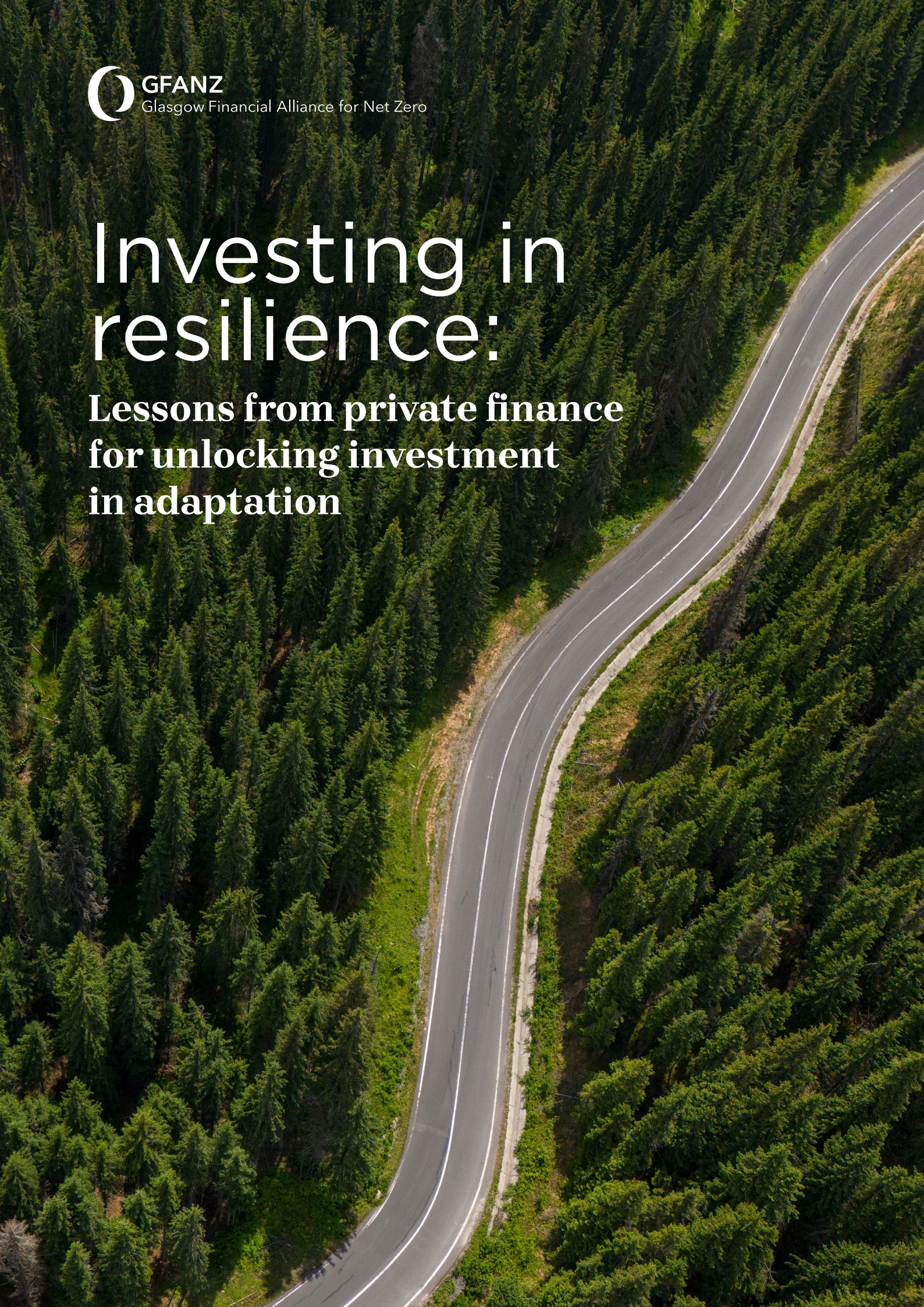
GFANZ
Glasgow Financial Alliance for Net Zero

Investing in resilience:

Lessons from private finance for unlocking investment in adaptation



Notice

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Executive Summary

The Glasgow Financial Alliance for Net Zero (GFANZ) is an independent, private-sector-led initiative focused on mobilizing capital and removing barriers to investment in the global transition. GFANZ brings together financial sector firms that recognize the opportunity created by the transition — including banks, insurers, asset owners, asset managers, and service providers. It helps drive transition finance and unlock private capital at scale through support for capacity building and the development of innovative financing opportunities and solutions.

In 2025, GFANZ engaged with financial institutions globally to explore the state of play in adaptation finance, identifying a series of barriers which were summarised in a G20 input paper.[1] This Report sets out positive examples — drawing on 22 in-depth case studies — exploring how financial institutions are supporting their corporate clients through practical financing solutions in the hope that these approaches could be replicated and scaled. Financial institutions and partners from around the world contributed case studies, including firms that are part of the GFANZ Principals Group or GFANZ's regional networks in Asia-Pacific, Latin America and the Caribbean, and Africa.

The case studies point to a clear and growing commercial opportunity, and illustrate the growing breadth and diversity of adaptation finance solutions being provided. They include solutions to build resilience against hazards from droughts to floods, and wildfires to hurricanes. They span all regions and both advanced and emerging markets, and involve a broad set of financial institutions, including banks, insurers, asset managers and owners, and blended finance vehicles. Nearly half of the case studies in this report involved only private financial institutions, often using conventional instruments such as loans, bonds, equity, and insurance, demonstrating that adaptation finance does not depend solely on public subsidy but is increasingly viable within existing commercial frameworks.

The case studies show that financial institutions are translating assessed physical risk into financial metrics, and working to build investment and business cases. Their modeling approaches can help pull forward and quantify the economic and financial benefits of investing in adaptation upfront, over reactive responses to the acute and chronic impacts of climate change. Their lending, investment, and underwriting decisions can enable the delivery of projects — from hard infrastructure all the way through to better response protocols — which enhance resilience on the ground.

Recognizing their diversity, the case studies point to a useful set of learnings, grouped here under four headings:

A BUILDING THE INVESTMENT CASE: Risk assessment and financial viability

Thorough physical risk assessment requires considerable quantities of data which can be hard to source for some financial institutions. The case studies also show, however, that major financial institutions are not waiting for perfect data to act. Some firms are turning data and analytics into a source of competitive differentiation: combining public hazard data with proprietary geospatial analytics and asset-specific data, to map asset locations precisely and develop structural vulnerability metrics and apply forward-looking climate scenarios. Some firms are also using probabilistic catastrophe modeling and financial loss modeling to quantify potential damages. While these methodologies are improving, several drivers of loss — such as business interruption, asset-specific vulnerabilities, insurance coverage, and supply chains — remain hard to model. Firms are assessing not just exposure, but also whether corporate clients are considering or putting in place resilience mitigants, drawing on everything from corporate disclosures to on-site visits — including engineering assessments — to consider vulnerabilities and mitigants.

Implications:

- **Governments** could prioritize the development and sharing of "public good" geospatial and climate hazard data tailored for financial decision-making, as is starting to be seen in a few jurisdictions. This could help lower the cost of physical risk assessment for a broad set of economic actors including real economy companies, and it would benefit smaller or regional financial institutions.
- **Corporates** looking to attract adaptation finance or demonstrate resilience could proactively choose to share relevant information — such as asset-level exposure data and details of resilience measures in place — with financing partners, as a way of supporting more informed financing discussions.
- **Financial institutions** could further invest in translating physical risk into metrics used in financial decision-making, as financing follows only when climate hazards are expressed in terms that credit, underwriting and investment teams use. Where data gaps persist, financial institutions can combine available public hazard data with proprietary analytics, corporate disclosures, and direct client engagement to build decision-useful assessments.

[1] GFANZ (2025), GFANZ G20 SFWG Input Paper — Priority 2: Scaling up financing for adaptation

- **Financial institutions** can build viable investment cases by identifying and stacking the full range of resilience benefits. Several case studies demonstrate the importance of stacking avoided losses, reduced insurance premiums, and new revenue streams into viable investment cases, rather than relying on a single cashflow source. Taken together this helps to place an explicit value on ex-ante resilience. Developing more consistent methodologies — with support from MDBs and standard-setters — can help scale this emerging practice across the market.
- Where combined private value streams remain insufficient to meet commercial return thresholds, including because of the upfront costs of developing a project or because the longer term benefits of investing in resilience accrue to a very diverse set of actors, **governments and public finance institutions** — including MDBs and DFIs — can deploy targeted catalytic capital to bridge the gap between broader socioeconomic value and private returns, with clear pathways to crowd in private capital as projects mature and demonstrate performance.

B DEVELOPING THE PIPELINE: Opportunities and project generation

Adaptation opportunities span the economy, extending beyond hard infrastructure to include agriculture and aquaculture, water, food and energy systems, buildings and housing resilience, and financial protection for sovereigns and low-income households. The case studies highlight direct adaptation finance, which reduces physical risk at the asset or borrower level, and adaptation-enabling finance, which supports the systems, products, and services that allow households, firms, and governments to adapt.

The case studies also show that financial institutions are actively engaging corporate clients to develop adaptation projects and solutions which could be financed. While this is very positive, the process remains extremely resource-intensive and structured, investable opportunities are still limited relative to the need for adaptation and the interest in financing it. Addressing this would require action from a diverse set of actors, including governments setting national resilience goals, developing adaptation strategies, and implementing policies to drive greater focus on resilience from actors across the economy. Public and concessional finance is playing a catalytic role, absorbing early-stage project preparation and structuring costs, particularly through technical assistance and viability gap funding, as well as dealing with cases where the socioeconomic benefits are very diversely enjoyed making them harder to monetise.

Aggregation mechanisms that pool smaller, fragmented opportunities into diversified funds or portfolios can help meet institutional investor requirements and enable financing at scale, particularly in contexts where individual projects are too small or localized to attract capital independently, or where such aggregation can improve credit quality assessments.

Implications:

- **All actors could do more** to recognize the broad and diverse set of adaptation and resilience opportunities that arise across the economy, taking many different forms, and financeable in many different ways. Understanding the wide diversity of adaptation challenges and opportunities, and those that are widespread meaning financing solutions can be replicated and scaled is valuable.
- **Governments** can unlock progress by going beyond the setting of high-level goals to developing sectoral strategies and project pipelines that translate national resilience priorities into concrete, investment-ready opportunities. Clear demand signals — in the form of national adaptation plans, sectoral targets, and policy frameworks — are key for giving financial institutions and corporates the confidence to invest preemptively rather than reactively.
- **Corporates** could give greater consideration both to the physical risks they face — directly to their assets, but also through business disruption and supply-chain exposure — and to the resilience opportunities these create. That includes identifying the mitigation measures worth undertaking, and considering how they would be delivered, and where they require additional investment or financing.
- **Financial institutions** may choose to undertake structured engagement with their corporate clients on their exposure to physical risk and the benefits of enhanced resilience, which can help to stimulate demand for investment in solutions. In some cases, such engagement may help convert client relationships into bankable project pipelines, though it is not a substitute for action by governments and real economy actors.
- **Public finance institutions** should prioritize early-stage project preparation and structuring support. Aggregation mechanisms that pool smaller, fragmented opportunities into diversified portfolios should also be supported, particularly where individual projects are too small or localized to attract institutional capital independently.

C ESTABLISHING THE FINANCING MECHANISMS: Tools and products

Adaptation transactions are beginning to be financed by the full range of existing financial institutions and with conventional financial instruments. Banks are originating, structuring and lending; insurers are providing analytics, transferring risk and acting as a source of finance; and asset managers and owners are providing long-term capital and developing products which enable aggregation. Many of the case studies show parts of the system working together, combining financing with risk transfer, technical expertise, and sustained engagement. Where risks or cash flows are less suited to purely commercial approaches, targeted use of public finance — including participation of MDBs and DFIs — can help align risk and return through blended finance and risk-sharing structures.

Targeted product innovation is working where resilience benefits are very diffuse, accrue to a very broad set of actors, or realized primarily as avoided losses rather than contractual revenues. Emerging approaches, such as outcome-linked payment structures or mechanisms to monetize resilience benefits, aim to convert avoided losses into predictable, investable cash flows. While still nascent, these models may prove essential in areas such as nature-based solutions. Reaching vulnerable socioeconomic segments requires financial products tailored to their affordability, access, and risk profiles.

In some cases, labeled instruments, such as blue or resilience-linked bonds, can play a helpful role by attracting dedicated pools of capital, signaling alignment with standards, and improving transparency. Across all products, moving from pilot transactions to programmatic deployment — which would also help transition from the current debt-based to more equity-based finance — will require standardized eligibility criteria, documentation, and monitoring frameworks that enable adaptation finance to be originated as efficiently as conventional finance.

Implications:

- **Financial institutions** can support the scaling of adaptation finance by systematically embedding resilience considerations into the design and pricing of existing financing instruments, including loans, bonds, guarantees, insurance, and equity. Banks, insurers, and asset managers play complementary roles and can work together to strengthen integration of adaptation and resilience across the financial system, combining capital provision with risk transfer and technical expertise. Where resilience benefits show up mainly as avoided losses rather than new revenue, product innovation can help convert them into contractable cashflows; for example, through outcome-linked or results-based payment structures. Where benefits are diffuse, spread across many beneficiaries, pooling and aggregation or public co-funding are typically needed to make them financeable. Enabling participation across all segments of the economy, including the most vulnerable, may also require product structuring tailored to the affordability, access, and risk profiles of low-income households, SMEs, and agricultural producers in EMDEs.
- **Public finance institutions**, including MDBs and DFIs, could prioritize the deployment of public and concessional finance where it is most needed, with clear pathways to crowd in private capital as projects mature and demonstrate performance. Blended finance structures should be designed in close collaboration with private investors from the outset, ensuring risk-sharing mechanisms, reporting requirements, and governance arrangements are calibrated to meet commercial, regulatory, and duration requirements.
- **Financial institutions** could also work together to standardize eligibility criteria, documentation, and impact measurement across all instrument types. This can reduce transaction costs and enable adaptation finance to be originated with the same efficiency as conventional transactions.

D CREATING CONDITIONS FOR SCALE: Ecosystem, collaboration, and infrastructure

Even more so than in relation to transition finance, scaling adaptation finance to the level needed to build real resilience across the economy depends on governments setting clear goals, policy and planning, and providing support to ensure that investment with positive socioeconomic outcomes — but that otherwise might not generate the sorts of returns that the private sector needs to proceed — goes ahead. Clear national adaptation goals — in terms of targeted national resilience — and strategies, underpinned by sectoral plans and policy are important for incentivising investment in resilience across the public sector and real economy.

At the national level, enhanced metrics for targeted resilience, identification of priority areas for investment, and enhanced public data infrastructure on physical risks could give all sectors — including finance — a common analytical foundation.

Finding ways to bring different actors together — across government, business and the financial sector — will be important to overcome the barriers that otherwise exist to scaling adaptation finance. Similarly, finding ways to enable the financial sector to work with a broad set of partners to support development of projects and financing solutions, could be more effective than asking individual firms to simply focus on assessing and reducing the physical risk they face. This includes collaboration within firms as well as across them: for insurers in particular, ensuring that underwriting and investment activities are mutually reinforcing on adaptation can help preserve insurability where physical risk is rising and, in turn, sustain the access to bank loans, mortgages, and project financing that depend on it.

Implications:

- **Governments** will need to set clear national goals and strategies for resilience, and to underpin those with sectoral planning, policy and project development. Regulatory and fiscal tools — such as valuation guidelines that incorporate climate risk and cost-recovery mechanisms — can create the demand certainty needed to justify long-term private capital expenditure on resilience. Governments should also invest in public data infrastructure, which can lower information barriers and transaction costs for all stakeholders, including real economy corporates.
- **Governments, public finance institutions, and the financial sector** could consider working together to develop platform-type approaches — similar to those emerging in transition finance — to coordinate and scale efforts across government, real economy, and public and private financial institutions. Adaptation investment often requires action at a larger scale or with more complexity than any individual company or institution can deal with, and multi-stakeholder coalitions can help align incentives, create investable opportunities, and bring together public and private financing optimally.
- **Policymakers and regulators** can work to ensure that regulatory approaches encourage financial institutions to work with a diverse set of partners to find and finance resilience solutions, rather than inadvertently steering them to focus more narrowly on reducing their own exposure to identified physical risk.
- **All actors** can work together to raise awareness of geography- and sector-specific physical risks, and of the investment solutions available to address them. Adaptation investing is still relatively novel, even as it scales rapidly, and the case studies show that literacy is very uneven — not only around rising physical risk and its impacts, but also around the solutions now being developed to address it. Closing that gap across government, households, businesses, and the financial sector would help unlock investment in collective resilience.

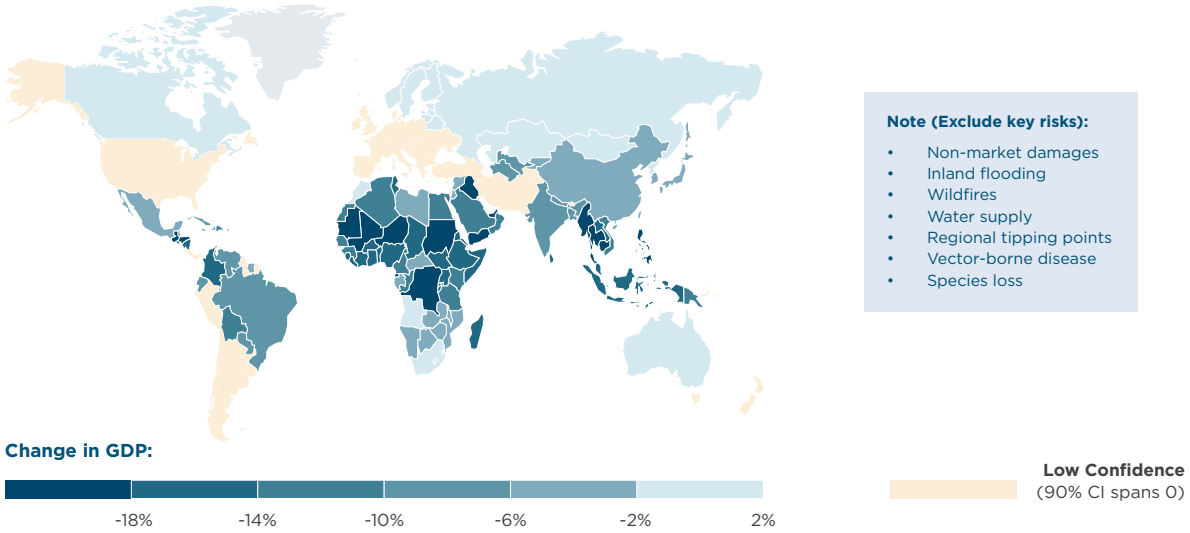
Context

Around the world, governments, companies, financial institutions, and households and communities are increasingly focused on finding practical ways to adapt to the rising physical impacts of climate change and to invest in resilience. While the scale of adaptation solutions and investment needed poses a significant challenge, it also presents an opportunity to use policy, planning, technology, and investment in solutions to build more resilient economies and societies. Governments will necessarily play a leading role, but there is increasing and welcome focus and innovation across the corporate and financial sectors.

This progress is important because the past eleven years have been the hottest on record and the IPCC reports that "… climate change is already affecting many weather and climate extremes in every region across the globe,[2] leading to a rising incidence and intensity of acute and chronic physical risks such as storms, cyclones, typhoons, hurricanes, wildfires, floods, droughts, landslides, extreme heat and cold, ocean acidification, sea level rises, change in precipitation patterns, and other impacts.[3] These events damage physical assets, disrupt economic production and supply chains, and impose losses for countries, companies and financial institutions. Research by the Grantham Research Institute and LSE illustrates how these losses vary by geography, finding that GDP per capita in low- and lower-middle-income countries is already 4–12% lower due to local temperature change and sea-level rise, with impacts projected to intensify further (Chart 1).[4]

[2] World Meteorological Organization (2026), State of the Global Climate 2025
[3] IPCC 2023, AR6 Synthesis Report: Summary for Policymakers
[4] Rising et al. (2026), The macroeconomic case for investing in climate adaptation, Grantham Research Institute for Climate Change, London School of Economics

Chart 1: Percentage losses in GDP from temperatures changes and sea-level risk in 2050 under a high emissions scenario



Note: Colours show the loss in GDP due to warming from 1960 to 2050, under a high-emissions baseline scenario, as a percentage of each country's counterfactual GDP without climate change. The estimate is based on 85 econometric models and only accounts for temperature changes and sea-level rise. Countries for which the 90% uncertainty range includes 0 are shown with diagonal white lines.

Source: Grantham Research Institute, LSE Global School of Sustainability

While there is methodological debate over how to quantify the long-run GDP impact of climate change, the Swiss Re Institute estimates that global GDP could be around 11% lower by 2050 under a 2°C pathway, and 4% lower under a Paris-aligned scenario. In such scenarios, reactive adaptation measures are significantly more expensive than proactive investment,[5] and tail-risk scenarios that contemplate the passing of climate tipping points point to materially larger long-run impacts and therefore benefits around investing in resilience.

These impacts create a growing need for investment in adaptation and resilience across sectors such as infrastructure, agriculture, real estate, and climate-resilient technologies that also represents a significant socioeconomic and commercial opportunity. McKinsey estimates that achieving developed country-level resilience in a 2°C world would require US$1.2 trillion a year in investment by 2050, noting opportunities in enhancing building resilience to heat and water damage, and measures and enhancing the efficiency and effectiveness of technologies such as undergrounding, irrigation, and air conditioning.[6] BCG and Temasek find climate intelligence, resilient building materials, active and passive cooling, flood defense, climate-adapted agricultural inputs, water efficiency, and emergency medical products and services as being sectors which could be particularly attractive to private equity investment opportunities.[7] BCG highlights that there is already a US$100 billion a year opportunity for banks in financing adaptation and resilience-related capital expenditure.[8] Bloomberg Intelligence tracks the market capitalisation of 275 companies active in adaptation and resilience solutions and finds that they have outperformed the S&P Global 1200 Index over the last five years.[9]

Despite the growing need, and significant measurement challenges, there remains a sizable gap between required and actual investment in adaptation and resilience. While precise figures vary, estimates suggest developing countries alone may require US$300 billion or more annually by 2035.[10, 11] Current financing represents a small fraction of this, with CPI estimates suggesting that adaptation and resilience finance reached US$67 billion in 2023, less than US$6 billion of which came from private sources. While this is likely an underestimate due to the amount of adaptation activity which takes place but is not labelled explicitly as adaptation, it underscores the importance of finding ways to significantly scale investment in adaptation and resilience. To help close this gap, major MDBs have committed that, by 2030, their annual finance for adaptation in low- and middle-income countries will reach US$42 billion, and several individual DFIs and MDBs have gone further by targeting at least 50% of their climate finance for adaptation.[12]

[5] JPMorgan (2024), Tipping Points: Decision making under deep uncertainty
[6] McKinsey Global Institute (2025), Advancing adaptation: Mapping costs from cooling to coastal defenses
[7] BCG and Temasek (2025), The Private Equity Opportunity in Climate Adaptation and Resilience
[8] Boston Consulting Group (2026), Climate Adaptation and Resilience Financing
[9] Bloomberg Intelligence (2026), The Climate Economy, 2026 Outlook
[10] UNEP (2025), Adaptation Gap Report
[11] CPI (2025), Top-down Climate Finance Needs
[12] 2024 Joint Summary Report on MDBs' Climate Finance

Key Lessons from the Case Studies

The 22 in-depth case studies outlined in this report vary considerably in scale, geography, type of financial institution, nature of financing, exposure to physical risk, and expected impact, reflecting the diversity of adaptation finance. Solutions address real world hazards including the impact of hurricanes, storms, droughts, heavy rainfall and floods, wildfires, and systemic solutions address multiple hazards. They span continents and include both advanced and emerging markets. The case studies involve a range of financial institutions including banks, insurers, asset managers, and blended finance vehicles.

Many of the case studies are delivered through debt-based instruments, often complemented by risk transfer mechanisms such as insurance or guarantees, although equity also plays a role. Around a quarter of the cases use labeled instruments, such as green or blue bonds, indicating that both conventional and labeled finance can support scaling. Almost half the solutions are purely private sector solutions, with private financial institutions financing private real economy companies to enhance their resilience. A significant share of transactions involve public finance or blended structures, particularly in emerging markets, where risk-sharing is needed to make projects investable. The examples range from early-stage pilots to proven and scalable models, with a number already embedded in mainstream financial activity.

Despite the variety of approaches, a series of common lessons emerge about the practical steps that are needed to make adaptation and resilience financeable and to scale the solutions which are already being developed and operated in the market. **These lessons are organized around four main categories, within which sit eight specific sets of lessons:**

BUILDING THE INVESTMENT CASE:
Risk assessment and financial viability

1. Physical risk assessment as a foundation for adaptation and resilience financing
2. Building the financial case preemptively

DEVELOPING THE PIPELINE:
Opportunities and project generation

3. Appreciating the scope and scale of adaptation opportunities
4. Supporting project generation through engagement, aggregation, and public finance

ESTABLISHING FINANCING MECHANISMS:
Tools and products

5. Adaptation is being financed across the financial sector, largely through existing instruments
6. Sharing risk through the use of public finance

CREATING CONDITIONS FOR SCALE:
Enabling environment, collaboration and capacity

7. Using government policy to create a conducive environment for project development
8. Collaboration and capacity as enablers of adaptation finance

A BUILDING THE INVESTMENT CASE: Risk assessment and financial viability

In many of the case studies, adaptation finance starts with financial institutions undertaking physical risk assessment and then translating this into financial decision-making metrics. Financial institutions are working with each other — with banks, insurers and asset managers each contributing their distinct capabilities — and with real-economy companies to build robust business cases to justify investment, recognizing that some benefits of adaptation investment may be realized through avoided losses rather than new revenue streams.

1. Physical risk assessment as a foundation for adaptation and resilience financing

Physical risk assessment is a first step in identifying adaptation opportunities and engaging corporate clients on enhancing their resilience. The case studies illustrate that firms undertake a combination of top down scenario analysis and portfolio-wide screening with bottom up on-site diagnostics to translate climate hazards into risk exposures and then to the financial metrics used in credit, underwriting, and capital allocation decisions.

- **Physical risk assessments are an involved exercise, combining analysis at multiple levels.** The case studies show financial institutions using a range of techniques to assess exposure to physical risks which include forward-looking hazard modeling, portfolio-level risk assessment, and detailed asset-level diagnostics, including on-site engineering assessments to capture local operational nuances. Each requires extensive and differing tools and expertise. For example, Zurich Insurance Group worked with the logistics company Maersk to combine probabilistic catastrophe modeling with on-site engineering assessments to evaluate the resilience of global port terminals. Similarly, Link REIT worked with AXA to assess its commercial real estate portfolio, identifying priority assets where resilience was most necessary. PIMCO uses geospatial hazard exposure to assess risks at the portfolio level. This reflects a broader shift from viewing climate risk as a long-term, abstract issue to treating it as a near- to medium-term financial risk that can be actively managed and priced.

