmers, and marginalized communities. Yet, traditional disaster response mechanisms often fail to prioritize people in vulnerable situations, leaving them with limited recovery options. Risk transfer solutions ensure financial protection reaches those most in need, reducing dependence on slow-moving international aid and expensive debt. Equitable recovery also depends on addressing social and behavioral factors. Risk perception, trust in financial products, and cultural values play a vital role in how low-income and marginalized groups engage with insurance. Including these voices in policy design and building participatory platforms for co-development of insurance products can increase uptake and relevance.

By integrating climate insurance into national social protection systems, governments can provide pre-arranged financial safety nets for at-risk populations, ensuring they receive timely support without bureaucratic obstacles. This compendium complements the broader set of G20 Working Group deliverables, including those related to financing, social protection, and infrastructure resilience. It is essential to ensure coherence across outputs—particularly the proposed high-level principles on DRR financing and the Recovery Readiness Assessment Framework—so that tools like insurance, credit, and cash-based responses function within a unified policy architecture. Such alignment avoids duplication, enhances impact, and improves accountability. In addition, risk pooling mechanisms enable developing countries to access disaster financing at more affordable rates, improving financial inclusion as well as climate resilience.

In the Pacific, innovative governance approaches are demonstrating how to integrate resilience into national systems. A regional initiative has supported governments in embedding climate and disaster risk considerations across multiple entry points—from infrastructure planning and budgeting to parliamentary oversight and community development. Examples include the introduction of climate risk as a criterion for budget scrutiny in Tonga, the development of resilience-financing functions within ministries of finance, and the integration of climate risk in investment appraisal processes in Tuvalu. In Fiji, Solomon Islands, and Vanuatu, programmatic responses to community-led risk assessments have influenced national planning and financing decisions. These governance enhancements provide a model for aligning risk transfer instruments with systemic public financial management reforms, thereby promoting sustainability and equity in disaster recovery.

Risk transfer solutions are not just financial instruments—they are a proven strategy for climate resilience, economic stability, and social equity. The return on investment is clear: every dollar spent on climate risk financing prevents exponentially higher costs in disaster recovery, economic disruption, and humanitarian aid. Now is the time for donors and development partners to scale up investment in risk transfer mechanisms, closing the financial protection gap for millions of vulnerable people. With that emerging threats and risks whether induced by natural hazards, human-made or exacerbated by climate change and becoming the new normal, we cannot afford to wait. Investing in risk transfer solutions today means securing a safer, more resilient future for the most climate-impacted communities tomorrow.