- **Financial institutions combine multiple data sources, with public data playing an important role.** While much of the data and analysis used is proprietary, public initiatives that provide system-wide access to high-resolution hazard data can build capability more efficiently than fragmented, institution-by-institution efforts. In some cases regulators have sponsored platforms offering standardized, asset-level risk data linked to financial metrics — lowering entry barriers for smaller institutions and creating a common analytical foundation across lenders, insurers, and investors. Reliable, independently verifiable public data is also essential for risk-transfer markets: in Jamaica's catastrophe bond, Aon and the World Bank used public datasets to define parametric triggers. Similar reliance on robust public data underpins sovereign risk pools such as SEADRIF, where government data is used to trigger payouts aligned with real-world outcomes.

- **Combining physical risk assessments with an evaluation of corporate readiness and the available options to increase resilience is an important next step.** Some institutions are beginning to assess asset-level exposure alongside the capacity of companies to respond to identified vulnerabilities and the available options to do so. This helps distinguish between companies that are exposed but taking steps to strengthen resilience from those that are exposed and likely to remain vulnerable. PIMCO's proprietary risk assessment framework scores both physical risk exposure and operational readiness, including governance and adaptation planning, which it applied in its engagement with a California-based utility. Rabobank's provision of finance to Brazilian livestock farmers similarly depends on borrowers' ability to adopt new practices and comply with Brazil's Forest Code. In other cases, readiness is assessed more implicitly. Insurers such as Zurich and Tokio Marine combine hazard modeling with site-level diagnostics to evaluate both asset vulnerability and the feasibility of resilience measures. In practice, the case studies indicate that a more exposed borrower with a credible, financeable resilience plan may represent lower risk than a less exposed borrower with no adaptation strategy.

- **Sustained engagement is a strategic alternative to risk-based exclusion or divestment.** The case studies reveal that sustained engagement with companies in high-exposure areas can be an effective mechanism for building systemic resilience relative to reallocating capital away from physical risks. PIMCO's engagement with a California-based utility demonstrated that rather than disengaging from high-risk entities, long-term, structured dialogue can support the development of credible adaptation strategies, such as wildfire mitigation plans, and restore market confidence. Similarly, Zurich has helped reframe adaptation as a capital allocation decision, noting that walking away from high-risk geographic areas does not build global resilience. Commercial International Bank (CIB) in Egypt reinforces this by integrating non-financial advisory services into its overall banking offering, using technical specialists to conduct walkthrough audits that demonstrate to corporate clients how enhanced resilience protects cash flows and business

continuity. Tokio Marine in Japan was able to move beyond post-loss risk transfer to act as an "ex-ante resilience enabler" when, following significant storm losses at a vehicle storage yard, the insurer proactively engaged with the manufacturer on physical resilience measures. These examples underscore that private sector engagement, supported by risk analytics and technical expertise, can convert awareness of physical risk into concrete investment decisions that stabilize portfolios and enhance long-term resilience.

2. Building the financial case preemptively

In the case studies, physical risks are quantified in the language of financial decision making through metrics such as avoided losses, reduced business disruption, lower insurance and financing costs, and, in some cases, new revenue streams. Building compelling business cases often requires stacking multiple benefits and aligning financing structures with the long-term realization of the value of resilience. Where resilience measures are taken preemptively this can be significantly less costly than taking measures after physical risk has materialized.

Physical risk analysis influences capital allocation when it is translated into metrics used in credit, underwriting, and investment decisions. Across the case studies, financial institutions are converting the outputs of their physical risk assessments into metrics that credit, investment, and underwriting teams use daily, such as loss curves, probability of default, loss given default, expected loss, value-at-risk, insurance pricing and loss ratios, asset valuation, and portfolio stress losses. Climate models often operate on long time horizons and probabilistic scenarios, while financial decisions require near-term metrics embedded within established risk return frameworks. These frameworks are often not designed to incorporate forward-looking physical risk or the benefits of planned resilience measures, but several case studies illustrate how this can be achieved in practice. Standard Chartered's trade finance for climate-resilient solar modules from JinkoSolar illustrates how banks can pair top-down physical risk modeling with bottom-up engineering data from manufacturers, applying the methodology set out in its Guide for Adaptation and Resilience Finance (developed with KPMG and UNDRR). Tokio Marine translated flood risk modeling into financial metrics that supported a business case for elevating assets at a port storage facility. Zurich applied a similar approach in its work with Maersk, quantifying the financial implications of climate risks and the benefits of resilience investments across port terminals. CIB's financing of enhanced cold chain refrigeration in the food and beverage sector in Egypt reduced the borrower's exposure to rising temperatures, strengthening the credit case. The case studies indicate that the ability to convert physical risk into financial metrics is key to moving from risk assessment to investment.

Developing a compelling case for financing adaptation often requires stacking multiple benefits and cash flows. Across the case studies, financial viability depends on demonstrating how different sources of value, such as direct revenues, reduced insurance premiums, and avoided losses from asset damage, supply chain disruption, and business interruptions, can be quantified and incorporated into financing models. This is inherently challenging for financial institutions and their corporate clients, often requiring robust modeling of counterfactual scenarios.There are not yet widely used methodologies, nor a common unit of resilience, which can help standardize this assessment. However, several case studies show that, where these value streams can be credibly quantified, adaptation investments can be commercially financeable without concessional support.

For example, Standard Chartered's guarantees to JinkoSolar were underpinned by analysis showing that more resilient solar panels reduce expected losses for end users under extreme weather, improving the underlying risk profile. Link REIT and AXA collaborated to translate resilience investments into measurable financial benefits, including a 10–20% reduction in expected losses, lower business interruption costs, and reduced insurance premiums, which together strengthened the investment case. Standard Bank's financing of climate-smart agriculture similarly depended on stacking multiple sources of value: protective netting and hydroponic systems reduced production variability, solar power lowered energy costs and removed grid dependency, and the resulting production consistency enabled access to premium export markets in Europe, Asia, and the Middle East, together creating a revenue profile sufficient to service the financing on fully commercial terms. In such cases, the "stacking" occurs through combining avoided losses and cost savings to offset upfront costs and improve overall returns.

In other cases, however, value stacking extends further by incorporating additional or more novel revenue streams. The FloodAction Coalition, for example, aggregates payments from multiple beneficiaries — including insurers, infrastructure operators, and public authorities — and over time may incorporate environmental credits, converting avoided losses into more stable, contractable cash flows. FirstRand Bank's investment banking division, Rand Merchant Bank (RMB), is exploring similar approaches, including the potential for environmental credits linked to measurable water outcomes to complement performance-based financing structures. These models explicitly structure multiple beneficiaries' willingness to pay into a single investment case. However, not all transactions can achieve commercial viability through private value streams alone. In several case studies, public or concessional finance plays a critical role in recognizing wider socioeconomic benefits or absorbing residual risks that private investors are unwilling to bear. In these blended structures, public capital helps bridge the gap between privately captured returns and the full social value of resilience, enabling projects to meet required risk-return thresholds.

A mismatch between short-term financing horizons and the long-term nature of resilience benefits can constrain adaptation investment. Adaptation measures often require upfront capital while financial and economic benefits are realized over extended periods. Several case studies show how financial institutions are adjusting financing structures to better align with these timelines. Supported by the blended finance vehicle AGRI3 fund, Rabobank provides 10 year loans with upfront 3 year grace periods to livestock farmers in Brazil undertaking land restoration, recognizing both the long-term nature of the projects and the lack of early-stage revenue. PIDG and NinetyOne provided 18-year debt aligned with the life of a water infrastructure project. Daiichi Life Insurance negotiated a customized 11-year bond with Aichi Prefecture in Japan, structuring the tenor to align with its long-dated insurance liabilities while providing the issuer with stable, long-duration funding for disaster-prevention infrastructure. Macquarie's equity ownership of Elenia, Finland's second largest electricity distribution network operator, supports long-term planning and investment, including ensuring that physical resilience is embedded into capital expenditure programs. Standard Bank combined differentiated tenors within a single facility, including a five-year medium-term loan for core infrastructure alongside a ten-year asset finance facility for solar panel installation. Even extending the duration of shorter-term instruments can play a role: Link REIT secured a two-year insurance contract, double the duration of typical annual policies, after taking actions to enhance the resilience of their CRE portfolio, this provided greater pricing certainty and supported the resilience investments. Aligning financing tenors with the time profile of resilience benefits is critical to making adaptation investments viable.

Adaptation investment is often catalyzed by realized losses, but more forward looking and pre-emptive action can be more cost effective. Historically, actions to raise resilience often follow losses as firms and governments respond to the costs of damage and disruption and prioritize resilience. Several case studies illustrate this dynamic. After a Japanese automobile manufacturer experienced storm-related losses, Tokio Marine supported the design of elevation measures to reduce future risk. Similarly, the Government of Jamaica issued catastrophe bonds following repeated hurricane impacts to strengthen fiscal resilience. The materialization of physical risk can accelerate subsequent investment in resilience. Other case studies illustrate how financial structures can help support a shift towards ex ante investments in resilience that could be more economically efficient. Link REIT's resilience-linked insurance pricing translated capital investments into immediate premium reductions, creating a tangible financial incentive for proactive investment. SEADRIF's parametric insurance provides pre-arranged liquidity based on predefined triggers, enabling governments to prepare for and respond rapidly to future shocks. These examples show how adaptation can evolve from experience-led responses into more systematic and forward-looking investment.

B DEVELOPING THE PIPELINE: Opportunities and project generation

The case studies show that adaptation opportunities are widespread across the economy, and appreciating this breadth of opportunity is important. Building a pipeline depends on actively identifying, structuring, and developing a financial case, often by converting embedded resilience benefits into financeable forms. Financial institutions therefore play a critical role in this process through engagement with corporates, product design, aggregation of opportunities, and the use of in house frameworks that make adaptation activities visible and investable.

3. Appreciating the scope and scale of adaptation opportunities

Many adaptation opportunities are embedded within broader activities and are not consistently recognized or classified as financeable investments. They extend far beyond physical infrastructure to include operational changes, risk management improvements, and the development of products and services that enhance resilience. Financial structuring can be required to design adaptation and resilience projects in a way which makes them investable.

- **Adaptation finance spans a wide range of activities including but going beyond traditional hard infrastructure.** The case studies illustrate that adaptation and resilience also includes enhancements to agriculture and aquaculture, water, food and energy systems, industrial and housing resilience, all the way to supporting the financial resilience of sovereigns and low income households in the face of natural disasters. Across sectors this can include low-cost and fast-to-implement interventions like operational adjustments, changes to maintenance practices, emergency protocols, and supply chain management; the use of data and digital tools to monitor risk and inform decision-making; and nature-based or land-use interventions that reduce exposure and enhance recovery. PIDG and Ninety One's financing of a water supply project in Kigali, Rwanda incorporated hydrological data collection and climate-resilient design features to diversify water sources and reduce exposure to drought and flooding. Link REIT combined physical upgrades with measures such as improved drainage management, flood-response protocols, and emergency drills to reduce expected losses from typhoons and extreme rainfall. In agriculture and aquaculture, and land use, adaptation is often delivered through changes in production systems rather than discrete infrastructure. Rabobank's program provides finance to restore degraded pasture and adopt regenerative and good agricultural practices, improving resilience to drought while strengthening borrower credit quality. Standard Bank financed a bundled package of

interconnected climate-smart agricultural technologies — including protective netting, hydroponic systems, and on-site post-harvest cooling — for a commercial blueberry operation in one of Namibia's most arid and climate-vulnerable regions, demonstrating how addressing multiple vulnerabilities simultaneously can transform a climate-exposed operation into one capable of meeting international export standards on fully commercial terms. FirstRand Bank's outcomes-based bond transaction included raising project funding from outcomes-based funders for the removal of invasive species in strategic water catchments, increasing water availability and reducing fire risk, with bond investors' returns linked to verified outcomes. Adaptation is a cross-cutting set of interventions that strengthen the underlying commercial and operational viability of assets across the entire real economy.

- **Many adaptation and resilience activities are embedded within routine transactions but not necessarily identified as such.** Financial institutions are already routinely providing finance to public and private entities which is used to increase the resilience of their activities. These case studies show examples of routine financing and asset stewardship which may not have been considered as climate change-related with an adaptation and resilience lens being applied. This integration means that while significant adaptation expenditure is already occurring, it is often not identified as such and this can mean that it is therefore not viewed as a fundamental driver of credit quality, business continuity, and long-term asset value.

  For example, Macquarie's equity investment in Elenia treated the undergrounding of overhead power lines as a core component of asset stewardship to ensure service reliability, allowing adaptation to be funded through existing regulatory and investment frameworks. When Standard Chartered applied the classification framework in their Guide to Adaptation and Resilience to projects within their portfolio they found a range of existing transactions that already met the criteria and could be classified as adaptation finance — even without additional structuring. They subsequently provided trade finance for resilient solar modules showing how familiar financial tools like bank guarantees can enable the deployment of resilient products. Similarly, Impax Asset Management applied a proprietary Climate Opportunities Taxonomy at the product and service level — rather than relying on corporate self-labelling — to identify approximately £5.8 billion of listed equities AUM with material adaptation-relevant revenues, much of it in companies that do not position themselves as adaptation businesses, suggesting that the investable adaptation opportunity in public markets is significantly larger than conventional disclosure-based approaches reveal.

  In the fixed income market, PIMCO's engagement with a California-based utility illustrated that resilience considerations cut across all financing types, including securitized and conventional issuances, because they are material to an issuer's long-term creditworthiness. Meanwhile, Zurich's work with Maersk reframed port future-proofing from a discretionary cost to a financially grounded capital allocation decision essential for avoiding business interruption losses. And First Abu Dhabi Bank's financing of wastewater treatment and desalination projects highlights that many adaptation investments are essential utility services with stable demand and predictable cash flows, making them commercially attractive through standard project finance mechanisms.

- **In some cases, financial structuring is required to design adaptation and resilience projects in a way which makes them investable.** The case studies illustrate several structuring techniques that help make adaptation and resilience activities investable. These include aggregating smaller or distributed projects into portfolios that meet the scale and diversification requirements of investors, as seen in MUFG's GAIA Fund; aligning financing terms, such as tenor, repayment profiles, or grace periods, with the time profile and risk characteristics of resilience benefits, as demonstrated by Rabobank's 10-year loans (with 3-year grace periods) for pasture restoration and PIDG/NinetyOne's long-term infrastructure financing; and separating risk across actors through blended capital structures that combine commercial finance with concessional layers or risk transfer instruments, as in the Insurance Development Forum's Infrastructure Resilience Development Fund. FirstRand Bank's RMB has developed an innovative solution to incentivize outcomes-based funders to finance invasive species removal by sharing the risk of the project being unsuccessful with private investors. In other cases, structuring focuses on making resilience benefits contractable; for example, through multi-stakeholder payment mechanisms that convert avoided losses into predictable cash flows, a model being explored by the UK FloodAction Coalition.

- **Adaptation finance also includes supporting the development and deployment of assets, products, and services that enable others to become more resilient.** This expands the focus from protecting individual assets to financing solutions that enable adaptation across the wider economy. Standard Chartered's financing of resilient solar panels demonstrates how financial institutions can support products designed to withstand physical climate risks, improving the resilience of end users. HSBC's financing of Thai Union supports climate-resilient aquaculture practices, strengthening resilience across its supplier base. Guardian Group's parametric microinsurance provides rapid liquidity to low-income households following extreme weather events, enabling faster recovery. For sovereigns, SEADRIF's parametric insurance products provide rapid post-disaster financing, supporting continuity of essential services. Beyond physical products, enabling solutions can also include services and data, such as Zurich's risk analytics and engineering assessments which support corporates in identifying and prioritizing resilience investments. Adaptation finance supports the systems, services, and value chains that enable resilience across the wider economy.

Direct adaptation finance vs. adaptation-enabling finance

There are two complementary forms of adaptation finance: direct adaptation finance and adaptation-enabling finance.

Direct adaptation finance

Refers to capital deployed to reduce the climate risk exposure of a specific asset, activity, or entity, with the resilience benefits accruing primarily to the financed project or borrower. This includes investments in physical upgrades, operational changes, nature-based solutions, or production system adjustments that reduce vulnerability to chronic stresses (such as heat, water scarcity, or sea-level rise) or acute hazards (such as floods, storms, droughts, or wildfires).

Adaptation-enabling finance

Refers to capital deployed into assets, products, services, or data solutions whose resilience benefits accrue primarily to third parties or the wider system. This includes financing for climate-resilient products and technologies used by end users, risk transfer mechanisms that provide rapid liquidity following climate shocks, and services such as risk analytics, data platforms, early warning systems, or capacity-building programs. In these cases, resilience benefits accrue primarily to third parties or broader systems, supporting adaptation across multiple actors, sectors, or geographies rather than a single financed asset.

4. Supporting project generation through engagement, aggregation, and public finance

Generating a pipeline of adaptation finance requires financial institutions to help corporates — whether borrowers, investees or insureds — to identify resilience needs and structure business cases for capital investments to address. Active engagement with corporates, product design, and aggregation mechanisms can all help translate these resilience needs into financing opportunities while reducing risk exposures. The pipeline challenge is less about a lack of underlying demand and more about a lack of structured opportunities that meet investor and lender requirements.

- **Active engagement with corporates is a key mechanism for converting resilience challenges into financeable projects.** In practice, financial institutions can only finance projects that are brought to market, but active engagement with corporates can help surface and structure financeable projects that might otherwise not occur. By combining risk assessment, technical and financial modeling expertise financial institutions can help corporates identify adaptation solutions and support the development of financeable projects. PIMCO's engagement with a California-based utility supported governance changes, including new leadership and the implementation of comprehensive wildfire mitigation plans, strengthening both resilience and access to capital. Zurich's work with Maersk allowed them to assess climate risks across port terminals and translate these into actionable investment proposals which were integrated into long-term capital programs. CIB has developed a Brain Trust Framework which positions them as originators and developers of bankable adaptation projects, rather than passive financiers. These examples show that sustained engagement, particularly when supported by risk analytics and technical expertise, can convert awareness of risk into concrete opportunities, expanding the pipeline of financeable projects. This approach — if embedded more broadly in the system — can drive deeper resilience improvements than the financial sector reducing exposure to high-risk assets.

- **Aggregation is often needed to scale adaptation finance.** Institutional investors typically require large-scale portfolios and diversified cash flows that individual, fragmented projects cannot provide. By bundling geographically dispersed interventions, like nature-based solutions across a river catchment or multiple infrastructure loans, platforms can meet the scale and governance thresholds required for institutional participation. The MUFG-GAIA fund acts as an aggregator pooling together smaller climate loans (which might individually be too small or risky for a commercial bank) across 25 different countries using MUFG's global network to originate a pipeline of projects. And the IDF-Infrastructure Resilience Development Fund pools insurer, IFC, and potentially other institutional investor funds to allow them diversified exposure to a portfolio of small and medium sized infrastructure projects in a range of underserved countries. In banking the aquaculture sector, individual smallholder farms are too fragmented to finance directly and so HSBC's financing of Thai Union includes an Aquaculture Improvement Program for their suppliers which allows training and advisory services to reach those suppliers efficiently and deliver resilience improvements at scale. The programmatic approach of Rabobank takes a replicable product and rolls out to a large group of livestock producers in Brazil. While approaching the issue in different ways, each of these examples shows that scale can come from finding ways of aggregating exposures or having intermediary entities which can manage a wide set of relationships.

- **Public finance can play an important role in particular during project design and structuring, absorbing costs that EMDE project developers may not be able to fund without a guarantee of project success.** Project development and structuring costs are often a binding constraint, particularly in EMDEs where resources are limited. Relatively small sums can play an important role in supporting project development, feasibility studies, covering listing costs, assisting in contract design, or supporting access to global investors. In complex sectors like agriculture or water, providing agronomists or engineers to support borrowers reduces implementation risk and directly improves repayment capacity. In NinetyOne's case study, grant funding and technical assistance from the PIDG Technical Assistance Facility was crucial in ensuring the development of the Kigali Bulk Water Project, reducing upfront cost pressures, ensuring the project remained affordable for the public while maintaining a bankable return for debt providers. A grant from the Hong Kong Insurance Authority covered the transaction costs associated with issuing the Government of Jamaica's catastrophe bonds, reducing the overall cost and supporting access to global capital markets for disaster insurance for low and middle income countries. The ADB provided grant funding and technical assistance to Thai Union to support the development of their green and blue bond framework which allowed them to structure a product to attract finance from global commercial banks like HSBC. These examples show that modest amounts of public funding can have a disproportionate impact by reducing early-stage risk and enabling projects to reach financial close.

C ESTABLISHING FINANCING MECHANISMS: Tools and products

The case studies show that existing financial tools are typically used, adapting them where necessary to reflect the specific characteristics of resilience investments. A wide range of mechanisms are being deployed — including direct lending, guarantees, trade finance, catastrophe bonds, debt funds, equity investments, and bond issuance and holding — often applied with a resilience lens that embeds physical risk considerations into otherwise conventional financing structures. In many cases, effective financing mechanisms combine multiple tools within a single structure, particularly where risks need to be shared across different actors. Some entities are using innovative financial instruments such as labeled products. Financial institutions are frequently working with public actors, insurers, and technical partners to design integrated solutions linking financing, risk mitigation, and performance measurement.

5. Adaptation is being financed across the financial sector, largely through existing instruments

Adaptation finance is being pursued by all types of financial institutions, reflecting both the breadth of needs and the flexibility of existing tools when applied through a resilience lens. Different types of institutions are playing complementary roles: banks are originating, structuring and lending; insurers are providing analytics, transferring risk, and acting as a source of finance; and asset managers and owners are providing long-term capital and developing products which enable aggregation. In many cases, effective solutions require collaboration across these actors, combining capital provision with risk transfer and technical expertise, suggesting that scaling will depend not only on expanding products but on strengthening integration across the financial system.

- **Many adaptation projects are financed using conventional financing mechanisms.** Standard financial products — including loans, bonds, insurance, and equity — are all used to support adaptation and resilience. Adaptation is often financed as part of business-as-usual activity rather than as a distinct asset class, reflecting the fact that many resilience measures enhance asset quality, cash flow stability, and creditworthiness, making them compatible with existing risk-return frameworks if given the right treatment. In some cases, financial institutions adapt conventional tools by incorporating forward-looking physical risk into decision-making, adjusting terms such as tenor or pricing, or integrating technical analysis to ensure investments deliver measurable risk reduction. For example, Rabobank's long-term lending for pasture restoration in Brazil, Link REIT's collaboration with AXA in translating resilience upgrades into reduced expected losses and lower insurance premiums, and Guardian Group's use of simplified, lower-cost pricing structures to extend parametric microinsurance to climate-exposed low-income households. Similarly, Macquarie's equity ownership of Elenia embeds resilience considerations into ongoing grid investment and asset stewardship, and PIDG/NinetyOne's financing of the Kigali Bulk Water Project demonstrates how climate-resilient infrastructure can be financed through standard project finance.

- **Banks are playing a central role in translating adaptation needs into financeable opportunities through originating, structuring and lending.** Across the case studies, banks are working with clients to identify vulnerabilities, shape investment plans, and provide financing solutions that support resilience. Standard Chartered has extended trade finance for climate-resilient solar modules; First Abu Dhabi Bank has issued blue bonds aligned with national water strategies; ING has delivered government-backed financing for households facing subsidence risk; and Standard Bank has structured an integrated working capital and capital expenditure facility for climate-smart agriculture. Banks are also playing a key role in structuring blended finance vehicles, such as MUFG's GAIA Fund, which combines public and private capital to deploy long-term financing for adaptation projects across emerging markets. Banks that have

built dedicated adaptation capability are increasingly using it as a source of competitive differentiation, particularly in emerging market segments where local risk knowledge, in-house classification frameworks, and structuring expertise are scarce.

- **Insurance plays a critical role across multiple dimensions.** Beyond providing traditional cover against losses, insurance companies are developing new approaches. Parametric insurance and catastrophe bonds are converting physical climate risks into pre-defined financial payouts, enabling rapid access to liquidity following extreme events, as illustrated by the Government of Jamaica's catastrophe bond and SEADRIF's parametric insurance solutions for Southeast Asian governments, including its first policy to Lao PDR. Insurance can also support adaptation by embedding resilience incentives into financial structures. Link REIT's collaboration with AXA translated resilience investments into reduced expected losses and lower insurance premiums, creating a financial incentive for proactive risk reduction. Increasingly, insurers are also seeking to align the two sides of their balance sheet on adaptation, ensuring that underwriting and investment activities reinforce one another. Reflecting this, insurers are also looking for ways to use the asset side of their balance sheets to directly finance adaptation: Daiichi Life Insurance underwrote ¥5 billion in dedicated disaster-prevention bonds issued by Aichi Prefecture in Japan, financing flood defenses and earthquake preparedness infrastructure through a fully commercial transaction structured around the insurer's own asset-liability management needs. Meanwhile, the Infrastructure Resilience Development Fund (IRDF), developed by the Insurance Development Forum (IDF), aims to mobilize US$750 million of insurance and other institutional capital for resilient infrastructure in emerging markets by combining public and private capital and structuring investments to meet insurers' risk and regulatory requirements.

- **Asset managers and investment funds are deploying long-term capital and enabling aggregation.** The longer term horizons of many asset managers can place them well for financing infrastructure and other long-lived assets where resilience benefits are realized over extended time horizons. PIDG and NinetyOne provided long-term debt for water infrastructure and Macquarie's equity ownership of Elenia enables long-term investment in resilient electricity distribution infrastructure. In some cases, funds are playing a key role in aggregating smaller and geographically dispersed opportunities into investable portfolios: for example, the MUFG-GAIA fund pools projects across multiple countries to create a diversified investment portfolio, while AGRI3 supports scaling through a program-based lending approach, enabling Rabobank to extend finance under a common internal framework. In other cases, listed equities can serve as a scalable channel for adaptation capital. By applying a structured taxonomy and revenue threshold analysis across its listed equities platform, Impax Asset Management has built adaptation exposure of approximately £5.8 billion within mainstream portfolio strategies, showing that adaptation exposure can also be built systematically within existing public market allocations.

- **Reaching vulnerable segments requires financial products tailored to their affordability, access, and risk profiles.** Those most exposed to climate impacts, such as low-income households, SMEs, and agricultural producers in EMDEs, often face the greatest barriers to accessing finance. Expanding adaptation finance therefore requires designing products that match the financial capacity and needs of these groups. Guardian Group's parametric microinsurance product for low-income households, for example, is designed with low minimum premia, while ING is supporting a government-backed scheme to provide affordable financing for low income homeowners facing subsidence risks who would otherwise be unable to access additional lending. More broadly, expecting EMDE companies and smallholders to immediately comply with high standards is often impractical, so robust improvement pathways can be essential. HSBC's financing of Thai Union, for example, requires that smallholder suppliers develop an Aquaculture Improvement Program (AIP) to make measurable progress towards recommended industry best practices over time.

- **Labeling can help mainstream adaptation by making resilience investments visible and investable.** While many adaptation investments are financed through conventional instruments, applying labels such as 'adaptation', 'resilience', or 'blue' can increase transparency, attract dedicated pools of capital, and establish clearer expectations for impact and reporting. The green, social, sustainability, and sustainability-linked bond (GSSB) market is one such channel. Investor-led shading taxonomies increasingly recognise that adaptation- and resilience-aligned activities can sit within GSSB structures where use-of-proceeds or KPIs are calibrated to resilience outcomes, providing both a recognisable label and a credible link to adaptation objectives. For example, First Abu Dhabi Bank issued blue bonds to finance wastewater treatment and solar-powered desalination projects aligned with national water security strategies, providing investors with clear use-of-proceeds and impact reporting. HSBC financed a blue bond issuance by Thai Union to support resilience across its aquaculture supply chain, including investments in climate-resilient farming practices and supplier-level adaptation measures. Daiichi's underwriting of bonds for Aichi Prefecture in Japan combined a certified green bond tranche for flood countermeasures with a non-labelled tranche for earthquake preparedness, illustrating how labelled and non-labelled approaches can work in parallel to channel capital toward a broader set of resilience activities than a single taxonomy might accommodate.The use of labels — or, where appropriate, clearly defined use-of-proceeds structures — provides investors with assurance that capital is directed toward specified activities and that impacts can be monitored and reported over time. It also helps financial institutions build internal confidence by anchoring adaptation transactions within familiar asset classes and established frameworks, reducing the perceived novelty and risk of these investments.

6. Sharing risk through the use of public finance

Many adaptation and resilience related transactions are already commercially viable, but there are also a range of projects, especially in EMDEs, where the risk-return profiles are not sufficiently attractive for solely private finance. In these cases, where the social and economic benefits are sufficiently high, public finance can play an important targeted role in derisking transactions, including supporting project development and finance structuring costs. Across the case studies, public finance plays a catalytic role by enabling private participation, accelerating project development, and shaping risk allocation, rather than acting as a primary source of capital.

- **Where adaptation projects are not commercially viable on a standalone basis, there are ways to ensure public finance is used strategically and catalytically.** As already noted, public and concessional capital is often essential to absorb early-stage costs and risks including around project development. Rather than displacing private capital, well-designed blended finance structures improve risk-return profiles by reallocating specific risks to actors best placed to bear them. Concessional capital is most catalytic when used as a junior tranche to absorb initial losses or insurance claims, thereby elevating the remaining risk to a level acceptable for private investors. The MUFG-GAIA Fund, the PIDG/NinetyOne-Emerging Africa and Asia Infrastructure Fund, the IDF-Infrastructure Resilience Development Fund and AGRI3 Fund are all examples of funds which use concessional finance and credit risk mitigation measures from public finance institutions to make the underlying set of projects investable. Government backed structures such as the Dutch government's Sustainable Foundation Repair Fund allow participating banks, like ING, to protect their collateral value while serving vulnerable populations.

- **Blended finance structures are most effective when designed in conjunction with the private investors they are intended to attract.** Different types of financial institutions require different forms of risk mitigation, project structures, and return profiles. Early alignment between public and private actors can better ensure that structures meet regulatory, credit, and duration requirements from the outset. The Insurance Development Forum spent two years designing the Infrastructure Resilience Development Fund structure — bringing together IFC and a group of six insurers — to ensure that it meets insurance company needs while providing finance for projects in a range of underserved EMDEs. MUFG, FinDev and the Green Climate Fund (GCF) engaged in active co-creation over two years to design the GAIA Fund and to ensure the fund's legal and regulatory treatment in Canada and Japan was understood before it was launched. However, unlike traditional private funds that grow significantly over successive closes or vintages, blended finance vehicles often reach their practical scale early in their lifecycle. Where they are structured to accommodate specific regulatory, governance, and risk-sharing requirements, this can mean limited flexibility to redesign them later. This highlights a key trade-off: structures tailored to anchor investors can accelerate initial deployment but may limit standardization and scalability over time.

- **Risk-sharing structures introduce complexity and procedural barriers that can impede scaling if not carefully managed.** While risk-sharing structures are vital for de-risking adaptation and resilience projects, they frequently introduce procedural complexity and governance burdens that can impede market growth. MDB and DFI participation often involves rigorous impact conditions, detailed reporting requirements, and bespoke governance arrangements. For many project developers and smaller financial institutions, these requirements can exceed operational capacity and delay deployment. In designing the GAIA Fund, MUFG and the public finance provided ensured that ambitious impact goals did not make the debt deals impossible to source or close. Rabobank and AGRI3 pre-agreed on uniform eligibility thresholds for the Renova Pasto program, allowing Rabobank to perform the initial screening within its standard workflow, which significantly reduced administrative friction and transaction costs. The effectiveness of blended finance therefore depends on both the availability of concessional capital and on simplifying and standardizing its use.

Financing mechanisms used for adaptation and resilience across the case studies

Physical risk analysis and advisory services:
Financial institutions provide physical risk assessments, climate analytics, and technical advisory services to help corporates identify adaptation opportunities and prioritize resilience investments. These diagnostic tools translate climate hazards into financial metrics that inform investment decisions and capital allocation. *(Zurich, Tokio Marine, PIMCO, Link-AXA, CIB)*

Direct lending:
Banks structure loans and credit facilities to finance adaptation projects, including long-term loans aligned with project lifecycles, blended finance credit lines, and targeted lending products for vulnerable segments. In some cases, these are delivered through government-backed or public-private schemes, where public frameworks help address affordability and risk constraints for households and SMEs. *(Rabobank, HSBC, ING, CIB, Standard Chartered, PIDG/NinetyOne)*

Bank guarantees and trade finance:
Guarantees and trade finance instruments (from governments, development finance institutions, or other sources) are used to reduce credit risk and attract private capital by absorbing early-stage losses or mitigating specific risks. These structures improve the risk-return profiles of adaptation projects, particularly in emerging markets. *(Standard Chartered)*

Blended finance debt funds:
Blended finance debt funds pool capital from public and private sources to finance portfolios of adaptation projects, achieving the scale and diversification required by institutional investors. These funds combine concessional capital (to absorb risk) with commercial debt, enabling investment in projects that would not be viable on a standalone basis. *(MUFG/GAIA Fund, PIDG/NinetyOne/Emerging Africa & Asia Infrastructure Fund, Insurance Development Forum/ Infrastructure Resilience Development Fund)*

Equity investment:
Equity investment provides long-term capital aligned with multi-year resilience improvements, supporting both operating companies and infrastructure assets. Equity ownership enables strategic engagement and long-term planning horizons necessary for complex resilience investments. *(Macquarie)*

Bond issuance:
Issuers raise capital through bond markets to finance adaptation-related investments. Bonds can be structured as use-of-proceeds instruments, where funds are directed toward specific adaptation themes with transparent reporting, or as outcome-linked structures, where investor returns are tied to verified environmental or resilience outcomes. *(First Abu Dhabi Bank, HSBC, First Rand)*

Bond holding and investment:
Institutional investors use their position as bondholders to engage with companies and infrastructure operators on resilience planning and adaptation investments. This engagement mechanism shapes capital allocation and encourages the implementation of multi-year adaptation and resilience plans. *(PIMCO)*

Insurance products:
Insurance products embed risk transfer and resilience incentives into financial structures either ex ante with reduced premium on the implementation of resilience measures or through time as the measures reduce losses and this is reflected in future premiums. *(Link REIT, Tokio Marine)*

Parametric insurance and catastrophe bonds:
Parametric insurance includes payouts based on predefined triggers rather than actual losses, providing certainty and speed. These instruments have been used at household and sovereign levels to provide rapid liquidity access following extreme events. Catastrophe bonds see the insurance coverage transferred to capital markets. *(AON, SEADRIF, Guardian Group)*

Multi-stakeholder platforms:
A new emerging model involves the use of multi-stakeholder coalitions to bring together public bodies, insurers, investors, and corporates to create investable opportunities for resilience interventions whose benefits are diffuse, geographically distributed, or realized primarily as avoided losses. Such platforms may combine blended public-private capital with outcome-linked payment structures that convert avoided losses or ecosystem-service benefits into contracted revenue, and organize origination to transform interventions that would otherwise be uninvestable into a commercial asset class. *(UBS/FloodAction Coalition)*

D CREATING CONDITIONS FOR SCALE: Enabling environment, collaboration, and capacity

Notwithstanding all the private-sector financing activity, scaling adaptation finance depends on enabling conditions that embed adaptation and resilience across the economy. The case studies point to three in particular: effective government planning and policy, collaboration across stakeholders, and technical capacity.

7. Using government policy to create a conducive environment for project development

Government planning and policy are key drivers of adaptation finance, creating demand, supporting risk allocation and the financial viability of investments. Across the case studies, governments play multiple roles as planners that generate project pipelines, as regulators that shape demand and revenue models, and as providers of data infrastructure that reduces market frictions.

- **Government planning is critical in generating a pipeline of adaptation projects.** Governments have a critical role in setting national goals, and developing strategies, priorities, policy, planning, and some projects. The case studies show that projects are more bankable when aligned with explicit national strategies. First Abu Dhabi Bank financed desalination and wastewater treatment projects aligned with national water strategies in Saudi Arabia and the UAE, while Tokio Marine has observed increased investment in port resilience following government guidance and fiscal incentives in Japan.

- **Regulatory frameworks can create demand and revenue certainty.** Clear regulatory signals — such as service-reliability requirements, valuation standards that incorporate climate risk, or requirements for physical risk assessment — can provide the certainty needed to justify long-term capital expenditure and help financial institutions better understand and manage their exposure. Predictable cost-recovery mechanisms were supportive of Macquarie's work with Elenia to harden their electricity grid. Government guidance, such as the Dutch Housing Valuation Guidelines, can reduce information asymmetry and incentivize household resilience investment, while Brazil's Forest Code incentivizes livestock producers to invest in productivity and land restoration rather than expanding through deforestation.

- **Consistent measurement methodologies and public-good data infrastructure can be critical enablers.** While individual institutions are increasingly combining hazard, exposure, and modeling data to assess physical risk, the ability to assess resilience across the economy as a whole remains limited by the absence of widely used metrics and the challenges of accessing physical hazard data for all sectors. The UK's FloodAction Coalition relies on publicly available flood modeling data to identify investable nature-based solutions at a catchment scale, while SEADRIF uses official government-reported impact data from the National Disaster Management Organization and the Government of Jamaica's catastrophe bond used the US Government's National Hurricane center data as the basis for triggers. Sustained government investment in data infrastructure of this kind reduces transaction costs, improves comparability across deals, and allows adaptation risks to be systematically incorporated into financial decision-making.

- **Independent verification and external benchmarks strengthen credibility and support broader market participation.** Across the case studies, financial institutions relied on industry standards and independent data to validate risk and define eligibility — from HSBC's anchoring of Thai Union's financing to the Global Sustainable Seafood Initiative, to FirstRand Bank's dependence on verified environmental outcomes, to insurers such as Zurich and Tokio Marine combining modeling with engineering expertise. Alignment with recognized reporting standards at fund level, as in MUFG's GAIA fund and the IDF-IRDF, further supports comparability and investor confidence.

8. Collaboration and capacity as enablers of adaptation finance

Adaptation finance often requires collaboration between governments, real economy corporates, and public and private finance, bringing together different responsibilities, expertise, and risk appetites to design solutions that individual entities would struggle to develop alone. Scaling also depends on building operational and technical capacity and developing standardized frameworks that enable transactions to move from bespoke pilots to programmatic, repeatable products.

- **Collaboration across actors helps identify and structure adaptation opportunities.** Individual financial institutions may struggle to generate adaptation opportunities on their own, but collaboration with corporates, public actors, and other financial institutions can help surface and develop them. Many financial institutions are working closely with their corporate clients to provide technical support to help them understand their exposures to physical risk and take action, such as Zurich, Tokio Marine, and PIMCO. Some are working with public financial institutions to design and market products which they are unable to originate and finance on their own, such as HSBC/ADB, World Bank/Aon, MUFG/FinDev Canada/GCF. Others are working collaboratively across the financial sector to bring together different expertise. For example, the Insurance Development Forum and FloodAction Coalition bring together institutions to design shared solutions that would be difficult to develop individually.

- **Adaptation responses can require action at a larger scale than the individual company.** While adaptation measures are often implemented at the project level, their effectiveness is frequently determined by system-wide factors, such as catchments, supply chains, or urban systems. FloodAction aligns multiple downstream beneficiaries to collectively fund upstream nature-based solutions that no single entity would finance independently. HSBC's financing of Thai Union demonstrates that resilience depends on strengthening entire supply chains, requiring collaborative improvements across fragmented smallholder producers. The Tokio Marine and Zurich/Maersk cases highlight that individual asset protection can be undermined by surrounding vulnerabilities, requiring coordinated area-wide interventions.

- **Standardization can support the transition from bespoke transactions to programmatic, repeatable products.** Standardized documentation, performance metrics, and reference frameworks can help reduce transaction costs and make adaptation opportunities visible. In some cases, reference taxonomies have supported origination and classification. On the banking side, Standard Chartered's Guide to Adaptation and Resilience Finance provides a recommended blueprint covering eligible use of proceeds, substantial contribution criteria, and maladaptation safeguards, alongside a classification system of over 100 financeable activities. On the investment side, Impax Asset Management has developed a Climate Opportunities Taxonomy that maps adaptation activities across seven domains and three lifecycle stages (Preparation, Response, and Recovery) applying quantitative revenue thresholds to define a measurable investable universe. Other regional and international taxonomies have similarly supported transactions by institutions such as First Abu Dhabi Bank, MUFG-GAIA Fund, and HSBC. Meanwhile, standardized performance-linked metrics, such as Aon's parametric "Cat-in-a-grid" triggers, make transactions easier to structure and more accessible to a wider range of investors.

- **Building operational and technical capacity across the system is as critical as capital in delivering adaptation outcomes.** Successful adaptation requires not only financing but the ability to implement and maintain complex interventions. Financial institutions are increasingly building up and providing this expertise: insurers such as Zurich and Tokio Marine are providing risk engineering and advisory services, using specialized teams to conduct asset-level vulnerability assessments and identify targeted resilience measures; Rabobank embeds agronomists to support clients in implementing resilience-enhancing practices; CIB provides technical advisory to help corporates build business cases for resilience measures; Standard Chartered ran an extensive internal training program to equip front-line bankers with the skills to identify and classify adaptation opportunities in routine client engagement; and SEADRIF and Aon bring structuring expertise to parametric insurance products, enabling physical risks to be transferred to global capital and reinsurance markets.

Adaptation Case Studies

Summary of Case Studies

Firm	Geography	Solution Type	Description
Aon	Jamaica	Catastrophe bond	Structured US$150 million catastrophe bond providing rapid sovereign liquidity following Hurricane Melissa
Commercial International Bank	Egypt	Framework and corporate lending	Developed Brain Trust, a structured framework for project generation and used it to originate and finance two resilience projects in the food and beverage sector
Daiichi Life Insurance	Japan	Sub-sovereign bond underwriting	Underwrote ¥5 billion bond for Aichi Prefecture to finance flood control and earthquake preparedness infrastructure.
First Abu Dhabi Bank	United Arab Emirates	Bond issuance	Issued US$70 million blue bond to finance desalination and wastewater treatment
FirstRand Bank	South Africa	Bond issuance	Issued R2.5 billion performance-based bond with investor returns linked to verified invasive species clearing
FloodAction Coalition	United Kingdom	Multi-stakeholder platform	Steering group member of FloodAction Coalition, creating £1+ billion investable market for natural flood management
Guardian Group	Jamaica	Parametric insurance	Distributed parametric microinsurance policies to vulnerable households via partnership with CCRIF
HSBC	Thailand	Blended finance / bond issuance	Provided B-loan in US$150 million syndicated facility with sustainability-linked pricing for aquaculture resilience
Insurance Development Forum	Global	Blended finance debt fund	Co-designed Infrastructure Resilience Development Fund to mobilize insurance and public capital for resilient infrastructure in EMDEs
Impax	Global	Taxonomy development; Public markets investing	Developed a proprietary taxonomy mapping adaptation activities across seven domains and three lifecycle stages (Preparation, Response, Recovery); approximately £5.8 billion of listed equities AUM meets a 20% adaptation revenue threshold.
ING	Netherlands	Blended finance debt fund	Participates in public-private risk-sharing arrangement aimed at financing foundation home repairs, acting as guarantor for mortgage clients
Link REIT	Hong Kong	Resilience-linked insurance pricing	Invested HK$8 million in flood and typhoon resilience measures; negotiated 11.7% premium reduction based on quantified risk reduction
Macquarie	Finland	Long-term equity investment	Multi-decade equity ownership in Elenia enabled €1.6 billion grid undergrounding investment, increasing buried lines from 41% to 66%
MUFG	Global	Blended finance debt fund	Co-founded GAIA Climate Loan Fund with US$340 million first close, using blended capital and MDB guarantees to finance adaptation projects
PIDG / NinetyOne	Rwanda	Direct lending	Provided 18-year loan for bulk water infrastructure aligned with 27-year concession period and resilience requirements
PIMCO	United States	Bond issuance and holding	Invested in utility's wildfire cost-recovery and sustainability bonds; used multi-year engagement to track resilience strategy and governance
Rabobank	Brazil	Direct lending	Provided 7–10 year loans with AGRI3 partial guarantees for pasture restoration and climate-resilient agriculture
Southeast Asia Disaster Risk Insurance Facility (SEADRIF)	ASEAN	Parametric insurance; catastrophe bond	Regional risk pool mobilized US$29.5 million in private reinsurance; delivered US$6.5 million in total payouts to Lao PDR government following climate shocks
Standard Bank	Namibia	Direct lending	Structured N$40 million integrated working capital and capex facility for climate-smart blueberry production, financing bundled resilience technologies on fully commercial terms with no concessional support.
Standard Chartered	Global	Bank guarantee	Provided bank guarantee enabling export of climate-resilient solar modules to emerging markets
Tokio Marine Group	Japan	Physical risk analytics/ advisory	Conducted pre-event risk assessment and flood modeling for manufacturing client
Zurich	Global	Physical risk analytics/advisory	Conducted on-site port assessments and catastrophe modeling for Maersk, informing €500+ million resilience investments across its network

Aon Securities

Sovereign resilience through catastrophe bonds

Jamaica, Caribbean

Aon Securities: A division of Aon plc, Aon Securities is a leading investment bank and broker-dealer specializing in insurance-linked securities (ILS). It provides capital-raising, strategic advisory, and structuring services for catastrophe bonds, helping clients transfer complex risks to capital markets. It has structured some of the industry's largest and most innovative insurance-linked securities offerings.

World Bank's International Bank for Reconstruction and Development (IBRD): Part of the World Bank Group, IBRD is the largest development bank in the world. It supports the World Bank Group's mission by providing loans, guarantees, risk management products, and advisory services to middle-income and creditworthy low-income countries, as well as by coordinating responses to regional and global challenges.

Physical risk data and risk modeling

Supporting the scaling of financing solutions

Nature of Risk Exposure

Jamaica is the world's third most-exposed country to natural disasters, located directly in the Atlantic Hurricane Belt. It faces increasing frequency and intensity of extreme weather events. Significant portions of the population (over 80%) live in low-lying coastal zones. Past events like Hurricane Dean in 2007 caused losses of US$329 million (roughly 3% of GDP at the time).

Jamaica's government has a large exposure to the costs of physical risk. Large-scale disasters can devastate its budget, forcing a choice between debt default and diverting funds from public services.

Solution Overview

Geography	Jamaica
Year	2024-2025
Solution Type	Catastrophe bond; Parametric insurance; EMDE financing
Applicable Sector(s)	Reinsurance; Public finance; Multilateral Development Banks

Description

In 2024, the Government of Jamaica decided to renew a World Bank catastrophe bond which expired in 2023 with a new issuance. By extending the coverage for another four hurricane seasons, they sought to maintain the resilience of Jamaica's public finances in the event of extreme hurricane events.

The World Bank issued a US$150 million catastrophe bond and simultaneously entered into a risk transfer agreement with the Government of Jamaica. Jamaica pays a premium for the coverage reflecting the terms the World Bank achieved on the bond.

Aon Securities acted as the joint lead manager of the bond issuance, helping to design the instrument and then place it with the capital markets.

Unlike traditional insurance, the bond uses a parametric "Cat-in-a-grid" trigger. Payouts are determined by storm characteristics, specifically central pressure and path, as they cross defined geographical boxes across and around the island. As such, the payout is not related to the actual losses that the country experiences and so can be independently

verified and completed quickly providing the government with an injection of funds at the time where recovery and reconstruction costs spike.

On October 28, 2025, the Category 5 Hurricane Melissa hit Jamaica, meeting the parametric conditions and triggering a full US$150 million payout. Jamaica received these funds on December 1, 2025, allowing for rapid post-disaster recovery.

Approach

The Government of Jamaica has been a leader in the use of catastrophe bonds to provide it with insurance in the event of natural disasters. Catastrophe bonds transfer financial risks from natural disasters to global capital markets and are one of many financial instruments available to support countries in the aftermath of natural disasters such as hurricanes and earthquakes. They are recognized by credit rating agencies as beneficial to countries and their debt sustainability and form part of disaster risk management toolkits.

Jamaica issued its first catastrophe bond in 2021, which was designed to provide coverage for three hurricane seasons. That bond didn't trigger and expired at the end of 2023. In 2024, it decided to extend the catastrophe bond coverage for four hurricane seasons to maintain the resilience of Jamaica's public finances. This instrument is part of a layered risk strategy and is intended as a backstop for only the most extreme, low-probability events. Elsewhere in the risk layering is Jamaica's own reserves, access to an IDB Contingent Loan; mutual insurance through the Caribbean Catastrophe Risk Insurance Facility (CCRIF), and an IMF Precautionary and Liquidity Line.

AON worked with Jamaica and the World Bank to structure a US$150 million catastrophe bond for sale into capital markets. Simultaneously the World Bank entered into a risk transfer agreement with the Government of Jamaica, whereby they pay a premium for the coverage reflecting the terms the World Bank achieved on the bond. The instrument's key features were:

1 Parametric design	Aon collaborated with Jamaica and the World Bank to optimize the trigger structure and ensure rapid liquidity. Because the payout is based on data (storm pressure) rather than physical loss adjustment, funds are delivered in weeks rather than the months or years that it would take to assess and calculate the payout of a conventional insurance product.
2 Trigger and payout structure	The payout to Jamaica depended on the path and intensity of named storms that cross the boxes covering the island ("Cat-in-a-grid"). Each box is associated with a threshold for the central pressure of named storms intersecting the box. The size of a payout increases in a stepwise scale with payout rates of 30%, 70%, 100% of principal. The trigger conditions are evaluated for each box, and payouts accumulate across the boxes. An independent agent, AIR Worldwide Corporation, provided the assessment of whether a storm met the conditions of the trigger.

Results: Aon used a targeted marketing strategy to place the bond with 15 global investors, including Insurance Linked Security (ILS) funds (66%) and asset managers (33%). By bringing the bond to international investors they were able to achieve financing costs in line with market pricing and secured coverage for four hurricane seasons. Jamaica paid a 7% interest rate over the Compound SOFR benchmark, paid monthly. This was an increase on their previous catastrophe bond, reflecting increases in insurance costs across the market and the Government's desire to ensure the triggers were set at a level which would have paid out in previous hurricanes. The Hong Kong Insurance Authority (HKIA) provided a grant for the benefit of the Government of Jamaica to cover transaction costs, and the bond was listed on the Hong Kong Stock Exchange.

Following Hurricane Melissa in October 2025, the trigger conditions for the bond were met, and within six weeks the Government of Jamaica received a full payout of US$150 million. These funds supported post-disaster recovery and infrastructure stabilisation, and underscored the effectiveness of parametric triggers for quick financial relief and the benefit of catastrophe bonds as part of sovereign risk management. The bond was extinguished at the point of payout.

Scaling Potential

Huge pool of potential investors. The catastrophe bond market has been growing strongly but remains a relatively small part of the overall insurance market. As an insurance-linked security, the product can appeal to a wider set of investors than traditional reinsurance coverage. The participation of asset managers, pension funds and insurers in this transaction show the breadth of potential investors.

Pricing linked to market rates. By pricing catastrophe bonds as a spread over the Compound SOFR benchmark — the widely used market rate — the product is designed for investors to easily hedge interest rate if they want to.

Proven part of a sovereign's disaster risk management framework. For sovereigns, the proven nature of parametric insurance structured, combined with the quick payout which doesn't rely on complex loss calculations, makes a catastrophe bond an attractive instrument to complement other forms of protection in a country's risk insurance portfolio.

Triggers are designed for the specific risks facing a given country. Catastrophe bonds can be designed for a wide range of specific risks, and are particularly suitable where there is a measurable trigger than can be independently verified. The precise nature of the trigger can be calibrated to the risk tolerance of the country buying the protection, and the appetite of investors for taking on tail risk.

Availability of model providers and verification agents is a challenge. Scaling to other regions and for other perils requires reliable and tested models, which investors are prepared to rely on for pricing. This history of hurricanes in the Caribbean means that region is well covered, but other parts of the world would need to develop this infrastructure.

Need for donor funding to make viable. Making products affordable for low and middle income countries often requires donor funding to complement private sector risk finance.

From Barriers to Solutions

Barriers

Cost of risk insurance: Sovereign governments may be deterred from using catastrophe bonds due to a perception of the significant costs and difficulties of doing so.

Concerns about speed of payout: The sovereign issuer may worry about their ability to get access to funds in a timely manner.

Solutions

Reduce credit risk and generate market demand: The issuance cost incudes the risk margin, counterparty credit risk,transaction costs and is influenced by market demand. The transaction was structured so that the World Bank sat between the Government of Jamaica and the bond investors, reducing the credit risk associated with Jamaica's ability to pay the coupon. As a lead manager, Aon design a targeted marketing campaign that reached beyond traditional reinsurance hubs and was able to get interest from a wide range of global investors. By generating demand from 15 investors they were able to ensure that the bond was competitively priced. To minimise the transaction costs, the World Bank and Aon secured a transaction cost grant from the Hong Kong Insurance Authority (HKIA). World Bank involvement also reduced costly frictions related to the tax status of catastrophe bonds.

Parametric structuring and liquid assets: Catastrophe bonds are designed so that the principal are fully paid up on issuance. This US$150 million is held on the IBRD balance sheet. As a AAA-rated MDB with a US$400 billion balance sheet and around US$ 100 billion in liquid assets it is well placed to pay out on demand. When the parametric trigger was hit, the World Bank was able to pay the Government of Jamaica, with full payout being made just 34 days after the hurricane hit. The use of an independent third-party agent to assess whether the trigger conditions were met reduced the risk of a protracted negotiation.