REFERENCES

1. Coval, J. D., Jurek, J. W., & Stafford, E. (2007). The Economics of Catastrophe Bonds. Harvard Business School.
2. Cummins, J. D. (2007). Catastrophe Bonds and Other Risk-Linked Securities: State of the Market and Recent Developments.
3. Mahul, O., & Cummins, J. D. (2009). Natural Catastrophe Risk Insurance Mechanisms for Developing Countries. World Bank.
4. Pughe, T. (2024). The Fundamentals of Insurance-Linked Securities: Parts 1 & 2. Educational Lectures.
5. Artemis. (2025). What is a Catastrophe Bond? Retrieved from Artemis.bm. Accessed 23 January 2025, https://www.artemis.bm/library/what-is-a-catastrophe-bond/
6. World Bank. (2024). Disaster Risk Transfer Product Note. Updated as of September 2024.
7. Plichta, M., & Poole, L. (2023). The State of Pre-arranged Financing for Disaster, Center for Disaster Protection.
8. The Munich Climate Insurance Initiative (MCII, 2022). Climate Risk Insurance in the Caribbean: 20 lessons learned from the Climate Risk Adaptation and insurance in the Caribbean (CRAIC) Project. https://climate-insurance.org/wp-content/uploads/2020/11/OnlineVersion_CRAIC_LL_201116.pdf
9. The Pacific Insurance and Climate Adaptation Program (PICAP, 2023). Strengthening Financial Resilience in the Pacific. 16 Lessons Learned from implementing Climate Risk Insurance Solutions. https://climate-insurance.org/wp-content/uploads/2023/06/PICAP_LessonsLearned_230616_final.pdf
10. The Pacific Insurance and Climate Adaptation Program (PICAP, 2021). iOnboard - Frequently Asked Questions. https://climate-insurance.org/wp-content/uploads/2022/02/iOnboardFAQ.pdf
11. Wang, X. and Y. Fu (2022). Digital financial inclusion and vulnerability to poverty: evidence from Chinese rural households. CAER, Vol. 14, No. 1, pp. 64–83.
12. Bollmann, A., & Wang, S. S. (2019). International Catastrophe Pooling for Extreme Weather: An Integrated Actuarial, Economic and Underwriting Perspective. Society of Actuaries.
13. Ministry of Home Affairs, Government of India. (n.d.). *National Disaster Response Fund (NDRF) and State Disaster Response Fund (SDRF).* National Disaster Management Division. Retrieved from https://ndmindia.mha.gov.in/ndmi/responsefund.
14. Pollner, J. D. (2001). Catastrophe Risk Management: Using Alternative Risk Financing and Insurance Pooling Mechanisms. Latin America and the Caribbean Region, World Bank.
15. World Bank. (2012). *FONDEN: Mexico's Natural Disaster Fund - A Review.* Washington, DC: World Bank.
16. World Bank. (2017). Sovereign Climate and Disaster Risk Pooling: World Bank Technical Contribution to the G20.International Bank for Reconstruction and Development. Washington, DC: World Bank

17. Fuchs & Wolff (2011). *Weather Index Insurance: Mexico.* American Journal of Agricultural Economics
18. https://mb.com.ph/2022/11/28/affirming-the-tax-exemption-of-microinsurance-mbas
19. lawnet.vn
20. a2ii.org
21. https://www.uncdf.org/article/6994
22. https://www.ey.com/en_gl/tax-alerts/high-court-of-kenya-suspends-vat-on-insurance-agency-and-insurance-brokerage-services
23. https://taxnews.ey.com/news/2022-0058-kenya-high-court-rules-that-insurance-agencies-insurance-brokerage-and-securities-brokerage-services-should-remain-as-vat-exempt
24. https://sdgprivatefinance.undp.org/leveraging-capital/sdg-investor-platform/farmer-insurances
25. IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001
26. Schaefer, L. and waters, E (2016). Climate Risk Insurance for the Poor and vulnerable: How to effectively Implement the pro-poor focus of Insuresilience. https://climate-insurance.org/wp-content/uploads/2020/05/MCII_2016_CRI_for_the_Poor_and_Vulnerable_full_study_lo-res-2.pdf
27. PICAP (2023). Climate and Disaster Risk Financing and Insurance:25 key terms you need to know. https://climate-insurance.org/wp-content/uploads/2023/07/CDRFI_25KeyTerms_Factsheet_June2023.pdf
28. https://www.unepfi.org/insurance/insurance/projects/nature-positive-insurance/
29. https://pollinationgroup.com/global-perspectives/the-role-of-insurance-in-unlocking-nature-finance/
30. https://www.nature.org/en-us/what-we-do/our-insights/perspectives/insuring-nature-to-ensure-a-resilient-future/
31. https://marfund.org/en/wp-content/uploads/2024/06/MARInsurance-Brief-2024-a.pdf
32. https://climate.axa/publications/marine-protected-areas-blue-finance/
33. https://www.instech.co/knowledge-centre/parametric-insurance-for-marine-ecosystems-the-parametric-post-issue-48/
34. For further insights, explore Watson et al., "Finance for Reducing Disaster Risk: 10 Things to Know" and UNISDR's report on PPPs in East Asia (2009) .