Risk of not being paid: There is a risk that trigger conditions are not met, leaving sovereigns without any coverage despite widespread destruction from a natural disaster.

Clear trigger conditions: The nature of parametric insurance means that trigger conditions need to be met for a payout. To reduce the risk that there was significant damage with no payout, the bond had two features. First, the payout was not design as being all or nothing, but rather stepped up depending on the severity of the hurricane. And second, the trigger allowed for cumulative triggering if conditions were breached in multiple grid cells. As a previous bond narrowly missed the trigger conditions this one was redesigned to ensure that it would have paid out if an identical storm hit Jamaica again.

Investors need independent and verifiable data: Ensuring the objectiveness of the instrument is important to assure investors.

Use of public data: The bond was designed so that the independent calculation agent, AIR Worldwide Corporation, uses data from the US Government's National Hurricane Center to verify the triggering event. The use of publicly available and reliable data gives confidence to investors in the reliability of the instrument.

Lessons Learned

Importance of communicating the nature of parametric insurance. In 2024, Hurricane Beryl narrowly missed the trigger pressure, resulting in no payout despite a disaster declaration, and widespread misunderstanding about the product. This highlights the need to manage expectations around near misses and have extensive communications to ensure an understanding across governments of the product design.

Positive rating signals. Fitch Ratings noted that the catastrophe bond provides a fiscal cushion that can positively influence sovereign credit ratings even before an event occurs. Moody's also referenced disaster risk management in its upgrade of Jamaica in December 2025. The fact that Jamaica was funding its own premium costs also illustrated that it was taking seriously the need to manage the fiscal pressures which arise from natural disasters.

Design for a global investor base. Private financial institutions can play a role in structuring and marketing a transaction to maximise the interest to global capital markets. Doing so can keep pricing tight, reducing costs to the sovereign.

Catastrophe bonds are part of a set of risk management tools. A catastrophe bond is not a standalone solution and are designed to be triggered in the most extreme and unlikely events. They should be seen as part of a broader strategy including budgetary reserves, traditional insurance, and access to multilateral support facilities.

Some self insurance improves conversations with donors after an event. Many low and middle income sovereigns rely on support from donors if they are hit by natural disasters. By having proactively taken steps to enhance their financial resilience through instruments like catastrophe bonds, a sovereign can show to potential donors a record of taking risk seriously and preparing.

Commercial International Bank

Scaling lending for resilience-enhancing measures in the food sector

Egypt, Africa

Commercial International Bank (CIB) is the largest private-sector bank in Egypt, with deep sector expertise and established client relationships across different sectors including agriculture, food and beverage, and water-intensive industries. CIB's approach to sustainable finance seeks to integrate sustainability across its policies, strategic initiatives, financed transactions, and operational practices.

Proparco, the private sector financing arm of the Agence Française de Développement (AFD) Group, supports sustainable economic growth and the reduction of inequalities by financing and supporting companies and financial institutions in emerging and developing countries, with a particular focus on climate, inclusion and development impact.

- Physical risk data and risk modeling
- Knowledge building and Internal systems
- Supporting the scaling of financing solutions

Nature of Risk Exposure

Egypt faces acute exposure to physical climate risks, particularly rising temperatures, intensifying heat waves, and severe water scarcity. These risks are expected to worsen and directly affect key sectors such as agriculture, food systems, and manufacturing. These exposures translate into operational disruptions, supply chain losses, and revenue volatility for businesses.

Solution Overview

Geography	Egypt
Year	2022 (concept, COP27), 2024–2025 (financed projects), ongoing (Brain Trust model)
Solution Type	Corporate lending; Framework development
Applicable Sector(s)	Food & Beverage; Agriculture; Water-Intensive Sectors

Description

CIB has developed a bank-wide Sustainable Finance Strategy and embedded it across governance, policies, systems, and core business processes. This includes an integrated Environmental & Social Risk Management (ESRM) system embedded into credit, due diligence, and portfolio monitoring processes. Central to this approach is a climate risk assessment capability that enables the bank to identify sector-specific transition and physical risks and assess implications and opportunities for clients.

CIB applied this framework when working with two corporate clients in the food industry who were exposed to physical risks, particularly heat stress and temperature-driven cold chain failures. CIB identified these vulnerabilities through materiality analysis and heatmap-based risk assessment, and worked closely with both clients to identify and finance targeted resilience-enhancing investments in storage, processing, and temperature control infrastructure.

Both projects were financed under CIB's Climate Finance Program, developed with PROPARCO and supported by blended finance from the Green Climate Fund (GCF). Beyond financing, the program provided technical assistance to help clients identify climate-related opportunities and prepare technical assessments aligned with DFI requirements.

To systematize and scale this approach, CIB launched the Brain Trust initiative at COP27. The Brain Trust is designed to support clients in investing in adaptation projects, helping them identify physical risks and sector-specific opportunities, demonstrating the commercial viability of adaptation investments, and strengthening resilience strategies through direct engagement. It operates through two complementary components:

- **A governance mechanism,** through which CIB convene clients and external stakeholders, including DFIs, technical experts, and technology providers to align incentives, integrate de-risking mechanisms, and enhance project bankability; and
- **An operational framework,** which sets out a structured process across the project lifecycle, from risk identification and project design, through financial structuring and instrument selection, to impact measurement, disclosure, and reporting.

This integrated approach enables CIB to design bankable adaptation projects that adhere to DFI common principles for adaptation finance and meet both commercial viability and technical eligibility criteria.

Approach

CIB has developed a bank-wide Sustainable Finance Strategy and embedded it across governance, policies, systems, and core business processes. This includes an ESRM system and climate risk management guide to transition and physical risk management, which enables the bank to identify sector-level climate vulnerabilities, map physical risks to its lending portfolio, translate these into financial implications.

In practice, physical risks are assessed through materiality analysis and heatmap-based methodologies, capturing both sectoral vulnerabilities and geographic exposure. These assessments feed into CIB's ESG risk scoring framework, which is being rolled out to systematically reflect climate risk within credit evaluation and portfolio oversight.

CIB applied this approach when working with two corporate clients in the food industry, who were vulnerable to heatwaves, water stress, and temperature-driven supply chain disruptions, including cold chain failures. Elevated risk scores highlighted the need for targeted resilience-enhancing measures and enhanced client engagement. CIB worked closely with both clients to identify and finance targeted resilience investments. Both projects were financed under CIB's Climate Finance Program, developed with PROPARCO and supported by blended finance from the GCF. Beyond financing, the program provided technical assistance to help clients identify opportunities and prepare DFI-aligned technical assessments.

Project 1: Freeze-Drying Facility	CIB provided a medium-term loan of €3.5 million to a corporate food industry client to finance a freeze-drying facility (steam boiler, freeze-drying system, and sorter) with processing capacity of 1,754 tons per year. Freeze-drying removes moisture from products, enabling shelf stability and reducing dependence on temperature-controlled logistics, directly addressing heat-driven supply chain vulnerabilities. The project is expected to reduce food loss by at least 526 tons annually and save 175,643 m^3 of water per year. Technical assistance included a resource efficiency assessment focused on optimizing energy use, reducing waste, and valorizing second-grade produce.
Project 2: Climate-Resilient Refrigeration	CIB provided a medium-term loan of US$3 million to a corporate food industry client to finance a high-efficiency refrigeration system designed to mitigate the impacts of rising temperatures and extreme heat on cold chain infrastructure. The system integrates variable speed drives and high-efficiency motors, reducing electricity consumption by ~25% compared to conventional systems while improving reliability under climate stress. The project is expected to reduce food loss by at least 496 tons annually, save 164,028 m^3 of water per year, and cut GHG emissions by 151 tCO_2 per year. Technical assistance included an energy audit of the cold storage facility, focusing on chiller system optimization, variable speed drive investments, and automation measures.

These transactions illustrate how CIB's approach enables the systematic identification, structuring, and financing of adaptation opportunities. The bank proactively identifies climate risks and co-develops investable resilience solutions with clients.

To scale this model, CIB launched the Brain Trust initiative, which operates through: (i) a governance mechanism bringing together CIB, clients, DFIs, and external technical partners to prove the business case, validate project design, and incorporate Sustainable Finance mechanisms; and (ii) an operational framework that defines a structured process across the project lifecycle, from risk identification and project design to financial structuring, instrument selection, and impact measurement, disclosure, and reporting.

Scaling Potential

CIB's experience assessing physical risk, financing resilience-enhancing projects, and launching the Brain Trust has surfaced a series of scaling enablers, including:

Robust internal systems. The approach of undertaking sector-level physical risk assessment, identifying material climate hazards and using these as lending triggers can be transferred to additional sectors and geographies.

MDB/DFI and commercial bank partnerships. Financial institutions can develop partnerships with MDB/DFIs that support them in identifying adaptation projects, pre-screening transactions against climate adaptation standards and DFI common principles, and engaging at the project formulation stage. In CIB's case, the Climate Finance Program with PROPARCO, supported by blended finance from the GCF, provided both concessional financing and technical assistance that strengthened project design and bankability.

Cross-departmental governance. Climate risk integration should extend beyond sustainability to credit, risk, and business teams, in order for strategic commitment to translate to frontline capability.

Granular physical risk data infrastructure. Scaling requires data on the geographic location of client assets and operations, rather than relying on headquarter or branch addresses. This level of granularity is essential for accurate physical risk mapping at the portfolio level.

From Barriers to Solutions

Barriers

Underpricing externalities: Environmental and social value creation in not fully reflected in financial decision-making.

Limited client awareness: Many clients underestimate exposure to climate risks.

Perception challenge: Investment in adaptation and resilience is often seen primarily as a cost rather than a value driver.

Solutions

Integration into internal systems. Embedding ESRM and climate risk assessment into core banking systems helps ensure that environmental and social risks are translated into financial implications. CIB ensured that staff had the technical expertise necessary. The ESRM model was built with the foundational capability to internalize externalities, demonstrating to clients and credit teams that resource efficiency, environmental performance, and social risk have material financial consequences.

Client engagement and advisory: CIB integrates non-financial client advisory services into its overall banking offering to enable it to work with clients on identifying vulnerabilities. CIB works with and leverages DFI technical assistance during early-stage project structuring. CIB provides external experts to review facility designs against heat wave scenarios, recommend necessary modifications, and document underlying design assumptions. This approach highlights specific areas where clients can invest to enhance the resilience of their operations.

Linking risk to financial feasibility outcomes: Through technical assessments and walkthrough audits, CIB demonstrates how resilience investments protect cash flows, reduce operational risk, and improve long-term profitability. By linking the resilience to financing outcomes, they support making the business case tangible and compelling prior to the lending and investment decisions.

Institutional fragmentation: Climate risk assessment and credit decision-making are not fully integrated in most financial institutions.

Aligning climate risk assessment and credit decisions: CIB used climate risk assessments alongside credit evaluation to show how adaptation investments can strengthen borrower resilience and reduce credit risk. The assessment highlighted the borrowers' climate-related risks which could affect their business. It also demonstrated that the proposed investments would improve the resilience of their business models.

Limited internal capacity and fragmented external system: There is limited expertise related to adaptation and resilience within financial institutions.

Internal and external network building: Internally, CIB built a Sustainability Strategic Network (SSN) of sustainability champions who are embedded across credit, risk, IT, and business teams and who can bridge climate knowledge and banking operations. Externally, CIB's Sustaining Sector Programme serves as an informational platform which increases industry wide knowledge and expertise and supports market development.

Lessons Learned

Strong internal systems are foundational. Robust sustainability and climate risk frameworks, systematically embedded across governance, systems, and core processes, are key to demonstrating the business case for adaptation finance. Without this, adaptation finance remains ad hoc rather than scalable.

Adaptation projects are often already financeable when climate risk is properly assessed. When banks and clients apply a business case logic that accounts for the impact of rising physical risks, and have the systems and models to conduct that analysis, it becomes clear that many adaptation projects are already viable and financeable. The gap is often not in project economics, but in the analytical capability to demonstrate them.

Multi-stakeholder governance and collaboration enhance project design and credibility. Banks and clients rarely have all the expertise they need in-house. Collaborating with external partners, including MDBs, DFIs, and technical experts, adds climate expertise, validates physical risk assessments, and strengthens valuation logic. This model is a core component of the Brain Trust, designed to ensure that project design benefits from diverse, complementary capabilities.

Customization is essential to validating risk-return profiles. Each adaptation project requires assessment of its specific operational context. From project design to selecting the appropriate sustainable finance instrument, clear risk identification, quantified impacts, and measurable outcomes are essential to demonstrating commercial viability and attracting financing.

Interdisciplinary expertise is critical. The presence of environmental expertise alongside financiers is important to properly assess risks, the benefits of enhance resilience and produce robust financial impact analysis.

Evolving enterprise risk frameworks are key to scaling. Translating climate risk into credit-relevant financial metrics required CIB to make dedicated investments in data, methodology, and staff capability. For adaptation finance to move beyond individual transactions to portfolio-scale impact, banks must evolve their enterprise risk frameworks to systematically capture, price, and integrate these non-traditional risks into core credit processes.

Daiichi Life Insurance

Active client engagement & stewardship

Supporting the scaling of financing solutions

Financing flood control and earthquake preparedness through dedicated bonds

Japan, Asia

Daiichi Life Insurance is one of Japan's largest life insurance companies, providing insurance, savings, and asset management services to customers globally. As a long-term institutional investor with significant fixed income holdings, Daiichi has increasingly integrated sustainability and climate considerations into its investment strategy, including investments that support climate resilience and disaster preparedness.

Nature of Risk Exposure

Aichi Prefecture is a local government in Japan, which faces growing exposure to both climate-related and geophysical hazards. As the annual frequency of heavy rainfall events increases across Japan, the prefecture manages 59 river systems, 284 rivers, and a total river length of 1,824 kilometers, with projected flood inundation areas covering approximately 20% of its land area, putting more than 2.2 million residents and ¥48 trillion in assets at risk.

The prefecture is also highly exposed to seismic risk: in January 2025, the probability of a Nankai Trough earthquake occurring within the next 30 years was revised upward to approximately 80%, with Aichi expected to experience seismic intensity of lower 6 or higher across a wide area. Aichi Prefecture is advancing resilience initiatives under its Fifth Environmental Basic Plan and disaster-prevention measures under its Third Aichi Earthquake Countermeasures Action Plan.

Solution Overview

Geography	Japan
Year	2025
Solution Type	Dedicated use-of-proceeds bonds
Applicable Sector(s)	Water infrastructure; Agriculture; Disaster risk management

Description

In 2025, Daiichi invested ¥5 billion in a dedicated disaster-prevention bond issuance by Aichi Prefecture, a sub-sovereign government in central Japan and one of Japan's largest local-government bond issuers, issuing over ¥300 billion in bonds annually. Aichi is one of Japan's leading industrial regions, but faces growing exposure to both climate-related flood risks and geophysical hazards, including increasingly severe typhoons and torrential rainfall, and the risk of a major Nankai Trough earthquake.

The transaction took the form of a privately placed "spot bond." a negotiated instrument that allowed Aichi Prefecture and Daiichi to customize both the maturity and use of proceeds of the bond, rather than relying on a standard public syndicated offering. For Aichi Prefecture, this structure offered a way to address changing market conditions, including a narrowing investor base, rising interest rates, and an increased reliance on shorter-dated issuance, all of which had increased its refinancing risk. For Daiichi, the negotiated 11-year tenor was specifically suited to its asset-liability management needs as a long-term life insurer, and the dedicated use of proceeds provided a clearly defined resilience investment alongside a standard commercial return. Aichi Prefecture was rated A+ by S&P at the time of issuance.

The ¥5 billion issuance was structured around two dedicated components:

> A ¥2.5 billion green bond with proceeds earmarked for flood countermeasures, financing river improvement and flood-control projects, including channel excavation, embankment reinforcement, and restoring flow capacity, as well as adaptation-related disaster prevention for farmland and agricultural facilities.

> A ¥2.5 billion bond with proceeds earmarked for earthquake countermeasures, financing Aichi Prefecture's disaster prevention base, including base camp sites for emergency rescue teams, a logistics terminal, and disaster prevention activity bases in zero-meter elevation zones to support rescue and evacuation by boat or helicopter in the event of tsunami, storm surge, or flooding.

The full issuance was underwritten by Daiichi at market rate, making this a fully commercial transaction with dedicated adaptation use of proceeds. It marked Japan's first bond issuance with proceeds dedicated exclusively to flood and earthquake disaster-prevention measures, and attracted significant interest from other local governments and investors across Japan.

Approach

In 2025, Daiichi underwrote ¥5 billion in bonds issued by Aichi Prefecture — a local government in Japan — which were specifically designed to finance flood defenses, river improvements, emergency logistics infrastructure, and disaster-response bases. The transaction was the product of close collaboration between the two parties, which worked together to design an instrument that would meet their respective needs, providing Aichi Prefecture with long-term, stable funding for disaster-prevention priorities, and giving Daiichi a long-duration, investment-grade fixed income asset aligned with its sustainability objectives. Daiichi then fully subscribed the entire ¥5 billion issuance at market rate. The transaction was structured around three key components:

1

A customized "spot bond" to align public financing needs with investor demand

Unlike Aichi Prefecture's standard syndicated bond offerings, which follow fixed maturities of 5, 10, 20, or 30 years and are sold to a broad consortium of financial institutions, the ¥5 billion issuance was privately negotiated and fully underwritten by Daiichi. This bilateral structure, known in Japan as a "spot bond," allowed both parties to customize maturity, size, and use of proceeds in ways a public syndicated offering cannot accommodate. For Aichi Prefecture, this addressed a shifting market environment, including a more concentrated investor base, rising interest rates, and increased reliance on shorter-dated issuance — all of which had raised refinancing risk and reduced funding stability. The spot bond format offered a route to longer-duration, stable funding outside the constraints of the standard public market. For Daiichi, the structure allowed them to negotiate an 11-year tenor suited to its asset-liability management needs as a long-term life insurer. Aichi Prefecture's credit profile (rated A+ by S&P) ensured the transaction met Daiichi's investment-grade requirements on fully commercial terms.

2

A dedicated resilience-focused use-of-proceeds structure

The ¥5 billion issuance was divided equally into two ¥2.5 billion tranches, each ring-fenced for a distinct disaster-prevention priority:

- The flood-focused tranche financed river improvement projects, including channel excavation, embankment reinforcement, and restoring flow capacity, across a river network whose inundation zones cover 20% of Aichi's land area, putting over 2.2 million residents and ¥48 trillion in assets at risk. Proceeds also covered disaster prevention for farmland and agricultural facilities, extending the financing beyond urban flood infrastructure to a broader range of productive assets.
- The earthquake-focused tranche financed Aichi's disaster prevention base, including base camp sites, command and operations facilities, and a logistics terminal for receiving and distributing relief supplies by air. Proceeds also supported disaster prevention bases in zero-meter elevation zones, enabling rescue and evacuation by boat or helicopter in the event of tsunami, storm surge, or flooding.

3

A combination of labelled and non-labelled resilience financing

The two tranches used different financing frameworks, reflecting the different nature of the underlying investments. The ¥2.5 billion flood tranche was structured as a certified green bond, with a third-party opinion from Rating and Investment Information (R&I) confirming alignment with the ICMA Green Bond Principles 2021 and Japan's Ministry of the Environment Green Bond Guidelines 2022. The ¥2.5 billion earthquake tranche used a dedicated use-of-proceeds structure without a formal ESG label, relying on transparent contractual proceeds restrictions alone to provide investor confidence.

Scaling Potential

CIB's experience assessing physical risk, financing resilience-enhancing projects, and launching the Brain Trust has surfaced a series of scaling enablers, including:

Public sector issuers as a scalable channel for adaptation finance. One of the central barriers to adaptation finance is that some investments — such as flood defenses and emergency infrastructure — may generate public benefits but not project-level revenues. Highly rated sub-sovereign issuers can help overcome this by embedding adaptation within conventional public borrowing programs, converting adaptation infrastructure with primarily public benefits into investment-grade fixed income. This approach is inherently scalable across jurisdictions with similar risk profiles, particularly where local governments face increasing exposure to climate and disaster risks but have established access to debt markets.

Investor-aligned bond design can unlock long-term institutional capital. Designing bonds around investor requirements (including duration, credit quality, and clear use-of-proceeds) allows adaptation investments to fit within existing portfolio mandates, rather than requiring investors to adopt new frameworks. This is particularly relevant for insurers and pension funds, whose long-dated liabilities create natural demand for assets with similar tenors, suggesting a structural alignment between resilience investment needs and institutional capital.

Flexible use-of-proceeds frameworks can expand the investable universe. The use of both labelled and non-labelled tranches illustrates that adaptation finance can extend beyond the boundaries of established green taxonomies, which do not always capture the full spectrum of resilience investments. By relying on clearly defined and transparent use-of-proceeds frameworks, issuers can channel capital to a broader set of disaster-prevention and resilience activities — such as earthquake preparedness — which may fall outside conventional classifications.

Policy frameworks as enablers of standardization and scale. The presence of national guidelines (such as Japan's Ministry of the Environment Green Bond Guideline) and international standards (such as the ICMA Green Bond Principles) can support scaling by providing clarity on eligible activities, verification processes, and disclosure expectations. Such frameworks reduce ambiguity for issuers and investors, lower transaction costs, and create a more predictable environment for market development.

From Barriers to Solutions

Barriers

Institutional investors may struggle to identify adaptation investments compatible with their mandates. Institutional investors operate within defined mandates and specific requirements around credit quality, duration, liquidity, and asset classification, particularly long-term investors managing liability-driven portfolios. Adaptation projects are often perceived as difficult to classify within conventional portfolios.

Solutions

Bond structure tailored to investor requirements. By negotiating directly with Daiichi, Aichi Prefecture was able to design a bond around the investor's specific needs: an 11-year tenor suited to long-dated insurance liabilities, a size and format compatible with fixed income mandates, and a credit profile (A+ from S&P) that met investment-grade thresholds. Standard public syndicated offerings cannot accommodate this level of customization.

Adaptation investments often lack direct revenue streams. Flood protection, river improvements, agricultural resilience measures, and disaster preparedness infrastructure may all generate substantial social and economic benefits but limited project-level cash flow. , making them difficult to finance through conventional capital market structures.

Sub-sovereign issuers increasingly face structural funding pressures, including rising interest rates, shorter issuance maturities, and concentrated investor bases, all of which raise refinancing risk and limit the ability to raise long-term capital for multi-year infrastructure programs.

Use-of-proceeds bonds require investors to trust that capital will be deployed as specified. Without independent verification and clearly defined eligibility criteria, there is a risk of ambiguity or misallocation that can undermine investor confidence, particularly in a nascent asset class with limited precedent.

Public-sector issuance structure. By financing resilience investments through Aichi Prefecture's public-sector borrowing capacity, the transaction enabled disaster-prevention priorities to be funded without relying on standalone project revenues, converting public-benefit resilience infrastructure into investable, investment-grade sovereign-backed fixed income without requiring standalone revenue streams.

Spot bond format as a funding strategy tool. The bilateral spot bond structure gave Aichi Prefecture access to long-duration funding outside the constraints of its standard public market offerings, helping to diversify its investor base and reduce refinancing risk — demonstrating that adaptation finance structures can simultaneously address issuers' mainstream funding challenges rather than adding complexity to them.

Independent verification and national policy alignment. The flood tranche obtained a third-party opinion from R&I confirming alignment with both the ICMA Green Bond Principles 2021 and Japan's Ministry of the Environment Green Bond Guidelines 2022 — the former providing international credibility and the latter providing domestic clarity on eligible categories and verification standards. For both tranches, use-of-proceeds were contractually defined and linked to specific disaster-prevention projects, giving investors verifiable assurance that capital would be deployed as intended.

Lessons Learned

Adaptation finance can be mobilized through conventional public debt markets. This case demonstrates that adaptation and resilience investments do not necessarily require highly novel financial structures. Strong public-sector issuers can mobilize institutional capital for resilience projects using well-understood bond structures when proceeds are clearly defined and aligned with investor requirements. In particular, municipal and sub-sovereign issuers can use dedicated use-of-proceeds bonds to finance public resilience infrastructure at scale.

Close investor-issuer collaboration is key to designing investable adaptation bonds. This transaction did not emerge from a standard bond issuance process; it was co-designed by Daiichi and Aichi through active dialogue. This allowed the two parties to align on structure, tenor, use of proceeds, and labelling in ways that met both parties' needs. Such early and sustained engagement between issuers and investors is key for developing instruments that are both impact-oriented and commercially viable.

Long-term investors may be naturally suited to resilience financing. Insurers and pension funds managing long-dated liabilities have a structural need for long-duration, investment-grade assets, and resilience bonds issued by creditworthy public-sector entities can meet that need. This case illustrates how institutional investors can support climate adaptation and disaster preparedness through their investment portfolios, not only through underwriting or risk transfer, and how that alignment of financial and impact objectives can make fully commercial adaptation transactions possible.

Resilience financing may require flexibility beyond traditional taxonomies. Not all resilience investments fit neatly within existing sustainable finance labels. The inclusion of a non-labelled earthquake countermeasure bond alongside a green-labelled flood countermeasure bond illustrates the value of flexible financing structures capable of supporting broader resilience objectives, particularly for disaster-prevention investments that strengthen resilience but may not qualify as conventional green projects.

First Abu Dhabi Bank

Financing water infrastructure with labeled blue bond issuance

United Arab Emirates and the Kingdom of Saudi Arabia, Middle East

First Abu Dhabi Bank (FAB) is the largest bank in the UAE, with a global network spanning five continents and a presence in over 20 markets. The Bank facilitates cross-border liquidity, trade, and investment flows, offering a comprehensive range of financial products and services both domestically and internationally.

FAB is committed to leading sustainable finance in the region and supporting the UAE's Net Zero 2050 Strategy. FAB was the first bank in the MENA region to commit to achieving net zero emissions by 2050. Between 2022 and 2025, FAB provided AED381 billion in sustainable and transition financing, achieving 76% of its 2030 target of AED500 billion (US$136 billion). The Bank's ESG strategy emphasises climate risk assessment and the advancement of adaptation financing.

Supporting the scaling of financing solutions

Nature of Risk Exposure

Water scarcity: The Middle East faces significant physical risks due to increasing drought conditions and the depletion of freshwater resources, making traditional water supplies highly vulnerable.

Infrastructure reliability: Conventional desalination process is energy-intensive and exposed to fuel supply disruptions; the transition to renewable-powered facilities enhances long-term operational resilience.

Regional economic impact: Water insecurity presents a systemic risk to agriculture and industrial growth across the Gulf Cooperation Council (GCC) countries.

Solution Overview

Geography	United Arab Emirates and Kingdom of Saudi Arabia
Year	2025
Solution Type	Labeled bond; Government policy and regulation
Applicable Sector(s)	Banking; Water infrastructure

Description

First Abu Dhabi Bank (FAB), has developed an ESG strategy focused on supporting the global transition to a low carbon and nature positive economy. This includes enabling a responsible transition for communities and embedding best-in-class governance practices. The Bank also prioritises resilience to climate related financial risks, including those arising from the physical impacts of climate change.

In August and October 2025, FAB issued two labelled blue bonds — use-of-proceeds instruments designed to finance ocean or water related projects, valued at US$50 million and US$20 million respectively. These were sold as a private placement to few investors, including an anchor investor who sought to comply with the EU's Sustainable Finance Disclosure Regulation and define themselves as an Article 9, or "dark green" investor and who wanted to invest into climate adaptation and water resilience related activities.

The bond proceeds were allocated to two significant projects in the United Arab Emirates and the Kingdom of Saudi Arabia:

> Wastewater treatment facilities with a combined capacity of 430,000 cubic meters per day, enabling large scale water recycling for irrigation across Abu Dhabi and Al Ain. This is equivalent to 172 Olympic swimming pools of water each day.

> A newly funded desalination facility producing 37 million liters per day, powered by an off-grid solar photovoltaic energy system with battery storage.

These investments in adaptation (water security) and mitigation (renewable energy for desalination) were made possible through the issuance of the private blue bond labelled instrument — the first of its kind for a Financial Institute (FI) in the GCC.

All projects underwent rigorous ESG risk assessments and are subject to ongoing monitoring to ensure positive climate outcomes and prevent maladaptation. Regular reporting allows the investor to meet their domestic disclosure obligations.

Approach

Blue bond issuance: In August 2025 and October 2025, FAB issued two blue bonds in private placement format. Blue bonds, a subset of green bonds, are specialized debt instruments that finance projects focused on ocean conservation, marine biodiversity, and sustainable water management. FAB designed three issuances in alignment with its Sustainable Finance Framework 2023, the International Capital Market Association's (ICMA) Green Bond Principles, and the IFC's 2022 Guidance for Blue Finance. These frameworks define clear criteria for the use of proceeds, project evaluation and selection, and relevant reporting.

The private placements were placed with international investors, including an EU based investment fund, which is classified as a "Dark Green" fund under Article 9 of the EU's Sustainable Fund Disclosure Regulation. This means that it has an explicit sustainable investment focus and puts strict limits on the assets it can invest in.

Key features of the three-year bond include:

- Proceeds are ring-fenced exclusively for eligible blue projects.
- Monthly reviews of allocated asset balances to ensure that proceeds are fully and appropriately deployed.
- If there are unallocated balances, they would be placed with the Central Bank of the UAE, so they are not used to finance ineligible assets.
- The mitigation and adaptation impacts of blue bond-financed projects will be disclosed in FAB's Sustainable Finance Impact Report.

Use of proceeds of the Blue bond: FAB raised approximately US$70 million through two issuances to finance two existing syndicated loans to the developers of water-related projects:

1. The design, construction, financing, and operation of two advanced wastewater treatment facilities, now delivering a daily capacity of 430,000 cubic meters; management of increasing volumes of wastewater generated by the UAE's growing population and urban development; and enabling water treatment for irrigation of farms, parks, and green spaces of Abu Dhabi and Al Ain.

2. A fully integrated renewable utility project comprising a desalination facility in Saudi Arabia producing 37 million liters per day, powered by renewable energy sources (410,000 MWh/year) and 700 MWh of battery storage. This project includes verification that the average carbon intensity of the electricity used for desalination is below 100 gCO_2e/kWh.

When financing these projects, and then determining which to allocate to the blue bond, FAB applied an ESG risk assessment in accordance with FAB's Environmental and Social (E&S) Risk Framework, as assessment of the blue bond use of proceeds criteria and the use of the Equator Principles to mitigate environmental and socials risks from the projects. The EU Green taxonomy criteria were referenced in the assessment process to ensure that the desalination facility was being powered in way that met their investor's expectations.

Reporting requirements: Central to the functioning of the both the Blue bond and the project finance is transparency. FAB is required to give transparent annual updates to the bond investor to keep them abreast of the performance of the assets financed by the bond. This relies on the borrowers also keeping FAB updated about the project. FAB tracks performance against key metrics, including wastewater treated in cubic meters and number of beneficiaries. FAB prepares a sustainable finance impact report on an annual basis, in which it disclose use of proceeds and impact at a bond level.

Scaling Potential

Use of proceeds bonds is a growing market. The model of a bank issuing labeled debt and then ring-fencing the finance raised for specific project types is a common feature in green bond markets. There are fewer examples of banks using the same mechanisms to finance adaptation and resilience related projects. Given the adaptation finance gap there is a significant scope for scaling. FAB issued two bonds in short succession to reflect the interest they received from multiple investors.

The focus on water infrastructure is regionally replicable. Given both the domestic water strategies of the countries in the Middle East and their common exposures to water stress, the blue bond model offers a specific way to highlight where action is being taken to address a growing economic and societal issue. they want to.

Scope to repeat as a public bond issuance. This specific transaction was designed to be a private placement and to meet the demands of a particular dark green investment fund. Now FAB has proved the concept, the same model could be used to raise funds from the public capital markets, allowing a range of investors to participate and to benefit from FAB expertise in originating projects, designing financial instruments, and undertaking maturity transformation and screening project developers.

Building market maturity. In nascent markets each successful transaction can have an outsized impact in building market awareness and understanding of the asset class. These transactions have proven to FAB that the model can work as well as provided a signal to other investors, banks, and project developers.

From Barriers to Solutions

Barriers

Market infancy: The issuance of first of a kind products can complicate approval processes and constrain firm's willingness to finance

Project uncertainty: Uncertainties about project viability constrains project and corporate finance.

Solutions

Clear firm-wide approach to sustainable finance: When FAB issued their first blue bond in August 2025, it was only the second major blue bond issued in the region and the first for a Financial Institution in the GCC, after a US$100 million issuance by DP World in December 2024. This meant there was no recognised model or precedent to build on.

Adopting a clear, firm-wide sustainable finance strategy ensured that the introduction of this new type of instrument was fully aligned with the Bank's priorities. This alignment facilitated internal buy-in and supported engagement with both investors and project developers.

Alignment with Government strategy: In 2017, the UAE unveiled the UAE Water Security Strategy 2036, aimed at ensuring sustainable access to water during both normal and emergency conditions. This strategy focuses on reducing water demand, increase water storage capacity and increase the reuse of treated water. The wastewater treatment facilities aligned with this strategy ensuring strong political and public-sector tailwinds for the funded projects. Similarly in Saudi Arabia, Vision 2030 and the National Water Strategy emphasise increased desalination capacity, with an important focus in expanding renewable energy powered projects. The alignment with national priorities enhanced the bankability of the projects.

Lack of internal capacity: New products require the development of internal expertise which can be difficult to generate when there are established processes and approaches.

Building understanding across the firm: As this was FAB's first issuance of its kind, securing internal stakeholder approval and confidence was critical. This required building familiarity with the product and demonstrating its viability. A recent bond issuance in the region helped validate market demand. They also used the bond proceeds to finance existing assets. This made the transaction simpler than it would have been if FAB had to fundraise and deploy financing at the same time.

Ensuring reliable revenues: Projects seeking commercial financing often require predictable cash flows.

Predictable cash flow profiles: Water related projects are well-suited for adaptation financing due to their stable demand, potential for public ownership, and, in many cases, regulated pricing structure that support predictable cash flows. Even in the absence of government coverage, these projects provide essential services with steadily increasing demand, making them attractive from an investment perspective.

Investor transparency and reporting: Consistent reporting is required to assess the resilience benefits of the projects and keep investors informed.

Use of internationally recognized frameworks: In originating the projects, FAB adhered to multiple internationally recognised best-practice frameworks (ICMA Green Bond Principles, the IFC recommendation, the Equator Principles, wile also referencing relevant criteria in the EU Taxonomy). These frameworks, enabled FAB to collect information from the developers of the project and was able to use this information to show investors that the transaction is aligned with market best practices. This improved investor confidence in the transaction and helped to ensure they could report on the benefits of the transaction.

Lessons Learned

Alignment with government adaptation strategies. Government planning can create demand and support cash flows. The projects that FAB financed all aligned with country level planning to enhance water security. Alignment with national plans gave both FAB and the end investor the confidence that these projects were viable and necessary pieces of infrastructure.

Predictable cash flows. Finding projects that have highly predictable cash flows makes it easier to make a commercial case to invest in adaptation financing measures.

Mitigation co-benefits. Adaptation projects that incorporate mitigation elements can enhance investment attractiveness. Attention to existing taxonomy thresholds can also help expand the pool of interested investors.

Using existing frameworks and definitions. Significant investor appetite exists where standards can be assured. FAB follow up their first Blue bond issuance with a second shortly after, reflecting this demand. This appetite is reinforced by having a robust set of metrics and impact KPIs, and by tying the terms of the financing to existing international frameworks and taxonomies.

FirstRand Bank

Structuring a performance-based bond to finance water resilience through ecosystem restoration

South Africa, Africa

FirstRand Bank (FRB) is one of Africa's largest banks, providing a broad range of retail, commercial, corporate and investment banking services in South Africa. Through its investment banking arm, Rand Merchant Bank (RMB), FRB plays a leading role in structuring innovative financial solutions to address complex sustainability and infrastructure challenges.

The Nature Conservancy South Africa (TNC-SA) is a conservation organization with expertise in ecological restoration and water security. Since 2018, TNC-SA has operated the Greater Cape Town Water Fund, clearing over 60,000 hectares of invasive alien plants (IAPs) and recovering more than 34.53 billion liters of streamflow water per year.

Conservation Alpha (CA) is an independent technical agent specializing in nature-based impact finance. Conservation Alpha helped design and serves as calculation agent for the World Bank's Wildlife Conservation Bond (Rhino Bond).

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

As one of the driest countries in the world, South Africa faces a growing water security crisis driven by climate change, population growth, and ecosystem degradation. Water availability is already highly constrained, with projections suggesting a potential supply-demand gap of up to 17% by 2030.

A major driver of reduced water availability is the spread of IAPs, which consume significantly more water than native vegetation. These species reduce streamflow into dams, degrade ecosystems, and increase wildfire risk. In the Western Cape, IAPs are estimated to reduce water inflows by tens of billions of liters annually.

Solution Overview

Geography	South Africa
Year	2026-Present
Solution Type	Outcomes-based bond
Applicable Sector(s)	Water security; Ecological restoration; Nature-based solutions

Description

To help address water insecurity in South Africa, FirstRand Bank issued the R2.5 billion **Cape Water Performance-Based Bond** as part of a broader transaction that raised funding for a nature conservation project and which links investor returns to ecological outcomes. The transaction was launched and coordinated by RMB, who partnered with TNC-SA as project implementer and CA as independent verification agent.

The transaction consists of (1) a standard senior unsecured FirstRand corporate bond, under which investors receive principal and base interest from the bank, and (2) a conservation project funded separately by outcomes-based funders and donors. There is no use-of-proceeds link between the bond and the project; proceeds are used for general corporate purposes. Instead, the connection between the bond and the project arises solely through a performance-based success payment tied to verified hectares of IAPs cleared. As such, the structure operates as a risk-sharing mechanism and

performance-linked overlay rather than a labeled bond. Investors partially underwrite the risk of project failure over the life of the transaction, providing some downside protection to outcomes-based funders. This allows RMB to attract new sources of project funding and more capital from outcomes-based funders than they might otherwise be unwilling to provide. The structure is comprised of three key components:

A R2.5 billion listed senior unsecured performance-based bond issued by FirstRand Bank (FRB), with a 5-year and 3-month tenor. Noteholders receive quarterly interest payments at the 3-month Jibar + 60 bps, and full repayment of principal at maturity. The 60 bps spread above JIBAR represents a ~35 bps underperformance relative to the spread on a vanilla FRB bond of similar maturity. This 35 bps is set aside by FRB and forms part of the Cape Water Payment Amount. Depending on verified IAP clearance outcomes, noteholders may also earn a performance-based success payment of up to ~70 bps, bringing total returns to up to ~130 bps above the reference rate in a full success scenario, or a minimum of Jibar + 60 bps in a no-success scenario.

Project funding of R150 million, provided by outcomes-based funders and catalytic donors. These funds directly finance the conservation activities implemented by TNC-SA and remain fully separate from bond proceeds.

The Cape Water Payment Amount, comprising the 45 bps set aside by FirstRand (comprised of the 35 bps yield "sacrificed" by noteholders, as explained in (i), and a 10 bps new product premium) and ~25 bps from funder-related contributions and accrued interest (totaling ~70 bps), is distributed at maturity based on verified hectares of IAPs cleared. Upon full success, the payment pool goes to noteholders; upon no success, it reverts to outcomes-based funders; or will be shared proportionally between noteholders and outcomes-based funders if the final outcome falls between full or no project success.

Approach

The Cape Water Performance-Based Bond combines a corporate bond with a performance-based payment mechanism, alongside a separately funded ecological restoration project and independent verification. The structure deliberately separates bond financing (provided by investors to FRB) from project funding (provided by donors and outcomes-based funders), linking the two only through the performance-based payment mechanism.

1

Outcomes-based bond structure

The bond is a senior unsecured FRB instrument with a 5-year, 3-month tenor. Investors receive principal and base interest from FRB, and proceeds are used for general corporate purposes rather than being earmarked for the restoration project. This reflects a deliberate decision not to use a use-of-proceeds model, avoiding "green" or "blue" bond labeling given the absence of a direct financing link and reducing greenwashing risk. Instead, the structure introduces a performance-based overlay on a conventional bond, linking investor returns to ecological outcomes without requiring investors to directly fund the project.

This structure creates three interlinked cash flow streams: investors earn between Jibar + 60 and ~130 bps, depending on ecological outcomes; outcomes-based funders receive between ~70 and 0 bps, inversely to investors; and FRB acts solely as issuer, and has no exposure to project performance, paying a fixed cost of Jibar + 105 bps in all scenarios (~10 bps above its benchmark funding cost). This 10 bps new product premium is expected to be a one-off incentive to investors given the innovative and unique structure.

The performance-linked component (the Cape Water Payment) is a ~70 bps pool funded by two sources: 45 bps set aside by FRB (ring-fenced, accruing interest over the life of the bond, and never retained by the bank) and ~25 bps contributed by outcomes-based funders. This pool is allocated at maturity based on independently verified hectares of IAPs cleared, across three outcome bands. In a no-success scenario (≤5,970 hectares cleared), investors receive only the base return and outcomes-based funders retain the full payment pool. As performance improves, investors receive an increasing share of the pool, and in a full success scenario (≥6,390 hectares), investors receive the entire amount, bringing total returns to ~130 bps.

	This creates a clear risk-sharing mechanism in which investors partially underwrite project execution risk over the life of the bond. They accept a lower base return (~35 bps below a comparable FRB bond) in exchange for performance-linked upside, while outcomes-based funders receive some downside protection. The probability of success was based on TNC-SA's track record of clearing of IAPs in the region since 2018 and factors in the risk associated with clearing of IAPs. This was done to give investors comfort in relation to probability of meetings targets but at the same time ensuring the targets were aligned with TNC-SA's track record.
2 Ecological restoration project	The Cape Water Invasive Alien Plant (IAP) Removal Project is implemented by TNC-SA over five years and funded separately from the bond by outcomes-based funders and donors. The project targets four priority catchments in the Western Cape, with 45 clearing areas covering 3,108 hectares for initial and follow-up treatment, and the potential to reach 6,670 hectares over the bond term. Removal activities include felling, cutting, herbicide application, and multi-year follow-up treatments. The project is expected to restore 16.5 million cubic meters of streamflow, while also delivering biodiversity restoration, wildfire risk reduction, climate resilience, and over 1,300 jobs. Investors have no role in implementation, which is managed solely by TNC-SA.
3 Independent monitoring, reporting, and verification (MRV)	The transaction relies on rigorous, independent verification of outcomes. CA serves as the technical agent, overseeing monitoring, reporting, and third-party verification throughout the bond term. This includes advanced techniques such as LiDAR and field validation, consistent with methodologies used in comparable instruments, including the World Bank Rhino Bond. The MRV framework builds on TNC-SA's established processes. Sites are assessed upfront to determine invasion levels and treatment needs; implementation is monitored through on-site quality control; and completed work is verified through final assessments signed off by TNC-SA. Semi-annual reporting is independently validated by CA to determine final performance outcomes.

Scaling Potential

A replicable model for outcomes-based funding. The Cape Water Performance-Based Bond is the first issuance in a planned series of performance-linked bonds. RMB is actively exploring a pipeline of similar projects that aims to further mobilize outcomes-based funding. If successfully scaled, this model could support the clearing of over one million hectares of land, significantly improving water yield across South Africa.

Water as a strategic entry point. Given its urgency and political salience in South Africa, water provides a natural starting point for scaling outcomes-based finance, with potential expansion into other nature-based sectors over a longer period.

Future scaling will require expanding the investor base and pool of issuers. Future scaling will require broadening both the issuer base and sources of outcomes-based capital. Future structures may involve additional banks, special purpose vehicles (SPVs), or partnerships with asset managers. Equally important is crowding in a wider set of outcomes-based funders beyond traditional philanthropy, including corporates, family offices, and foundations.

Unlocking institutional capital through performance-linked structures. While donor and concessional capital directly funds project implementation, the model uses performance-based incentives to create a bond that can attract institutional investors. This enables private capital to gain exposure to nature-based outcomes without directly financing project activities.

Pathway to self-sustaining water credit markets. Initial designs incorporated both hectares cleared and modeled water yield as success metrics; however, due to measurement uncertainty, the current structure relies on hectares cleared. Over time, advances in data, machine learning, and field validation could enable robust water yield estimation, supporting the emergence of water credit markets. Future structures may then transition from bond-based mechanisms to direct monetization of verified water outcomes.

Standardization and repetition support scale. Scaling is supported by standardized processes (such as bond mechanics, MRV frameworks, and legal structures) and repeat transactions that build investor familiarity and reduce costs.

From Barriers to Solutions

Barriers

Limited ability of investors to assess and price nature-based project risk. Institutional investors often lack the tools, data, and benchmarks needed to evaluate the execution risk of nature-based projects. Uncertainty around outcome measurement and limited historical performance data constrain investor confidence and participation.

Misalignment between investor requirements and conservation project characteristics. Institutional investors require liquid, investment-grade instruments with clear risk-return profiles, while conservation projects are often perceived as illiquid, grant-dependent, and operationally complex, with uncertain and short-term funding.

Lack of rigorous measurement and verification of conservation outcomes. Traditional conservation funding often involves limited accountability for results, with donors receiving qualitative reports rather than independently verified quantitative metrics.

Misalignment of incentives between conservation funders and commercial investors. Traditional models separate conservation funding (grants) from commercial capital (seeking financial returns), creating parallel systems with different objectives and timelines.

High transaction costs and complexity. Innovative financial structures require significant upfront investment in legal agreements, technical design, risk modeling, and regulatory approvals. These costs can be prohibitive for individual projects.

Perception that conservation is not financially sustainable. Many stakeholders view conservation as perpetually dependent on donor funding, without pathways to commercial viability or market-based revenue generation.

Solutions

Credible implementing partner with demonstrated track record and data. Investors face an approximate ~70 bps return differential between full success and no success scenarios. Investing in the bond requires assessing the probability of ecological delivery based on historical data and implementation capacity. TNC-SA's track record and extensive data, based on having cleared more than 40,000 hectares over a period of eight years, was a key factor supporting investor confidence in execution risk.

Separation of financial instrument from project delivery, combined with long-term outcomes-based funding. A senior unsecured bond structure provides investors with market-standard returns, liquidity, and credit exposure, while a performance-linked overlay offers upside tied to verified outcomes, without requiring direct project financing or involvement. In parallel, committed multi-year funding (e.g., R150 million over five years) from outcomes-based funders ensures stable, long-term capital for implementation.

Independent third-party verification. Conservation Alpha provides independent technical oversight and verification of all conservation outcomes using objective methods based on TNC-SA's established quality control processes, with sign-off from both the implementer and CapeNature. This independence and rigor builds trust among investors and enables replication.

Outcomes-based mechanism aligning financial and conservation incentives. The Cape Water Payment Amount links investor returns to verified ecological outcomes. Investors effectively provide some downside protection to outcomes-based funders, creating shared incentives for success while preserving the commercial structure of the bond.

Replicable transaction template with established partnerships. The bond establishes standardized legal agreements, MRV frameworks, OBF structures, and bond mechanics that can be replicated across other catchments. RMB has developed a pipeline of projects that can leverage this template, with proven partnerships providing institutional capacity for rapid deployment.

Pathway to self-sustaining water credit markets. While the first bond relies on donor funding, the transaction is designed as a bridge to future payment-for-ecosystem-services models. By developing standardized methodologies for water credit monetization, the project creates the foundation for water users to directly purchase verified water yield increases, enabling future market-based conservation revenue.

Lessons Learned

Outcomes-based financing can align incentives across diverse stakeholders. Linking financial returns to measurable environmental outcomes creates direct alignment between investors, implementers, and funders. Investors take on performance risk, implementers are incentivized to deliver results, and funders deploy capital with greater accountability, helping ensure that financing translates into verified impact.

Flexible structures are needed to accommodate diverse funders. Nature based financing draws on a wide range of capital providers (catalytic donors, public benefit organizations and commercial investors) with distinct mandates, constraints, and return expectations. Enabling their participation requires flexible structures, even at the cost of added complexity. A modular structure that separates (rather than fully pools) funding streams allows each group to engage within existing legal and operational frameworks, while supporting project delivery and enabling more scalable capital stacks.

Strong implementers are a prerequisite for investor participation. Outcomes-based structures require investors to underwrite execution risk, making the quality of implementers central to the investment case. Organizations must demonstrate a proven track record, access to reliable data, and sufficient operational scale to deliver consistent results over multi-year time horizons.

Independent verification underpins credibility and investability. Robust MRV frameworks, particularly those led by independent technical agents, are essential to validate outcomes and reduce information asymmetry. High-integrity verification builds trust among stakeholders, enables performance-linked payments, and is critical for attracting institutional capital.

Long-term capital is key for durable ecological outcomes. Nature-based solutions require sustained intervention, including initial implementation and ongoing maintenance. Financing structures must therefore support multi-year timelines and incorporate flexibility as conditions evolve.

FloodAction Coalition

Catalyzing a market for nature-based flood and drought resilience

United Kingdom, Europe

The FloodAction Coalition is a cross-sectoral partnership that brings together insurers, investors, landowners, asset owners and managers, and policymakers to transform nature-based flood and drought solutions into an investable asset class.

The Coalition is convened by The Conduit and chaired by Aviva, with a cross-sector Steering Group Committee guiding the strategy. Steering Group members include UBS, and the UBS Optimus Foundation, a standalone foundation that offers services and supports UBS clients to undertake philanthropic and impact investing activities across a spectrum of sectors, with a focus on climate and environment, health and education. Other Steering Group members include Howden, Systemiq, Rebalance Earth, National Trust, The Crown Estate, Rivers Trust, National Highways, Zurich, Anglian Water, Allianz, the EA, and Nattergal.

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

Flooding is one of the UK's fastest-growing climate risks, with 5.7 million properties and one-third of critical infrastructure at risk, and causing £2.4 billion in direct damages annually. By 2050, 8 million homes are projected to be at flood risk.

Acute events such as river and coastal floods cause sudden losses to property, infrastructure and business activity, while chronic pressures, such as surface water flooding, rising groundwater levels and deteriorating drainage capacity, increase baseline vulnerability. Critical infrastructure is often located in flood-prone areas, amplifying the potential for wider economic disruption. Additionally, droughts and water quality issues are other chronic water-related issues that impact our communities and economy.

For financial institutions, this creates material financial exposure across real estate, infrastructure and insurance-linked assets.

Solution Overview

Geography	United Kingdom
Year	2025-Present
Solution Type	Blended finance platform; Project development
Applicable Sector(s)	Coalition; Banking; Insurance; Public entities; Water management; Nature

Description

UBS and the UBS Optimus Foundation form part of the Steering Group of the FloodAction Coalition, a national cross-sectoral initiative designed to scale nature-based solutions (NbS) for flood and drought resilience across the UK. The Coalition was founded in November 2025 and brings together insurers, landowners, asset owners and managers, and investors with the ambition of mobilizing a £1+ billion natural flood and drought resilience market by 2028, and is building toward a £150 million early-stage investment pipeline by 2026.

The Coalition seeks to unlock public and private capital at scale to build investable portfolios of Natural Flood Management (NFM) solutions at a landscape/river catchment scale, including wetland restoration, floodplain reconnection, peatland restoration, and riparian woodlands. NFM interventions can reduce flood peaks by up to 30%, increase drought resilience by storing water during dry periods, improve water quality by filtering pollutants, sequester carbon, and enhance biodiversity. But NFM can have tangible and lasting impacts only if implemented at scale. The Coalition operates at the scale of the river catchments, creating the conditions for coordinated, systems-level resilience investment by aligning those exposed to downstream risk with those capable of delivering interventions upstream.

Over time, the Coalition aims to establish a structured, coordinated market in which insurers, investors and asset holders co-fund NFM, model downstream risk reduction and generate resilience-linked returns, delivering commercial benefits for market players. While the exact structure is still being developed and is not yet live, the overall approach will consist of:

1 Identifying and structuring "opportunity clusters":

The Coalition will identify catchments where asset holders exposed to flood and drought risk are geographically aligned with landowners capable of delivering effective NFM interventions.

2 Supporting project preparation:

Within those clusters, the Coalition will then incubate and prepare projects for investment.

3 Developing blended financing structures:

The Coalition will design financing structures capable of attracting institutional participation, blending public and private capital, with concessionary or catalytic funding absorbing early-stage risk and crowding in commercial investors.

4 Structuring resilience-linked revenue models:

The Coalition will quantify how upstream interventions reduce expected downstream flood losses, business interruption exposure or operational risk for specific assets. These modeled reductions will form the basis for structured payment agreements with beneficiaries, aggregated into portfolio-level revenue streams.

Approach

The FloodAction Coalition seeks to become a market-building platform for natural flood and drought management in UK and beyond. The core model (under development) consists of:

1 Identifying spatial clusters	FloodAction has started by identifying 'opportunity clusters': river catchments where downstream asset exposure to flood/drought risk aligns geographically with upstream landowners capable of delivering effective NFM interventions. This creates the economies of scale necessary to attract institutional capital and solves coordination problems by bringing water companies, infrastructure operators, transport operators, supermarkets with warehouses, data center operators, and other corporate beneficiaries into coordinated engagement with public and private landowners and NbS developers.
2 Supporting project preparation and pipeline development	Within identified clusters, FloodAction will support technical project preparation, including hydrological modeling, feasibility assessments, stakeholder coordination, and the development of governance and monitoring frameworks. The Coalition is building toward an initial £150 million pipeline of demonstrator projects for 2026. These projects involve long-term delivery timelines (8–10 years) reflecting the nature of natural regeneration interventions. The demonstrators are intended to validate delivery models, refine revenue mechanisms, establish performance data, and create proof of concept for outcome payment structures.