35. Index Insurance Innovation Lab (2019). "IBLI: Index-Based Livestock Insurance for Vulnerable Groups." Index-Based Livestock Insurance in East Africa | Feed the Future Innovation Lab for Markets, Risk and Resilience
36. World Bank (2018). "Refugee Micro-Insurance: Protecting Displaced Populations."
37. The Micro-Insurance Academy (2018). "Microinsurance for Vulnerable Groups: The Case of Informal Workers in India."
38.
39. **Vietnam Ministry of Agriculture and Rural Development** (2019). "Vietnam Crop Insurance Program: Addressing Agricultural Risks in the Context of Climate Change."
40. Index insurance best practices for insurance regulators and practitioners in the Pacific Island countries - UN Capital Development Fund (UNCDF)
41. Caribbean Catastrophe Risk Insurance Facility. (2020). "Parametric Insurance for Resilience."
42. Asian Development Bank. (2019). "Pacific Catastrophe Risk Insurance: A Lifeline for Governments and Infrastructure."
43. World Bank. (2017). "Catastrophe Bonds and Insurance in Mexico."
44. Philippine Department of Finance. (2019). "Parametric Insurance for Public Infrastructure in the Philippines.".
45. **Nature Conservancy**. (2020). "Sustainability-Linked Insurance: Protecting Brazil's Forests."
46. **Environmental Defense Fund (EDF)**. (2021). "Insurance for Forest Conservation: The Case of the Amazon."
47. **The Micro-Insurance Academy**. (2018). "Parametric Insurance for Water Resources Management in India."
48. **The World Bank**. (2020). "Costa Rica's Payment for Environmental Services and Insurance for Ecosystem Services."
49. **World Bank** (2018). "La Niña and Drought Insurance in Senegal: Pre-financing Models."
50. **Philippine Department of Agriculture** (2018). "Tax Incentives for Agricultural Insurance."
51. **Government of India, Ministry of Agriculture** (2020). "Pradhan Mantri Fasal Bima Yojana: Tax Benefits for Farmers."
52. **South African Government Department of Agriculture, Forestry and Fisheries** (2020). "Agricultural Insurance Tax Incentives."
53. **Index Insurance Innovation Lab** (2019). "IBLI: Index-Based Livestock Insurance for Vulnerable Populations in Kenya."
54. **Philippine Crop Insurance Corporation (PCIC)** (2020). "Insurance and Premium Pre-financing for Smallholder Farmers."
55. **World Bank** (2018). "La Niña and Drought Insurance in Senegal: Pre-financing Models."
56. **World Bank** (2020). "Maldives: Takaful for Climate Resilience."
57. **Takaful Indonesia** (2020). "Takaful for Agriculture in Indonesia: Risk Mitigation through Shariah-Compliant Insurance."
58. **Pakistan Insurance Association** (2019). "Flood Risk Takaful: Protecting Communities in Pakistan."

59. **Indian Ministry of Agriculture** (2019). "Pradhan Mantri Fasal Bima Yojana: Reinsurance Partnerships."
60. **African Risk Capacity (ARC)** (2019). "The African Risk Capacity: A Special Purpose Vehicle for Climate Risk Financing."
61. **World Bank** (2013). "Pacific Catastrophe Risk Insurance Pilot: Using SPVs for Climate Risk Financing in Small Island States.
62. **Reserve Bank of India** (2016). "Catastrophe Risk Pool for Andhra Pradesh: A Special Purpose Vehicle for Climate Risk Management."
63. **World Bank** (2006). "Mexico's Catastrophe Bond: A Pioneering Risk Financing Solution."
64. **World Bank** (2017). "The Philippines Issues Sovereign Catastrophe Bond for Typhoon Risk."
65. **World Bank** (2007). "The Caribbean Catastrophe Risk Insurance Facility: A Model for Regional Risk Financing."
66. **World Bank** (2019). "Turkey's Catastrophe Bond for Earthquake Risk."
67. **World Bank** (2017). "Indonesia Issues Catastrophe Bond for Earthquake Risk Management."

G20
SOUTH AFRICA 2025

UNCDF

Solidarity

Equality

Sustainability