3 Designing blended financing structures	FloodAction will also play a key role designing financing structures capable of attracting institutional participation. These will blend public and private capital, with concessionary or catalytic funding absorbing early-stage risk and project development costs. Working with the insurance sector, FloodAction is developing performance guarantee policies to underwrite transactions and facilitate private investment. The expectation is that reliance on catalytic capital will decline as revenues mature and investor confidence strengthens.
4 Structuring resilience-linked revenue models	Finally, the Coalition will model how upstream NFM interventions reduce expected flood losses, business interruption exposure, or operational risk for specific downstream assets. These quantified risk reductions will form the basis for structured payment agreements with beneficiaries — translating avoided losses into payments for ecosystem services (e.g. insurers may contribute based on reduced exposure and vulnerability; infrastructure operators on avoided disruption; utilities on improved water quality; and public authorities on environmental or climate objectives). By pooling contributions from multiple beneficiaries whose risks are reduced, the Coalition creates diversified and more predictable cash flows.

Scaling Potential

Demonstrator pipeline should support future scaling. The initial £150 million pipeline of projects targeted for 2026 can serve as proof of concept for both delivery and payment models. While these projects have long delivery timelines (8–10 years) reflecting the nature of natural regeneration, they are designed to validate revenue aggregation mechanisms, test outcome-based payment structures with different buyer types, establish performance data, and prove that corporate buyers will pay for resilience outcomes rather than free-ride. By 2028, the Coalition aims to mobilize £1 billion across multiple catchments. Success in the demonstrator phase — particularly proof of concept on the payment side — will be critical to transitioning from pilot projects to a repeatable national platform.

Initial focus on public entities. So far, public sector entities such as the Environment Agency, Network Rail, and water companies have been the initial focus for engagement, serving as 'lower-hanging fruit' due to their clearer exposure to flood risk and regulatory mandates. These early partnerships will help validate outcome-based payment structures and build confidence in the model. As the market matures, the Coalition will increasingly more diffuse corporate buyers — such as steel manufacturers, IT firms with data centers, and supermarkets with storage warehouses, etc. — who face less direct but still material exposure to climate-related disruptions.

Pathway to commercial viability and institutional capital. As modeling assumptions are validated and contracted revenue streams mature, investor confidence should grow. Over time, as project developers and market participants build capacity, the Coalition intends to step back, enabling the ecosystem to evolve into a self-sustaining market. Pension funds, particularly local ones, have shown interest, given the alignment between their long-term investment horizons and the 8–10 year delivery timelines of these projects. Once predictable cash flows are in place, UBS could play a capital markets role by structuring and issuing fixed income instruments that convert future outcome-based payments into upfront development capital, helping to scale investment without providing direct lending.

Standardization should lower scaling costs and accelerate deployment. Early-stage platforms are resource-intensive and bespoke. By standardizing modeling methodologies, governance templates, contracting frameworks, and resilience metrics, the Coalition is developing repeatable deployment templates. As documentation becomes more consistent and investor familiarity increases, transaction costs should decline and structuring timelines shorten.

Potential for integration into insurance and risk management systems. Quantified upstream risk reduction could eventually be embedded within underwriting and asset protection frameworks. If insurers incorporate catchment-level resilience investments into portfolio risk management strategies, and infrastructure operators treat upstream interventions as long-term asset protection planning, structural demand could increase significantly.

Policy as a critical scaling enabler. Key policy accelerators could include: public co-funding mechanisms; outcome-based procurement frameworks; MRV infrastructure creation; standardization of resilience units and KPIs; financial regulatory requirements addressing climate exposure (e.g., mortgage portfolio flood risk); free licensing of government flood modeling data and tools as digital public infrastructure; and reformed farm subsidy models incentivizing land stewardship.

From Barriers to Solutions

Barriers

Difficulty translating avoided losses into investable cash flows. Flood prevention generates value primarily through reduced expected losses rather than traditional revenue streams. Defining and pricing a standardized 'unit of resilience' (analogous to a carbon credit) and converting physical metrics (cubic meters of water retention) into financial terms across different risk transmission pathways remains a challenge.

Insufficient or uncertain risk-adjusted returns. Even where resilience benefits are recognized, investors often view cash flows as uncertain, contingent on climate variability or policy support. The absence of standardized structures, diversified revenue bases and clear capital stack positioning can make returns appear speculative or impact-driven. Incentivizing corporate buyers to pay for resilience rather than free-ride remains challenging.

Early-stage complexity and high development costs. Project development in nature-based resilience can be complex and resource-intensive. Hydrological modeling, feasibility assessments, landowner coordination and impact verification require upfront capital and technical expertise that commercial investors may not have.

Fragmented incentives and insufficient scale. Flood resilience benefits accrue across insurers, infrastructure operators, corporates, landowners and public authorities, yet individual interventions are typically small, geographically dispersed and lack sufficient scale/coordination to attract institutional capital. In many cases, no single beneficiary captures enough value to justify investment independently.

Lack of track record can weaken investor confidence. Institutional investors often require demonstrable performance data, standardized contracting frameworks and governance clarity before allocating capital to a new resilience model.

Solutions

Difficulty translating avoided losses into investable cash flows. Flood prevention generates value primarily through reduced expected losses rather than traditional revenue streams. Defining and pricing a standardized 'unit of resilience' (analogous to a carbon credit) and converting physical metrics (cubic meters of water retention) into financial terms across different risk transmission pathways remains a challenge.

Stacked revenue streams supported by blended finance. FloodAction aggregates multiple resilience-linked value streams, such as flood protection, reduced business interruption exposure, water-quality improvements, biodiversity uplift and carbon benefits, into diversified cash flows at portfolio level. Public or concessionary capital is also deployed strategically to absorb early-stage uncertainty or provide subordinated risk capital, improving the risk-return profile for senior investors. This combination of revenue stacking and blended capital helps position NFM as performance-based infrastructure capable of delivering resilience-linked returns consistent with institutional expectations.

Structured project preparation. By standardizing documentation and establishing monitoring methodologies, the Coalition reduces transaction friction and enhances bankability. Close collaboration with landowners and NbS developers ensures projects are technically robust, environmentally credible and commercially structured, transforming geographically dispersed interventions into structured portfolio-ready projects.

Spatial aggregation and portfolio structuring. By operating at the scale of the river catchment rather than individual parcels, FloodAction ensures projects are sufficiently large and systemically coherent to produce measurable downstream risk reduction. This spatial aggregation aligns beneficiaries and implementers within a single hydrological boundary, enabling coordinated delivery and creating structured value propositions capable of supporting portfolio-level financing.

Demonstrator pipeline. The initial £150 million pipeline targeted for 2026 will help validate delivery models, refine revenue mechanisms, and establish performance data. It will also serve as proof of concept on the payment side, demonstrating corporate buyer engagement and willingness to pay for outcomes.

Lessons Learned

Quantifying and valuing resilience is foundational to market formation. A core challenge in scaling resilience finance lies in translating physical interventions into investable financial terms. This requires both the definition of standardized "units of resilience" (analogous to carbon credits) and the development of credible modeling frameworks that quantify downstream risk reduction. Tools are required to support counterfactual scenarios and long-term impact horizons, while also converting physical metrics — such as cubic meters of water retention — into decision-useful financial indicators like cashflow impacts, underwriting exposure, or mortgage portfolio risk. However, modeling costs (often exceeding £50,000 per intervention) remain a significant barrier. Publicly accessible digital infrastructure and standardized methodologies are critical to reducing these costs and enabling broader market participation.

Catalytic capital enables market formation but must transition to commercial viability. Philanthropic and concessionary capital is critical for absorbing early-stage uncertainty, funding project development, and providing stakeholder engagement and secretariat functions during market-building. However, long-term scalability depends on demonstrating that structures can attract sustained commercial participation (e.g., pension funds with longer horizons) under mainstream risk-return expectations, with declining reliance on catalytic capital over time.

Market architecture and coordination create investable scale. Resilience interventions generate clear economic value but fail to attract investment when incentives are fragmented. Creating economies of scale through coordinated engagement with multiple beneficiaries (rather than fragmented individual negotiations) solves coordination problems and creates structured value propositions. Aggregation — whether geographic, contractual, or financial — transforms isolated small-scale projects into portfolios capable of attracting institutional participation.

Diversified, stacked revenue models improve investability. Aggregating multiple value streams (flood protection, water quality, biodiversity, carbon benefits) across diverse beneficiaries creates more predictable and durable cash flows. Different buyer types require different contract structures: outcome-based payments with predefined KPIs for some; operational expense funding for others. Revenue diversification enhances financial resilience alongside environmental resilience.

Regulatory alignment and policy infrastructure accelerate scaling. Public policy can play multiple enabling roles: creating measurement, reporting and verification infrastructure; defining standardized resilience units and KPIs; stimulating demand for resilience investments; or providing digital public infrastructure for modeling.

Guardian Group

Enhancing the climate resilience of low-income households through parametric microinsurance

Jamaica, Caribbean

Guardian Group is one of the largest financial services providers in the Caribbean, with a strong presence in general insurance across multiple markets. Through its Jamaican subsidiary, Guardian General Insurance Jamaica (GGIJ), the group has expanded its offering into climate risk solutions targeted at underserved populations.

CCRIF SPC is the Caribbean and Central America's parametric insurance facility and development insurer, established in 2007 as the world's first multi-country, multi-peril risk pool. Over nearly two decades, CCRIF has delivered 82 payouts totalling more than US$483 million, all within 14 days. Its sovereign parametric products, covering tropical cyclones, excess rainfall, earthquakes, and utility sectors, are underpinned by pd hazard, exposure, and vulnerability models. CCRIF created the Livelihood Protection Policy (LPP) to extend the same parametric architecture used for sovereign risk to individuals and informal workers.

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

Jamaica faces acute exposure to hurricanes, extreme rainfall, and flooding. These shocks hit low-income households and informal workers hardest: groups that typically lack savings, formal insurance, or financial buffers. Unlike larger firms that can absorb delays or navigate indemnity claims, vulnerable populations need rapid, predictable liquidity to stabilize income and restart activity. Traditional insurance, with its documentation requirements and slow claims adjustment, is misaligned with these needs.

Solution Overview

Geography	Jamaica (with expansion to Belize, Grenada, Saint Lucia planned in 2026)
Year	2025-Present
Solution Type	Parametric microinsurance
Applicable Sector(s)	Low-income households and microbusinesses

Description

After Hurricane Melissa struck Jamaica in October 2025, CCRIF delivered record-breaking sovereign payouts of US$91.9 million within 14 days, providing the Government of Jamaica with immediate liquidity for disaster response. But while sovereign payouts are key for macro level recovery, they do not always translate fully into timely or adequate support for the households whose livelihoods are most disrupted by extreme weather events.

To close this gap, CCRIF developed the Livelihood Protection Policy (LPP), a parametric microinsurance model designed to downscale CCRIF's sovereign level tropical cyclone (TC) and excess rainfall (XSR) models to the household and individual levels. CCRIF developed the LPP through more than a decade of research, piloting, and refinement under the Climate Risk Adaptation and Insurance in the Caribbean (CRAIC) initiative, which allowed CCRIF to demonstrate that the same modelling architecture used to protect governments could be adapted to protect individuals, informal workers, and micro entrepreneurs.

Building on this foundation, CCRIF partnered with Guardian Group to bring the LPP to market in Jamaica. Guardian serves as the local underwriter and distributor, offering the LPP under its retail brand Climate Guard. In essence, Climate Guard is powered by CCRIF's LPP: the underlying product, trigger design, and payout logic are all derived from CCRIF's parametric models, while Guardian provides the customer facing brand, distribution channels, and market access needed to reach vulnerable populations at scale. Through partnerships with credit unions, cooperatives, community organizations, and other aggregators, Guardian Group is able to reach informal workers and low-income households who may not have bank accounts or traditional financial relationships.

Climate Guard is designed specifically for groups that are often the first to lose income when storms strike, including small farmers, vendors, seasonal tourism workers, vendors, day laborers, and micro- and agri-entrepreneurs, many of whom are traditionally excluded from formal insurance markets due to affordability constraints, lack of insurable assets, limited financial records, or the administrative complexity of indemnity based products. LPP policies start at US$100, with a simple, uniform premium rate of 11.5% for wind and rainfall coverage. Unlike traditional insurance, which requires on-the-ground loss assessments, documentation, and lengthy claims processing, Climate Guard is event based rather than loss based. Payouts are triggered automatically when predefined hazard thresholds are exceeded, using independently verified weather data from CCRIF's TC and XSR models. This eliminates the need for claims submission and ensures that policyholders receive funds within 14 days, at payout levels ranging from partial to full depending on event severity.

Approach

Climate Guard is structured around three interdependent components: CCRIF's parametric trigger design and risk infrastructure; Guardian Group's underwriting and distribution; and a multi-channel delivery model targeting populations excluded from formal insurance.

1

Parametric microinsurance product design

Climate Guard's parametric trigger design is based on two hazard parameters: maximum sustained wind speed and a standardized rainfall intensity index measured over 12- and 48-hour periods. Thresholds are calibrated at the parish level using CCRIF's historical hazard datasets, and verified using storm track data, satellite rainfall estimates, and national meteorological services.

Once weather thresholds are exceeded in a policyholder's location, payouts are automatically dispersed within 14 days, without the need for claims assessment or loss verification. This minimizes delays and complexity in claims processing, and enables the delivery of fast, predictable payouts aligned with the immediate liquidity needs of vulnerable households. Payouts follow a four-level structure: 20%, 35%, 75%, and 100% of the peril-specific sub-limit, triggered by a single event. Wind and rainfall are assessed independently; a policyholder may receive a payout for one peril, both, or neither. Trigger calculation, data verification, and payout calculation all are performed by CCRIF and its global calculation agents.

Unlike traditional insurance that compensates for specific asset losses, Climate Guard provides cash that policyholders can deploy as needed: replanting crops, repairing equipment, restocking inventory, or covering household costs. Policies start at US$100 with a flat 11.5% premium rate for both wind and rainfall coverage.

To support market entry, donor funding is also providing a 50% premium subsidy directly to policyholders in Year 1. This subsidy is time-limited: as the product scales, the intent is for it to be phased out and for Climate Guard to operate on fully commercial terms.

2

CCRIF's risk modelling and infrastructure

Climate Guard builds on CCRIF's established parametric risk infrastructure, which has been operational since 2007 and has delivered more than US$ 483 million in payouts to member governments across the Caribbean and Central America. CCRIF provides support through:

- **Catastrophe risk modeling:** Sophisticated hazard models assessing the frequency, severity, and geographic distribution of hurricanes, excess rainfall, and other perils across the region.
- **Independent data verification**: Data drawn from multiple independent sources, including national meteorological services, regional climate centers, and satellite systems.

	• **Operational systems**: Established processes for premium collection, trigger monitoring, payout calculation, and fund disbursement, enabling rapid and reliable service delivery. By leveraging this existing infrastructure, Guardian Group is able to distribute parametric microinsurance without needing to build sophisticated modeling and operational systems from scratch, reducing development costs and time to market.
3 Local distribution and market access	Distribution channels include Guardian's existing client base and partnerships with credit unions, cooperatives, and community organizations — intermediaries that can reach informal workers and low-income households without bank accounts or formal financial records. Mobile money integration supports timely payouts in areas with limited banking access.

Scaling Potential

Designed for replication across the Caribbean and comparable regions. Climate Guard is designed for replication across the Caribbean, with expansion to Belize, Grenada, and Saint Lucia planned for 2026. The underlying model of parametric microinsurance delivered through local distribution partnerships is transferable to any market with high climate exposure, large informal sectors, and low insurance penetration. There is also potential to expand into additional perils including drought, storm surge, and agricultural index products.

CCRIF's sovereign platform provides a ready-made entry point for microinsurance scale. By building on CCRIF's infrastructure, this model demonstrates how sovereign risk platforms can be extended to serve households and microenterprises with parametric microinsurance policies, creating a multi-layered approach to disaster risk financing. exposure to climate-related disruptions.

A scalable pathway to expand resilience coverage to underserved populations. Parametric microinsurance offers a scalable pathway to extend coverage to underserved populations, as it avoids many of the administrative and cost barriers associated with traditional insurance. For local underwriters, there will likely continue to be a dependence on partners like CCRIF for modelling infrastructure, credibility, and risk pooling efficiencies.

From Barriers to Solutions

Barriers	Solutions
Slow, documentation-heavy claims processes delay recovery. Traditional indemnity insurance requires on-site loss assessment, documentation, and claims adjustment, taking weeks or months. This is incompatible with the immediate liquidity needs of low-income households.	**Automatic, data-verified payouts triggered by objective weather thresholds.** Climate Guard uses parametric triggers verified by storm tracks, satellite estimates, and national meteorological services. Payouts follow a four-level structure (20%, 35%, 75%, or 100% of the peril sub-limit) disbursed within 14 days, with no claims submission required.
Low-income households face structural barriers to access and affordability. Low-income households often lack insurable assets, financial records, or banking access, prerequisites of traditional insurance. Affordability is also a persistent constraint, particularly for the most vulnerable groups in rural and remote communities.	**Inclusive, low-entry design supported by affordability strategies.** Climate Guard requires no asset valuation: policies start at US$100 with a flat 11.5% premium rate. To further lower the affordability barrier in the initial market-building phase, donor funding provides a 50% premium subsidy directly to policyholders in Year 1. This subsidy is explicitly time-limited, and is designed to wind down as the product scales. Mobile money integration further supports payouts where traditional banking access is limited.

Traditional products are misaligned with the liquidity needs of vulnerable households. Traditional insurance compensates for the loss of specific assets. Vulnerable households typically need immediate cash to stabilize income and consumption, a fundamentally different financial need that indemnity products are not designed to meet.

Rapid, livelihood-focused payouts aligned with real recovery needs. Climate Guard delivers fixed cash payouts policyholders can deploy flexibly, such as replanting crops, repairing equipment, or covering household costs, with no restrictions on use. Wind and rainfall are assessed independently: policyholders may receive a payout for one peril, both, or neither.

Low awareness and limited trust hinder uptake of unfamiliar parametric products. Parametric insurance is unfamiliar to most low-income households. Misunderstandings about how event-based triggers work, and the resulting basis risk when payouts do not align with individual losses, can erode trust and suppress uptake.

Community-based education and distribution through trusted local networks. Guardian invests in plain-language explainers and community workshops to demystify parametric triggers and manage expectations around basis risk. Distribution through credit unions, cooperatives, and community organizations leverages trusted relationships to build confidence and lower acquisition costs.

Regulatory frameworks remain geared toward indemnity insurance. Insurance regulation across most Caribbean markets was mostly designed for indemnity products and lacks frameworks for index-based triggers or consumer protections specific to parametric products. Regulatory capacity to assess innovative models remains limited, slowing approvals.

Proactive regulatory engagement, including sandbox proposals for parametric products. Guardian has engaged regulators proactively to secure conditional approvals and submitted sandbox proposals covering parametric trigger rules, data transparency requirements, and consumer protection standards for index-based products. This engagement is now a prerequisite for planned market expansion.

Limited local modelling capacity and data gaps constrain product development. Building robust parametric modelling and payout systems locally is technically complex and costly. Many Caribbean countries also lack the long-term, granular hazard datasets needed to calibrate triggers accurately, resulting in modelling uncertainty and elevated premiums.

Leveraging CCRIF's modelling infrastructure and global technical partners for scale. Climate Guard is built on CCRIF's established modelling and verification infrastructure, eliminating the need for Guardian to build proprietary catastrophe models. CCRIF and its global calculation agents handle trigger monitoring, data validation, and automated payout computation, ensuring settlements are fast, objective, and independently verified.

Lessons Learned

Multi-layered disaster risk financing strengthens resilience at all levels. The combination of CCRIF's sovereign policies and Climate Guard demonstrates the value of layered disaster risk financing. Sovereign coverage gives governments rapid macro-level liquidity, while household microinsurance ensures individuals can recover without waiting for that liquidity to filter down.

Education and communication are critical for uptake and trust. Parametric insurance differs fundamentally from traditional indemnity products, and low-income clients often expect payouts to match verified losses. Clear, plain-language communication about triggers, coverage, premiums, and payout mechanisms is essential to build understanding and avoid mistrust. Guardian emphasizes customer-centric approaches and guidance at the point of sale to improve satisfaction and uptake.

Livelihood-focused insurance may better support low-income households. For informal workers and low-income households, the primary climate shock is income disruption, not asset loss. Products designed around rapid liquidity and income stabilization, rather than replacement of specific assets—better match the financial realities of these communities.

Extensive piloting and refinement improve product effectiveness. CRIF's decade-long CRAIC pilot program was essential for calibrating triggers, testing distribution models, and building evidence of impact. Iterative learning and stakeholder engagement are key to product success.

Parametric insurance should be positioned as part of a broader resilience strategy. Climate Guard is most effective when positioned as one component of a broader resilience strategy, complementing government disaster response, community risk reduction, and traditional insurance, rather than as a standalone solution. Messaging that reflects this integration improves uptake and sets appropriate expectations.

Partnerships between regional risk pools and local insurers create synergies. Regional risk pools bring catastrophe modelling depth, data infrastructure, and risk transfer expertise that individual local insurers cannot easily replicate. Local insurers bring market knowledge, regulatory relationships, and trusted distribution networks. The CCRIF-Guardian model shows how collaboration can produce scalable, technically robust products that neither party could deliver independently.

Distribution through local partners can maximize reach and trust. Credit unions, cooperatives, and community organizations are essential for reaching underserved populations cost-effectively. These intermediaries reduce distribution costs, build trust, and can offer group policies that expand coverage at scale. Commission incentives and digital payout channels further enhance reach, particularly in rural areas where banking access is limited.

HSBC

Enhancing the resilience of aquaculture supply chains using blended finance

Thailand, Asia

HSBC is a bank headquartered in London, UK. It is one of the world's largest financial institutions, managing over US$3.3 trillion in assets across more than 56 countries and territories. It aims to facilitate and mobilise between US$750 billion and US$1 trillion in Sustainable Finance and Investment by 2030.

Asian Development Bank (ADB) is a multilateral development finance institution founded in 1966, headquartered in Manila, Philippines. Owned by 68 members, it provides loans, grants, and technical assistance for infrastructure, energy, and climate change projects to promote sustainable growth.

Thai Union is a global seafood company founded in 1977. With over 44,000 employees, the company has positioned itself as an industry agent of change through its SeaChange sustainability strategy. The firm aims to lead the seafood industry toward positive management practices, specifically focusing on ethical labor, greenhouse gas reduction, and improved traceability.

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

The aquaculture sector in Thailand faces increasing exposure to physical climate risks, including heat stress, changing ocean conditions, and more frequent extreme weather events, all of which directly affect shrimp yields and farm productivity. These risks are compounded by disease outbreaks, pollution, and environmental degradation, including pressures linked to aquafeed supply chains such as overfishing and deforestation.

Solution Overview

Geography	Thailand
Year	2025
Solution Type	Labelled products; Blended finance; Dual currency loan
Applicable Sector(s)	Banking; MDBs and DFIs; Sustainable aquaculture

Description

Thai Union is a global seafood producer with a highly fragmented shrimp supply chain in Thailand, across Southeast Asia, and beyond. It has a company wide objective sustainability strategy which includes 11 commitments aimed at reducing carbon emissions, minimizing waste, safeguarding marine and terrestrial habitats, and ensuring safe, decent, and equitable work throughout supply chains. In the past couple of years, ADB has supported Thai Union in developing a Blue and Green Finance Framework, which provided a structured approach to raise use-of-proceeds financing aligned with international standards. With the financing raised to date under the framework, Thai Union has now exceeded its goal of securing 75% of its long-term financing on sustainable terms by 2025 and is on track to reach 100% by 2030.

HSBC had an existing corporate banking relationship with Thai Union and has led previous transactions for them including sustainability linked loans. When assessing the financing needs related to decarbonization of Thai Union's shrimp supply chain, HSBC encouraged Thai Union to engage with the ADB and to develop a blended finance structure which could target supply chain resilience and carbon emission reductions.

As the first financing under their new Green Blue and Green Finance Framework, Thai Union raised a US$150 million working capital facility designed not only to finance operations but to enhance the resilience and sustainability of its shrimp supply chain. The transaction combined development and commercial capital through an A/B loan structure, with ADB providing a US$50 million A-loan and acting as mandated lead arranger for a US$100 million syndicated B-loan from six commercial banks, including HSBC.

The use of a Blue loan label requires Thai Union to meet technical environmental and sustainability criteria, providing reassurance to lenders around the use of proceeds. The blue label meant that the financing targets shrimp certified under Global Sustainable Seafood Initiative (GSSI) recognized schemes, such as the Aquaculture Stewardship Council (ASC) or Best Aquaculture Practices (BAP), helping ensure alignment with credible, externally validated benchmarks. This was further supported by a second-party opinion from DNV on the use of the blue loan label for the framework and financed by ADB.

The financing also included a technical assistance (TA) grant from the ADB which supports shrimp farmers in adopting climate-smart aquaculture practices. This includes training on managing the impact of heat waves, increasing disease resilience, and improving input efficiency which reduces nutrient runoff into local ecosystems.

This combination of factors, plus the ADB's role as lender of record, its preferred creditor status, and its ability to undertake complex environmental, social, and supply chain due diligence supported commercial lenders' participation in the transaction.

Approach

Sustainable aquaculture projects are often difficult to finance on purely commercial terms. The difficulty in distinguishing between different types of aquaculture, the high level of perceived environmental and social risks associated with intensive aquaculture practices, and the fragmented nature of the sector, which is dominated by a wide network of uncertified and sometimes unincorporated smallholder farmers, has made commercial lenders wary of providing finance. Moreover, shrimp farming is increasingly exposed to climate-related disease and price volatility, increasing the risk to lenders. HSBC worked with the ADB and Thai Union to design a product that could attract private commercial capital by combining risk-sharing, the use of standardized frameworks, and targeted capacity building:

1 Multi-tranche syndication to de-risk private participating	Thai Union raised finance using a catalytic A/B loan syndication structure, designed to mobilize private capital alongside development finance. ADB provided a senior unsecured US$50 million loan with a 5-year maturity. The ADB then acted as mandated lead arranger and mobilised a syndicate of private sector lenders, including HSBC, Bank of China, MUFG, OCBC, SMBC, and UOB, to finance a commercial B-loan of US$100 million mirroring the terms of the A-loan. This tranche gave additional comfort to the commercial banks to lend under the umbrella of ADB's preferred creditor status and rigorous due diligence.
2 Framework alignment and verification	The deal was structured under Thai Union's Blue and Green Finance Framework which was developed with support of the ADB, and was the first financing framework explicitly aligned with Thailand's draft Taxonomy. To help ensure the Framework complied with international sustainable finance principles, Thai Union obtained a verified second-party opinion from DNV, which was financed by ADB. The financing specifically targets shrimp certified under Global Sustainable Seafood Initiative (GSSI) recognized schemes, such as the Aquaculture Stewardship Council (ASC) or Best Aquaculture Practices (BAP) to tie action to externally and internationally recognized schemes. The Blue bond was issued using the ICMA Green Bond standards. The use of an internationally recognised framework helped give ADB and the commercial lenders confidence in the sustainability requirements of the financing. Finally, Thai Union tied their actions under this financing to their company-wide sustainability strategy, SeaChange 2030.
3 Integrated technical assistance	To bridge the gap between financial capital and on-the-ground resilience, the loan is paired with a technical assistance ("TA") grant. This decouples the cost of training, framework development, and elements of operational and certification support from the loan repayment. The TA consisted of three elements. First, training will be provided to shrimp farmers in climate-smart aquaculture practices and

functional financial literacy, with a specific focus on boosting farm resilience to diseases and heat waves, ensuring the shrimp farms are robust enough to meet the loan's sustainability KPIs. Second, direct field support to help farms meet the strict standards required by the Aquaculture Stewardship Council (ASC) and Best Aquaculture Practices (BAP). For farms that aren't yet ready for full certification, the TA funded the roadmap to get them there, focusing on credible improvement pathways. And third, the ADB provided the technical expertise to help Thai Union write their Blue and Green Finance Framework.

Scaling Potential

Replicability in agribusiness. As ADB's first private sector loan for the agribusiness sector in Thailand, this transaction provides a blueprint for scaling sustainable value chain financing across the region. It demonstrates how financing structures can be designed to address sectors characterized by fragmented smallholder supply chains, ensuring that benefits extend beyond the corporate borrower to upstream producers.

Market building for resilient products. The transaction illustrates how resilience investments can be embedded within financing structures to reduce exposure to climate-related risks. By strengthening the resilience of shrimp farmers to heat stress, disease, and environmental degradation, the financing reduces supply chain volatility and, in turn, lowers credit risk for both the borrower and its lenders. This highlights the potential for resilience-focused financing to function as a risk mitigation tool, not just an impact objective, although translating that into credit risk decisions is still a work in progress.

The use of internationally recognized benchmarks. The use of internationally recognized frameworks and certifications plays a critical role in scaling. Alignment with Thailand's emerging taxonomy, combined with third-party verification and industry certifications (e.g. ASC, BAP), provides credible, comparable signals to investors.

Scaling beyond the concessional. While this transaction benefited from public finance involvement, the terms of the A-loan were not concessional. Public finance was used in the provision of TA and the implicit support of the preferred creditor status reduced some risk to the private sector. But this loan can act as a pilot for similar types of lending which could be commercial viable on their own, or with more limited public sector involvement.

Alignment of corporate issue strategy with lender strategy. Where both the lender and borrower have targets and objectives around their participation in labelled finance transactions, this can create a powerful synergy that streamlines the deal.

From Barriers to Solutions

Barriers

Limited private capital for agribusiness: Traditional lenders often perceive agribusinesses as high-risk due to higher volatility from climate exposure, disease risk, and fragmented supply chains.

Complexity of due diligence processes: Undertaking adequate due diligence and environmental assessments on borrowers with large networks of suppliers is costly and difficult.

Solutions

Blended syndication structure leveraging MDB risk mitigation. The A/B loan structure allowed HSBC to participate under ADB's preferred creditor status and due diligence framework, improving the risk-return profile and enabling finance for riskier activities like supporting smallholder supply chain transformation. The borrowing was also made more attractive for Thai Union due to ADB's withholding tax exemption.

Reliance on ADB's technical expertise: By entering into a transaction which has been developed in conjunction with the ADB, HSBC and the other commercial banks were able to benefit from the high quality due diligence processes and the environmental and social assessments undertaken by ADB.

Fragmentation and variation across a wide group of smallholder suppliers: Enforcing a particular standard on dispersed small scale stakeholders can be difficult given different starting points and capacity to affect changes.

Recognition of variations in supply status: Rather than enforcing the use of top tier standards from the outset, the transaction recognises that smallholder shrimp farmers will have to go through a process, under an Aquaculture Improvement Program (AIP), to make measurable progress towards the industry best practices.

Need for expertise to assess robustness of frameworks and the delivery of impact metrics: Commercial banks do not always have the internal expertise necessary to assess strategies and approaches across all sectors.

Use of second and third-party expertise: ADB helped design the Blue and Green Bond Framework, DNV verified it, the GSSI certifications act as a clear and quantifiable trigger for sustainable status and are reflected in the bond KPIs.

Getting internal decision makers comfortable with new loan structures. Blended finance structures changes the balance of risks in a transaction meaning additional internal scrutiny.

Use of relationship model: HSBC's corporate financing approach focuses heavily on relationship management. Through close engagement with ADB and Thai Union, the HSBC team was able to navigate the increased complexity of the blended finance structure.

Lack of standardization in Blue finance: Blue labels are a relatively new category of finance with less of a track record than green labels.

Use of internationally recognized standard: Thai Union developed their Blue and Green Bond Framework in conjunction with ADB, drawing on existing frameworks. This included using ICMA's Green Bond Principles and their guidance on using "Bonds to Finance the Sustainable Blue Economy".

Lessons Learned

Resilience can act as a credit enhancement, although this is not yet routinely priced in. Lenders are exposed to the resilience of the borrower's operations and supply chain. Strengthening climate resilience reduces the likelihood of disruption from heat stress and disease, thereby lowering volatility and protecting credit quality. Banks are working on how to systematically include these risk advantages into credit risk processes.

Independent verification plays a vital role. Third parties can play an important role in verifying the robustness of a borrower's internal frameworks and their adherence to lending conditions.

Targeted TA can support resilience. Public financial institutions can play an important role providing TA to structure products and support the delivery of impact targets. By improving project preparation, operational capacity, and compliance with sustainability standards, TA helps convert high-impact but unbankable activities into investable opportunities.

Meeting suppliers where they are can support improvement. In sectors dominated by small scale and dispersed suppliers, imposing immediate compliance with high standards is often impractical. Structured improvement pathways, supported by certification frameworks, enable gradual alignment with best practices while maintaining inclusivity and scalability.

Alignment of strategies can unlock finance. A corporate-wide strategy to make operations more sustainable can give lenders comfort that borrowers are taking a structured approach and that funds are used to enhance resilience. This can be magnified when it interacts with a lender's own sustainable financing objectives.

Public finance can play an important role in financing non-traditional activities. Financing fragmented supply chains consisting of thousands of smallholder farmers is unlikely to attract private finance on its own. By working with the corporate client and structuring finance that can be directed to smallholders, public finance can make the activity financeable.

Insurance Development Forum

Industry collaboration to mobilize blended finance for resilient infrastructure

South America, Asia, and Africa

Insurance Development Forum (IDF) is an industry-led Public-Private Partnership (PPP) that brings together insurance industry leaders, government officials, and international organizations. Launched in 2016 by the UN, the World Bank, and the insurance industry, the IDF uses the financial mechanisms and risk expertise of the insurance sector to help disaster-vulnerable economies build resilience. IDF's membership comprises 120 partner organizations across five continents, including several global insurers. IDF operates through a series of workstreams and taskforces, with the Infrastructure Resilience Development Fund (IRDF) being led by Infrastructure Task Force (ITF).

Global Infrastructure Partners (GIP), a part of BlackRock, is a leading infrastructure investor that specializes in investing in, owning, and operating some of the largest and most complex assets across the energy, transport, digital infrastructure, and water and waste management sectors.

Supporting the scaling of financing solutions

Nature of Risk Exposure

Vulnerable communities in EMDEs are disproportionately exposed to acute and chronic physical climate hazards, including tropical cyclones, flooding, and droughts. These hazards threaten essential infrastructure, such as power grids, hospitals, and water systems, which often lack the technical design to withstand extreme events.

For institutional investors, these regions present high perceived credit risk, currency volatility, and a lack of investment-grade project pipelines. Without tailored financing structures traditional commercial capital often avoids sub-investment grade infrastructure in higher-risk jurisdictions.

Solution Overview

Geography	South America, Asia, and Africa
Year	2024 (Blueprint development), 2025 (First Close) — Present
Solution Type	Blended debt finance
Applicable Sector(s)	Insurance; Asset management; Water management; Waste; Energy; Transportation; Digital infrastructure; Healthcare

Description

The Infrastructure Resilience Development Fund (IRDF) strategy is an innovative blended finance debt platform designed to mobilize institutional capital toward resilient infrastructure in emerging markets and developing economies (EMDEs). The fund was built upon a blueprint developed by six IDF members — AXA, Convex, Generali, SCOR, Swiss Re, and Zurich — to address the specific investment criteria of the insurance sector.

IDF engaged Global Infrastructure Partners, a part of BlackRock, to help design the fund, using their network and expertise to turn the blueprint into an investable structure, and then to act as investment manager. The IRDF targets small to medium-sized commercial infrastructure projects across a range of countries in Latin America, Africa and Asia. The strategy utilizes

a blended finance structure which integrates public and private capital from the International Finance Corporation (IFC) alongside private insurance capital. It has two different pools, aimed at firms with different risk tolerances and risk-return requirements.

The strategy aims to provide debt finance to infrastructure projects which are both resilient to physical risk and provide additional resilience to the communities that they operate in.

The strategy officially launched in October 2025 and simultaneously announced its first close, having raised US$340 million from IFC and the six IDF members involved in its design. It has a target size of US$750 million.

The fund has begun deploying capital and has maintained a healthy pipeline of potential projects.

Approach

The IRDF was designed through collaboration between IDF members who worked together to create a recommended model which could overcome the traditional barriers that prevent insurance capital from reaching high-impact, small-scale infrastructure projects in EMDEs. It has a target size of US$750 million and which has three main features:

1

The use of a blended capital stack

The IRDF utilizes a blended finance architecture which combines different types of capital to balance risk and return for institutional investors. The strategy is organized into two distinct risk pools to accommodate investors with varying risk appetites:

- **Pool 1 (Junior):** This pool focuses on senior and mezzanine debt for projects in higher risk countries, which typically have a sub-investment grade (BB average) profile. To make this investable for commercial players, it includes a first-loss cushion, provided by the IFC and other catalytic investors, that absorbs the first wave of any potential losses, protecting private senior lenders.
- **Pool 2 (Senior):** This pool targets projects in lower risk countries with a credit profile closer to investment grade (BBB- average). It utilizes DFI credit enhancements, such as guarantees, to further stabilize returns and ensure the portfolio meets the requirements of the global insurance industry.

A blended pool mixes assets across the junior and senior pools to achieve portfolio diversification for insurers. The maturity profile varies across the pools and investors and will be matched by the asset maturity. Exit for investors is through the maturity of the investment.

2

Sector-specific resilience and ESG screening using recognized standards

The IRDF uses a resilience and ESG framework to ensure that every project integrates physical resilience measures, including through its capital expenditure. They use existing market standards such as the EU's SFDR Article 8 criteria and the IFC's Performance Standards. The fund monitors investments and collects data on key performance metrics, such as:

- **Operational durability:** Tracking service disruption and the number of households protected against power outages during natural disasters.
- **Community access:** Measuring access to essential infrastructure (e.g. schools, hospitals, housing, electricity), with a focus on on underserved or vulnerable demographics (e.g. rural and low-income populations).
- **Economic support:** Quantifying local job creation and the amount of products or services sourced locally to ensure the project strengthens the surrounding economy.

The fund aims to ensure both that the infrastructure assets themselves are resilient to physical risks and also that they are explicitly contributing to the resilience of the communities in which they are operating in.

3

Developing a pipeline of small to mid sized assets in underserved countries

Institutional investors often struggle to find investable projects in EMDEs because individual projects are frequently too small to justify the high costs of due diligence. The IRDF addresses this by focusing specifically on small to medium-sized commercial infrastructure, with average project sizes of US$50-$500 million, and by standardizing appraisal processes and aggregating multiple smaller projects into a single, diversified strategy, creating the necessary scale for insurer participation. The fund is targeting projects in countries with significant financing gaps and levels of geopolitical risk consistent with the fund's investment mandate. The strategy targets smaller projects as the investors wanted to see positive, measurable outcomes over the short term, something which is harder to achieve for very large infrastructure projects which can take years or decades to build.

Results: Once IDF had designed the blueprint for the fund, they actively sought an asset manager to operate the strategy, originating and managing assets in line with the blueprint. Global Infrastructure Partners, a part of BlackRock, was selected as the investment manager.

The blueprint has successfully transitioned from its design phase into an active investment strategy with significant initial backing. The strategy achieved its first close in October 2025, raising a total of US$340 million, and will continue fundraising throughout 2026. This initial capital raise was anchored by a substantial commitment from the IFC, alongside contributions from the core IDF members who pioneered the original fund blueprint. The capital raised is intended to be catalytic and prove the model's viability. Beyond raising capital, the strategy has already authorized its first investment and maintains a healthy pipeline of potential projects to ensure that the raised funds are deployed efficiently. Fundraising continues with a wider set of institutional investors including but not limited to other insurers.

Scaling Potential

Institutional alignment. By tailoring the fund to the specific credit quality and liquidity needs of the insurance sector, the IDF aims to access some of the trillions of dollars managed by global insurers and focus it towards climate adaptation and resilience projects.

Using existing market norms. The fund's use of IFC Performance Standards and SFDR Article 8 reporting helps ensure that resilient infrastructure develops in a way that it familiar to investors. As global disclosure requirements (like the ISSB) become mandatory, the IRDF's blueprint is already compliant, reducing the cost for investors who need to meet transparency and ESG reporting obligations.

Focus on a missing market. The IRDF's focus on small to medium-sized commercial projects is a deliberate strategy to help build a market that currently does not exist for institutional players. By aggregating and de-risking these smaller loans, the IRDF aims to creates a track record that could eventually lead to the securitization of these assets. They also targeted countries with large financing gaps, helping to build a track record in places where capital deployment is more limited.

Capital raising signals institutional interest. The successful first close of the fund is a signal to the broader market that EMDE infrastructure can be institutionally investable when supported by the right public-private architecture.

From Barriers to Solutions

Barriers

High perceived risk in EMDEs: Institutional investors often view emerging markets as too risky due to political instability and lack of historical data, which keeps private capital on the sidelines.

Solutions

Blended pool structure: The strategy uses a tiered capital stack where public first-loss capital from the IFC and other catalytic investors absorbs initial losses in a blended pool. This protection improves the credit profile for senior insurance investors, allowing them to access higher-risk jurisdictions with more security.

Fragmented project pipeline: Many resilience projects in developing economies are small to mid-sized, making them too labor-intensive and expensive for large insurers to evaluate individually.

Aggregation of small-to-mid sized projects: By specifically targeting the underserved small-to-mid commercial segment, the strategy can achieve diversification benefits. The use of a professional fund manager removed the need for institutional investors to assess individual projects and allows them broad exposure.

Difficulty in measuring impact and increase in resilience. Investors often want assurance that their financing will enhance resilience either of a specific project or of a wider community.

Impact-oriented metrics: The IRDF applies a rigorous screening process that tracks specific resilience KPIs, such as CapEx committed to physical hardening and "out-of-service times avoided". This provides investors with measurable data on how their capital is directly reducing physical climate risk.

Mismatched investment criteria: Traditional emerging market debt often lacks the credit quality, duration, or predictable cash flows required by highly regulated insurance companies.

Tailored blueprint: IDF members co-designed the fund's blueprint specifically to meet insurance sector investment requirements. This ensures the debt tenors and risk-adjusted returns are compatible with the long-term liabilities of insurers and pension funds.

Lessons Learned

Blended finance requires active co-creation. Blended finance structures are most effective when they are co-designed by the eventual end-investors. Rather than an asset manager creating a fund and hoping to find buyers, the IRDF succeeded because insurers spent two years drafting a blueprint that explicitly addressed their regulatory, credit quality, and duration requirements which taking into account the need to remain attractive to the wider set of institutional investors. This early collaboration between IDF members and BlackRock as the investment manager ensured that the final structure was tailored to the needs of insurers, pension funds and other investors, significantly shortening the path from concept to capital mobilization. It has also deepened the partnership between IDF members and BlackRock in fundraising, something which might not happen in a conventional fund set up.

Resilience is highly complementary to infrastructure. The IRDF demonstrates that infrastructure investment can be both resilient and support wider resilience. The resilient nature of the assets supports the predictability of the cash flows by ensuring that assets, such as power grids or hospitals, remain functional even during extreme natural disasters. The nature and location of the assets ensure that the projects enhance the level of resilience in the wider community, for example by providing electricity connection to underserved areas,

Standardization is a key feature of scalability. By establishing a set of expectations around the design of a blended finance strategy, the IRDF is a replicable model that could be adopted by other fund managers seeking to fundraise for EMDE projects. While the specifics will change by strategy, the basic features of a USD denominated debt strategy, seeking to raise over US$700 million, with geographic and sectoral diversity in the financed assets are replicable and scalable.

Small-to-mid scale projects hold the key to closing vulnerability gaps. While large-scale infrastructure projects often attract significant attention, the IRDF identifies that critical protection gaps are frequently found in small to medium-sized commercial projects. These smaller assets are vital for the resilience of vulnerable communities but are typically underserved by traditional institutional capital. The IRDF seeks to prove that by aggregating these smaller projects into a professionally managed, blended pool, investors can achieve the necessary scale and diversification while delivering high-impact social and environmental outcomes at the community level.

Regulatory barriers need overcoming. To make a strategy attractive to insurance companies, it needs to be designed to take account of the regulatory environment. This meant that structure was designed to be simple, include no foreign exchange mismatches, and ensure maturity matching. While designing the strategy, the insurers involved identified a series of regulatory barriers which may be having unintended consequences in constraining insurers financing assets in EMDEs and investing more in infrastructure. This has motivated IDF to launch work on assessing regulatory barriers.

Impax Asset Management

Scaling adaptation investing through a systematic listed equity framework

Global

IMPAX Asset Management

Impax Asset Management is a specialist asset manager focused on the transition to a more sustainable global economy. Founded in 1998 and listed on the London Stock Exchange's AIM market, the firm manages approximately £23 billion in assets across listed equities, private equity, and infrastructure strategies.

Impax has a longstanding track record in environmental markets investing, with a core focus on companies whose products and services address resource efficiency and sustainability challenges. As the financial materiality of physical risks has increased, the firm has expanded its analytical approach to explicitly capture adaptation and resilience as a distinct investment theme.

Knowledge building and Internal systems

Supporting the scaling of financing solutions

Nature of Risk Exposure

Impax's analytical approach is grounded in the recognition that physical climate risks — including extreme heat, flooding, drought, and severe storms — are already materially affecting company performance across sectors. These risks are particularly acute in sectors with geographically fixed assets, such as utilities and energy infrastructure, agriculture, and real estate, where exposure to climate hazards is not as easy to diversify against.

Impax integrates physical risk analysis during corporate resilience analysis, considering current risk exposure across critical assets and supply chain nodes, the strength of risk management practices, and adaptation actions to enhance future resilience.

Solution Overview

Geography	Global
Year	2023-Present
Solution Type	Taxonomy development; Public markets investing
Applicable Sector(s)	Water & Utilities; Energy; Agriculture & Forestry; Infrastructure & Built Environment; Information & Communication Technology; Financial Services; Healthcare

Description

Impax Asset Management has developed an internal framework to identify and invest in listed companies whose revenues are directly linked to growing global demand for climate adaptation and resilience. Building on its longstanding focus on environmental markets, Impax has expanded its analytical approach to capture the increasing financial materiality of physical climate risks across sectors.

At the core of this approach is a proprietary Climate Opportunities Taxonomy, which maps investable activities across seven adaptation domains and three stages of the adaptation lifecycle: Preparation, Response, and Recovery. This framework enables Impax to classify companies by the share of revenues derived from adaptation-related products and services, applying quantitative revenue thresholds that act as strategy-level eligibility gates: a 50% minimum for Impax's climate-focused strategy and 20% for its broader Environmental Markets strategy. As at end-2025, approximately £5.8 billion of listed equities assets under management met the 20% threshold, demonstrating that adaptation exposure is already significant within mainstream portfolios.

Within this opportunity set, the water value chain represents the most mature and investable segment. Impax identifies water as a critical transmission channel for physical climate risks — including drought, flooding, and heat stress — and a sector with a distinctive commercial model. Unlike many adaptation measures that function as public goods, water infrastructure generates stable, regulated revenues from paying customers and benefits from persistent demand growth driven by both climate impacts and structural factors such as urbanisation, agriculture, and industrial activity.

Impax's portfolio reflects this focus, with exposure spanning stormwater management, water treatment, efficiency technologies, and regulated utilities. Examples include companies providing flood mitigation infrastructure, water treatment systems, precision irrigation technologies, and municipal water services, collectively covering all three lifecycle stages of adaptation and capturing revenues before, during, and after climate events.

Beyond water, Impax's framework extends across multiple sectors — including energy systems, agriculture, infrastructure, information and communication technology, financial services, and healthcare — reflecting the cross-cutting nature of adaptation demand.

Approach

Impax's approach to adaptation investing pairs a structured classification system with fundamental equity analysis and active ownership, enabling it to identify and allocate capital systematically to companies exposed to growing demand for adaptation and resilience solutions:

1

The use of a blended capital stack

At the core of the approach is Impax's proprietary Climate Opportunities Taxonomy, which maps adaptation-related activities across seven domains and multiple sub-sectors, and across three stages of the adaptation lifecycle:

- **Preparation:** investments that reduce exposure to future physical risks (e.g. resilient infrastructure, precision irrigation);
- **Response:** solutions that maintain operational continuity during climate events (e.g. emergency water treatment, backup systems); and
- **Recovery:** activities that support rebuilding and restoration following disruption.

This lifecycle framing captures revenues before, during, and after climate shocks, extending the universe beyond prevention-focused strategies.

Exposure is assessed at the product and service level rather than from corporate self-labelling: for each business segment, Impax estimates the share of revenue from eligible adaptation activities and classifies the company to its highest-exposure sub-sector. An activity qualifies either by supplying a critical component or service into an end-market necessary for adaptation to physical risks, or by delivering measurable incremental resilience or efficiency against a defined baseline — with definitions calibrated by technology and overseen by Impax's Thematic Universe Working Group. Classification draws on public disclosure first, then third-party data and direct engagement, using conservative estimation only as a last resort. Strategy-level revenue thresholds then define the investable universe: approximately £5.8 billion of AUM met the 20% threshold as at end-2025. Eligible holdings include companies involved in stormwater infrastructure, standby power for extreme-weather events, and natural-catastrophe reinsurance.

2

Fundamental analysis and active ownership

Within this universe, Impax applies bottom-up fundamental analysis to select companies with durable competitive advantages and genuine exposure to structural adaptation demand, favouring sectors where physical risk translates into stable revenue. Water is the clearest example, combining climate-driven demand, regulated or contracted revenue models, and sustained infrastructure investment. Crucially, adaptation revenue share governs eligibility, not position size — sizing is set bottom-up on valuation, quality and growth durability within risk limits. For several long-held names, the adaptation lens makes an existing resilience dimension explicit rather than acting as a new acquisition trigger.

Impax complements selection with active ownership, concentrating initial engagement on the most vulnerable sectors — utilities and semiconductors. Two findings stand out: disclosure quality is highly uneven (a handful of utilities that have weathered climate disasters produce exemplary "climate adaptation vulnerability assessments," but most companies fall short of what investors need), and concentrated supply-chain nodes are surprisingly fragile (Hurricane Helene's disruption of a North Carolina mine supplying ~80% of the high-purity quartz used in semiconductor manufacturing created industry-wide risk for months). These insights feed portfolio-management discussions, though allocation decisions are multi-factoral and not attributed to physical risk alone.

Scaling Potential

A classification-driven approach supports scalable portfolio construction. Impax's Climate Opportunities Taxonomy offers a consistent way to identify adaptation-related revenues at the product and service level, and applying quantitative thresholds turns those revenues into measurable, auditable portfolio exposures. Because the same method flows through into both construction and client reporting, it creates a repeatable investment process that can be applied across funds and mandates.

Classification systems can support wider adoption across the investment industry. Impax's experience shows that practitioner-led classification can complement emerging regulatory standards: grounded in real investment experience, market-built frameworks can develop quickly and stay close to practice, which is especially valuable for adaptation, where eligible solutions are diverse, context-specific and fast-moving. Voluntarily shared and refined across the industry, such frameworks can help build the comparability that institutional investors need to size, allocate to, and report on adaptation with confidence.

Broader applicability across sectors and asset classes. Impax's framework spans seven adaptation domains, enabling broad diversification within portfolios. The taxonomy and lifecycle approach can also be extended beyond listed equities to private equity, infrastructure, and fixed income, supporting consistent identification and measurement of adaptation exposure across an asset manager's broader platform.

From Barriers to Solutions

Barriers

Adaptation revenues are often invisible to investors. Many companies generating material adaptation-related revenues do not self-identify as "adaptation" businesses. This leaves the opportunity set poorly visible to investors relying on corporate disclosure or third-party ESG data alone.

Lack of a widely accepted definitional framework. Without consistent definitions, investors face difficulty identifying, classifying, and reporting on adaptation-relevant exposures with credibility. This constrains institutional allocation and limits comparability across portfolios.

Institutional adaptation allocations remain small. Few credible, at-scale listed equity vehicles exist to translate adaptation intent into portfolio positions, limiting the ability of institutional investors to build meaningful exposure.

Solutions

Bottom-up, product-level analysis expands the identifiable universe. Impax's taxonomy-guided research approach enables analysts to identify adaptation revenue streams at the product and service level — independent of corporate self-labelling — significantly expanding the investable universe beyond what issuer disclosure reveals.

A structured classification system supports consistent identification and reporting. Impax's Climate Opportunities Taxonomy provides a domain-specific, sub-sector-level classification with quantitative revenue thresholds, enabling systematic identification of adaptation companies and supporting clear, auditable reporting to institutional investors.

Listed equities lower barriers to institutional adoption. Public equity strategies offer liquidity, scalability, and structural familiarity, enabling institutional investors to build adaptation exposure within existing portfolio frameworks and governance processes — without requiring bespoke structuring or illiquid commitments.

Lessons Learned

Revenue-threshold analysis reveals the depth of the opportunity. Classifying holdings against quantitative revenue thresholds showed that adaptation exposure is already substantial within mainstream listed-equity strategies: £5.8 billion of Impax's AUM met the 20% threshold as at December 2025, giving a rigorous basis for sizing the opportunity and communicating positioning to investors, beyond qualitative claims of adaptation alignment.

The most scalable adaptation investments rest on established revenue models. Where companies serve paying customers through regulated or recurring income tied to essential services, the commercial logic is clear. Water is the strongest example: metered supply of a resource with no substitute, at regulated rates, in a market where climate change is constraining supply as demand rises, making it one of the most investable adaptation themes in listed equities.

A lifecycle lens surfaces revenues that prevention-only approaches miss. Structuring the opportunity across Preparation, Response and Recovery identified investable companies, particularly in response and recovery — from emergency capabilities deployed during events to post-event restoration — whose adaptation revenues are invisible through a prevention-focused lens, enabling broader, more diversified exposure.

Active ownership validates the thesis over time. Engaging companies on resilience strategy, product development and climate-risk disclosure gives ongoing, product-level insight into how adaptation revenues are evolving, complementing the initial classification with forward-looking evidence of business-model durability and growth.

Material exposures often sit in concentrated supply-chain nodes rather than owned assets, so analysis should map vulnerable upstream links. Many companies also remain reactive rather than proactive, and some still rely on optimistic scenarios (e.g. RCP 2.6, premised on 1.5°C) that understate exposure. It is important for investors to probe preparedness and scenario assumptions, not just past losses.

ING

Supporting climate-resilient housing through public-private collaboration

Netherlands, Europe

ING is a European financial institution providing banking services to individuals, small and medium-sized enterprises, large corporations, and financial institutions, with a strong presence across Europe and operations in the Americas, Asia, and Australia. The firm has expertise in retail and wholesale banking and is a market leader in residential mortgage lending in the Netherlands, where it plays a central role in household finance.

Nature of Risk Exposure

Banks' mortgage books can be directly exposed to physical climate risks that could impact asset value, borrower affordability, and long-term portfolio stability. In the Netherlands in particular, foundation problems can represent a high physical risk in certain Dutch regions, due to longer-term shifts in climate patterns in combination with construction year, foundation type, groundwater level and subsoil. Increasing drought could result in subsidence, especially in peat and clay areas, potentially leading to destabilised buildings due to wooden pile rot or differential settlement of houses with shallow foundations. This could result in declining property values, high repair costs, or homes becoming uninhabitable.

For commercial lenders, these risks can in turn translate to reduced collateral value, higher credit risk over the lifetime of the loan, and geographic concentration risk, given the clustering of subsidence-prone areas.

Solution Overview

Geography	Netherlands
Year	2025-Present
Solution Type	Blended debt finance; Government policy
Applicable Sector(s)	Banking; Residential real estate; Low-income households

Description

Approximately 6% of homes in the Netherlands are expected to require climate-related foundation repair within the next 15 years, with average costs that can exceed €120,000 per property. The government estimates that, nationwide, many affected homeowners are unlikely to be able to access additional mortgage financing to renovate their foundations.

To address this gap, the Dutch government established the national roll-out of the **Sustainable Foundation Repair Fund** (FDF) in 2025, in collaboration with, among others, the Dutch Association of Insurers and the Dutch Banking Federation. The Fund is managed by the Dutch Municipal Housing Fund (SVn) and provides loans to homeowners who are unable to finance essential foundation repairs through traditional mortgage channels due to regulated Loan-to-Value (LTV) and Loan-to-Income (LTI) limits. Homeowners who borrow money from the FDF are granted deferred repayment and a waiver of interest payments as long as their income is insufficient to cover these payments. This "customised loan" applies for a period of three years. After each such period, the borrower will start paying market-based interest rates and repayments, unless a reassessment shows that their income is still below the level set in the guidelines.

Dutch mortgage lenders (including ING) and the National Mortgage Guarantee (NHG) act as guarantors in the FDF as part of a public–private risk-sharing arrangement, in the event a client has residual debt at the moment of sale of a repaired home.

The FDF aims to remove barriers in the financing of necessary and highly costly foundation repairs, ensuring that houses remain safe, habitable, and future-proof, while mitigating the risk of a nationwide foundation crisis. The Fund operates as a revolving facility, with repayments recycled into new lending, and is supported by public capital (initially €20 million in 2017 and an addition of €20 million in 2025).

The fund reflects a coordinated approach in which:

- The public sector absorbs a portion of non-commercial and affordability risk
- Commercial banks support existing clients via targeted guarantees rather than new loan origination

Approach

ING's approach to enabling more climate-resilient housing uses targeted risk-sharing mechanisms with the support of physical risk assessment:

Supporting households' access to resilience-enhancing financing: ING and other Dutch mortgage providers play a risk-absorption role in the Sustainable Foundation Repair Fund by acting as guarantors. This participation is selective: banks only take on guarantee obligations when the borrowers already hold mortgages with them, rather than actively acquiring new clients through the Fund.

Under this model government provides concessional capital, mortgage providers and NHG share risk based on residual debt after the sale of a repaired property, and financing is extended to households that would otherwise be excluded from traditional mortgage lending due to regulated loan limits. This structure enables investment in essential resilience measures while maintaining commercial discipline for participating lenders. Risk is monitored over time with ongoing assessment of borrower repayment capacity based on income.

More broadly, and as part of ING's wider approach to assessing climate-related risks, ING continues to develop its internal capabilities to assess exposure to a range of chronic and acute physical climate hazards across time horizons, using data from recognized providers and public authorities. In parallel, ING continues to enhance its climate stress-testing as well as its climate resilience analysis framework to assess the impact of physical and transition risks on corporate and mortgage exposures from a credit-risk perspective. Climate risks are also being considered in the credit risk assessment of our clients as it may pose a financial risk. Lending criteria require mandatory credit risk mitigations, such as insurance or adaptation measures. These include collecting additional data during underwriting to demonstrate risk mitigation. For commercial and residential real estate, material hazards are also being reflected in the property's market value.

Scaling Potential

Several elements of the Netherlands' approach could be replicated and expanded across other geographies and hazard types including:

Public–private repair funds as a replicable model. Public-private models similar to the Sustainable Foundation Repair Fund could be developed to support other types of resilience-enhancing measures, such as flood-proofing retrofits, wildfire-resistant upgrades, or heat-resilient housing. Replication would require clear public-sector risk-sharing, defined eligibility criteria, and strong coordination between lenders, government, and technical experts.

Valuation standards and mandatory information at moment of sale can play a catalytic role. The introduction of foundation condition indicators into Dutch housing valuation guidelines and sales information highlights the catalytic role in shifting market behaviour. Establishing a wider set of hazard-specific risk categories can improve risk transparency, reduce information asymmetries, and enable lenders to incorporate physical risk more systematically into credit decisions. Similar reforms in other jurisdictions could unlock resilience finance by making physical risk visible, comparable, and actionable at the property level.

From Barriers to Solutions

Barriers

Affordability barriers for households. Foundation repair and other resilience-enhancing measures involve high upfront costs that are often prohibitively expensive for households and, in many cases, unfinanceable through traditional mortgage products. This creates a financing gap for investments that are essential for maintaining habitability and long-term asset value.

Misalignment between long-term physical risk and short-term credit decisions. Physical risks such as foundation risk evolve over long time horizons, while mortgage underwriting and pricing are typically based on near-term affordability and current collateral values.

Limited property-level physical risk transparency. Slow-onset risks such as foundation risk have historically been difficult to observe and quantify at the individual property level, limiting lenders' ability to assess risk, differentiate borrowers, and price loans appropriately.

Solutions

Public–private risk sharing to enable affordability. The FDF combines concessional government capital with risk-sharing from mortgage providers, reducing credit risk and enabling the provision of low-cost, long-tenor loans. By absorbing part of the non-commercial and affordability-related risk, the structure allows households to access financing that would otherwise be unavailable, while maintaining participation from private lenders.

Integration of physical risk into risk management and decision-making. Banks are working to incorporate physical risk considerations into stress testing and portfolio monitoring frameworks, enabling a more forward-looking view of risk exposure. These tools support strategic decisions around geographic concentration, portfolio resilience, and the value of enabling adaptation investments that reduce long-term credit risk.

Improved data availability and standardisation of risk indicators. The integration of foundation condition metrics into Dutch valuation standard per 1 April 2026 and in property sales information at moment of sale (expected in 2028), along with a publicly available dataset on foundation risk (expected in 2028) will lead to better availability and usability of property-level risk data. This would reduce information asymmetries, supports more accurate collateral valuation, and will lead to more risk-sensitive lending over time.

Lessons Learned

Public capital is most effective when it targets specific market failures, not entire transactions. For adaptation investments with high upfront costs and uncertain long-term payoffs, public capital or guarantees can help absorb risks that are difficult to price commercially, enabling private lenders to participate at scale. Public capital is most catalytic when it is narrowly deployed to address specific constraints, rather than broadly subsidising projects. This targeted approach enables private participation while preserving market discipline and improving replicability.

Standardisation can facilitate the integration of physical risk into financial decision-making. Incorporating physical climate risk into lending and pricing depends not just on timely data availability, but on the standardisation of comparable, decision-useful metrics. Without this, lenders face challenges in consistently differentiating and pricing risk. Regulatory or industry-wide standardisation, such as embedding risk indicators into property sales information and valuation frameworks, could help improve risk transparency and support more systematic integration into financial decisions.

Incremental investment pathways can unlock broader participation. Even where risks are understood, borrowers may be unable or unwilling to undertake large upfront investments. Financial structures that allow for incremental upgrades, staged investments, or deferred cost recovery can significantly expand participation and lead to cumulative resilience gains over time.

Policy clarity as a critical enabler. The formal recognition of climate risks within regulatory, valuation or supervisory frameworks helps align incentives across stakeholders, reduce uncertainty, and create the conditions for financial innovation. In this context, policy acts as a coordination mechanism as much as a source of support.

Link and AXA

Securing property insurance premium reductions through building resilience

Hong Kong, Asia

Link Asset Management is a leading real estate investor and manager focusing on APAC. It manages a real estate investment portfolio as well as Link Real Estate Investment Trust (Link REIT), the largest REIT in Asia, which includes a diversified portfolio of retail facilities, car parks, offices, and logistics assets across Hong Kong, Mainland China, Australia, Singapore, and the United Kingdom. Link also serves as an investment manager to capital partners through its business line, Link Real Estate Partners.

AXA Hong Kong and Macau is a member of the AXA Group, a leading global insurer with presence in 52 markets, serving over 92 million customers worldwide. As one of the most diversified insurers in Hong Kong, AXA offers products across Life, Health and General Insurance. It is the largest General Insurance provider as well as a major Health and Employee Benefits provider.

Physical risk data and risk modeling

Supporting the scaling of financing solutions

Nature of Risk Exposure

Risk assessments by AXA and Link highlighted acute physical risks, primarily flooding and typhoons, as the most pressing climate risks facing Link's real estate portfolio. Specific high-risk assets were identified due to their structural exposure to floods and typhoons.

Solution Overview

Geography	Hong Kong
Year	2023-Present
Solution Type	Resilience-linked property insurance
Applicable Sector(s)	Insurance; Commercial real estate

Description

In 2023, Hong Kong experienced one of its most severe seasons of extreme weather events, including the historic Haikui Typhoon and Black Rain of 2023, which caused major flooding and significant business interruption across several of Link's flagship assets. In response to these events, Link decided to conduct extensive physical risk assessment of its Hong Kong real estate portfolio and implement HK$8 million in flood and typhoon resilience measures over the course of 2024, targeting its highest-risk assets.

In an attempt to reduce the payback period on these investments, Link sought to create a resilience-linked property insurance model that would translate improved resilience into reduced property insurance premiums. To do so, Link partnered with AXA on a proof-of-concept (PoC) analysis that quantified the potential loss reduction benefits of Link's resilience investments. AXA's modeling found that the HK$8 million in flood resilience investments could reduce loss severity by 10–20% under extreme weather scenarios, warranting a reduction in property insurance premiums of a similar magnitude. The PoC provided Link with quantifiable evidence of the loss mitigation benefits of its resilience measures, strengthening its negotiating position during its subsequent insurance renewal process.

With this analysis in hand, Link decided to conduct a resilience-focused roadshow which engaged more than 20 insurers to identify an insurer who would be receptive to valuing the benefit of its adaptation investments. In the end, Link renewed their policy with the incumbent insurer, who was able to offer the most competitive pricing, and agreed to materially improved terms as a result of Link's resilience investments, including: (i) an 11.7% reduction in property premiums for 2025 (vs 2024) — substantially outperforming the market's ~3% average reduction; (ii) eligibility for an additional 7.5% performance-linked premium reduction, contingent on Link maintaining a loss ratio (claim values as share of premium paid) below 60%; and (iii) a two-year contract (based on the aforementioned condition), replacing the typical annual renewal cycle and providing greater pricing stability.

Approach

Link adopted a four-part strategy: (i) quantify its physical climate risks, (ii) identify and invest in targeted resilience upgrades, (iii) model the financial benefits of these measures, and (iv) use this analysis to negotiate improved insurance terms:

1 Physical risk assessment	Link conducted a suite of physical climate risk assessments to evaluate hazard exposure, model financial impacts, and identify asset-level vulnerabilities across its Hong Kong portfolio. These included: Climate Value-at-Risk (CVaR) modeling, which allowed the firm to estimate potential losses under multiple climate scenarios; coastal threat and flood exposure analysis, assessing risks from storm surge, sea-level rise, and drainage constraints; and detailed engineering assessments of 12 high-risk assets to identify structural and operational weaknesses. The analyses confirmed flooding and typhoons as the dominant acute risks and identified specific assets requiring immediate intervention.
2 Targeted resilience enhancements	Based on the findings of its physical risk assessment, Link invested HK$8 million in targeted flood and typhoon resilience measures across its highest-risk properties. Interventions included engineering upgrades (such as installing detachable flood barriers, and flood sensors, making drainage improvements, and relocating electrical switchboards) as well as operational enhancements (including improving drainage clearance schedules, introducing flood-response protocols, developing real-time monitoring systems, and initiating emergency drills). All measures were supported by feasibility studies to ensure technical robustness and high risk-reduction potential.
3 Quantifying potential loss mitigation	To evaluate whether these investments would translate into improved insurance terms, Link partnered with AXA on a Proof of Concept (PoC) analysis. AXA assessed asset level flood exposure and modeled how the HK$8 million in resilience measures would reduce both direct physical damage, and indirect business interruption impacts.The PoC concluded that Link's interventions could reduce loss severity by 10–20% under extreme weather scenarios similar to those experienced in 2023, providing quantifiable evidence of adaptation-driven financial risk reduction and strengthening Link's negotiation position ahead of its insurance renewal.
4 Proactive market engagement and insurance outcomes	Equipped with this modeling, Link proactively re-engaged the insurance market. Working with its broker, Marsh, Link undertook a resilience-focused "roadshow", engaging with more than 20 insurers to identify partners willing to recognize the value of its adaptation measures. Link's incumbent insurer ultimately provided the most favorable terms and agreed to: (i) an immediate reduction of 11.7% in property premiums in 2025 (vs 2024), (ii) an additional performance-linked premium reduction of 7.5% available in the future, contingent on Link being able to maintain a loss ratio below 60%, and (iii) a longer, two-year contract predicated on the aforementioned condition, rather than the standard annual renewal terms.

Scaling Potential

Link's approach illustrates a replicable roadmap for the real estate sector:

Model the hazards and calculate the probable financial impact. By combining methodologies such as CVaR to simulate specific scenarios with specific asset-level characteristics such as the location and nature of the building, firms can calculate the Probable Maximum Loss (PML), taking into account both actual physical damage and the financial impact of business interruption. This analysis can serve as the foundation for evaluating risk tolerance and the cost/benefit of different possible

Plan or implement targeted resilience measures. Guided by their financial risk modeling, firms can prioritize adaptation measures that offer the highest risk reduction per dollar invested. This can entail a mix of engineering solutions, such as flood gates and electrical switchboards, and operational protocols, such as enhanced drainage clearance schedules and emergency response drills. By focusing these interventions on specific risk hotspot (e.g., coastal properties or low-lying malls), companies can demonstrably lower their physical vulnerability in a way that underwriters can subsequently value.

Quantify and proactively communicate the impact of planned or completed measures to the insurance market. This could involve carrying out a resilience-focused roadshow and/or exploring other avenues that give companies an opportunity to engage multiple insurers. Firms could use this as an opportunity to showcase planned or, as in the case of Link, completed resilience-enhancing measures, and identify partners willing to factor in the value of these measures in their coverage and premium terms.

Engage insurance partner to negotiate improved terms. Firms can then engage with providers to secure lower premiums or longer contracts based on demonstrated resilience outcomes, contingent on certain co-agreed resilience-linked KPIs. Periodic monitoring by the insurer can ensure that pre-agreed KPIs are being achieved, and provide additional incentives for clients to further invest in adaptation measures.

From Barriers to Solutions

Barriers

Uncertain payback period for resilience investments. Adaptation investments typically require upfront investment while the financial benefits are realised only through avoided future losses. Because these benefits are uncertain and may materialise over long time horizons, asset owners often struggle to justify resilience investments relative to other capital priorities.

Difficulty converting engineering resilience measures into financial risk metrics. Asset owners often implement physical interventions, such as flood barriers or drainage improvements, but may lack the analytical frameworks needed to quantify how these measures affect expected losses

Scenario-based risk modeling can quantify the financial impact of resilience measures. Through the PoC analysis conducted with AXA, Link was able to translate engineering interventions into actuarial terms by modeling reductions in expected losses under extreme weather scenarios. This enabled insurers to assess resilience measures within a financial risk framework used in underwriting.

Solutions

Linking resilience investments to insurance terms can help shorten payback periods. By demonstrating that Link's HK$8 million investment in resilience upgrades could reduce expected loss severity by 10–20% under extreme weather scenarios, Link was able to negotiate an immediate reduction in property insurance premiums. This translated avoided future losses into a near-term financial benefit, strengthening the investment case for resilience measures and reducing the perceived payback period.

Scenario-based risk modeling can quantify the financial impact of resilience measures. Through the PoC analysis conducted with AXA, Link was able to translate engineering interventions into actuarial terms by modeling reductions in expected losses under extreme weather scenarios. This enabled insurers to assess resilience measures within a financial risk framework used in underwriting.

Multi-year insurance agreements can support longer term resilience planning. Link's negotiations with insurers resulted in a two-year insurance contract. This provided greater pricing stability and created stronger incentives to maintain and continue investing in resilience-enhancing measures. However, Link had trouble securing the internal and external buy-in necessary to develop even longer multi-year relationships with insurers.

Limited standardization in avoided-loss modeling methodologies. One of the biggest obstacles identified by Link was the absence of a credible, widely accepted way to quantify avoided losses such as how much damage would have occurred without the implemented resilience measures.

While methodologies are still evolving, the AXA/Link collaboration illustrates how insurers can use scenario-based modeling and asset-level analysis to estimate the loss-reduction benefits of adaptation measures. Such approaches provide a template for developing more standardized avoided-loss methodologies that could enable broader market adoption of resilience-linked insurance structures.

Insurance pricing remains heavily reliant on backward-looking loss metrics. Property insurance underwriting in Hong Kong is heavily reliant on historical loss ratios, which may not capture improvements in forward-looking resilience. As a result, proactive adaptation investments may not be fully reflected in pricing outcomes.

Introducing resilience-linked performance mechanisms can help align incentives. Link's insurance agreement included a 7.5% performance-linked premium reduction contingent on maintaining a loss ratio below 60%, a KPI that was ultimately missed due to non-climate related incidents (e.g. burst pipe, mechanical failures). Such mechanisms represent a step toward incorporating future-facing resilience outcomes into pricing structures.

Limited transparency in how insurers incorporate resilience into underwriting decisions. Even when asset owners provide detailed risk assessments and modeling outputs, they may have limited visibility into how this information in used when setting premiums or coverage terms. This reduces incentives for firms to invest in resilience.

Structured engagement with the insurance market can improve recognition of resilience investments. Link engaged with more than 20 insurers. This proactive engagement helped identify insurers willing to consider resilience improvements in underwriting and strengthened Link's negotiating position.

Lessons Learned

Risk assessments should be tailored and timed to feed directly into underwriting decisions. To better influence pricing, risk assessments should be completed before the renewal cycle, framed explicitly for underwriting use, translated into actuarial terms, and accompanied by avoided-loss modeiing.

Developing a standardized methodology for avoided-loss modeling is essential to scaling resilience-linked insurance. A major obstacle to scaling resilience-linked insurance solutions is the absence of widely accepted methodologies for estimating avoided losses. Challenges include defining counterfactual baselines, isolating climate-related losses from other operational incidents, and translating engineering assessments into actuarial risk metrics. Without standardization, insurers cannot consistently incorporate loss-mitigation benefits into pricing, and asset owners cannot build a reliable ROI case for adaptation investments.

Loss ratio is an insufficient KPI — new resilience metrics are needed. There is a need to develop and embed resilience-specific KPIs (e.g. weather-normalized loss ratios, hazard-specific performance metrics, CapEx-to-risk-reduction indices, verified implementation of adaptation measures, avoided-loss benchmarks) into sustainability linked insurance solutions. Until such KPIs are widely adopted, incentives will remain misaligned and resilience benefits undervalued.

Internal buy-in is key. Within asset owners, capital management teams and insurance procurement teams often default to traditional broker-led processes, prioritize price over structure or incentive innovation, and view climate KPIs as risky or difficult to achieve. It's essential for asset owners to build early internal alignment: educating capital management teams, clarifying the value proposition, and integrating resilience objectives into renewal strategies and broker mandates.

Greater transparency is needed in the underwriting process. Persistent issues include limited transparency on how CapEx is incorporated; inconsistent valuation of risk data across insurers; dependence on individual underwriters' judgment or interest in innovation; lack of standardized methods for integrating resilience data. Greater transparency and a clearer articulation of how resilience influences pricing would strengthen incentives.

Macquarie

Strengthening Finland's electricity grid against extreme weather through multi-year capital investment

Finland, Europe

MACQUARIE

Macquarie Asset Management (MAM) is a global asset manager with deep experience investing in infrastructure, real assets, and essential services. Headquartered in Sydney with offices across Europe, North America, and Asia-Pacific, MAM manages capital on behalf of pension funds, insurance companies, sovereign wealth funds, and other institutional investors. With over two decades of experience investing in utilities and energy networks globally, MAM has developed particular expertise in electricity transmission and distribution, renewable integration, and grid modernisation. MAM's investment approach integrates regulatory analysis, operational improvement, capital structuring expertise, and disciplined risk management.

Active client engagement & stewardship

Supporting the scaling of financing solutions

Nature of Risk Exposure

Finland's electricity distribution network spans vast forested and sparsely populated regions, where overhead lines are directly exposed to acute physical climate hazards — including high-wind storms, thunderstorms, heavy snowfall, ice loading, and falling trees. These hazards can cause line failures, infrastructure damage, and prolonged power outages across communities covering a large geographic area.

Climate projections for Northern Europe point to increasing storm intensity, more frequent extreme wind events, heavier wet snow, and freeze–thaw cycles that weaken both vegetation and network resilience. At the same time, accelerating electrification is increasing system load and societal reliance on uninterrupted power. The combination of rising demand and escalating physical hazard exposure magnifies the economic and social consequences of outages.

Without sustained investment in underground cabling, automation, smart grid technologies, and advanced vegetation management, distribution networks remain highly exposed to recurring storm-related disruption.

Solution Overview

Geography	Finland
Year	2017-Present
Solution Type	Engagement; Equity investment
Applicable Sector(s)	Asset management; Infrastructure; Utilities

Description

In 2017, a Macquarie Asset Management (MAM)-led consortium acquired Elenia — Finland's second-largest electricity distribution network operator, which serves approximately 430,000 customers across more than 100 municipalities (as at December 2025).

Since acquiring its ownership stake, MAM has supported Elenia in improving the physical resilience of its electricity network, which historically relied on extensive overhead medium-voltage power lines highly exposed to weather-related hazards. With support from MAM, Elenia was able to meaningfully accelerate its multi-year resilience-enhancing strategy, which focused on:

Undergrounding critical distribution infrastructure to reduce exposure to extreme weather events such as storms, snow, and ice. Since MAM's involvement, additional capital expenditure significantly accelerated Elenia's underground cabling rate — from 41% at the time of acquisition to 66% at the end of 2025, significantly higher than the national rate of 55% and with a long-term goal of reaching 90% by 2036.

Network automation and remote monitoring capabilities for faster fault detection and restoration, advanced digital grid management systems to enhance operational visibility and outage response, and improved data collection and intelligence to strengthen storm preparedness and long-term planning.

Expanded network capacity to support renewable integration and rising electrification demand.

In 2025, Storm Hannes — the most severe storm to impact Finland in 14 years — provided a real-world stress test of this resilience strategy. While the storm caused significant electricity supply disruption and power outages across many parts of Finland, areas within Elenia's network that had undergone undergrounding and modernisation experienced fewer outages and faster recovery times, mitigating more costly impacts and longer disruptions. This underscored both the progress achieved to date and the continued need for investment in remaining vulnerable segments of the grid.

Approach

Through its long-term equity investment, MAM has played a key role in strengthening the resilience of Elenia's electricity distribution infrastructure. MAM's role spans strategic oversight, board participation, and disciplined capital allocation aligned with long-duration infrastructure objectives. More specifically, MAM has supported Elenia in enhancing its resilience by:

1

Supporting the development and execution of multi-year capital expenditure (CapEx) plans focused on resilience

After major storms in 2011 exposed systemic vulnerabilities in Finland's network, Elenia launched a long-term programme to weatherproof and modernise its grid. Since then, the company has invested more than €1.6 billion in strengthening network resilience.

Under MAM's stewardship, this programme has been accelerated and strategically prioritised within forward-looking capital planning cycles. Investment has focused on systematically replacing exposed overhead lines with underground cabling, reinforcing critical network segments, and modernising ageing infrastructure. With MAM's support, Elenia was able to lay more than 1,200 kilometres of new underground cable in 2024 alone, and increase its overall underground cabling rate from 41% at the time of acquisition to 66% by the end of 2025 — with a long-term goal of reaching 90% by 2036 — materially reducing exposure to extreme weather across large sections of the network.

In addition to physical hardening measures, MAM has supported Elenia in: incorporating network automation and remote-control capabilities for faster fault detection and restoration; implementing advanced digital grid management systems to enhance operational visibility, situational awareness and outage response; improving data collection and system intelligence to strengthen storm preparedness and long-term resilience planning; and expanding network capacity to support renewable integration and rising electrification demand.

2

Strengthening operational execution and workforce capability

Delivering large-scale underground cabling across remote, forested and weather-exposed terrain requires disciplined operational management and a strong safety culture. Through board-level engagement and knowledge-sharing across its global infrastructure portfolio, MAM has supported continuous improvements in key health and safety topics, project execution, and workforce capability. This has helped ensure that undergrounding and modernisation programmes can be scaled efficiently while maintaining high standards of reliability and safety.

Elenia's resilience strategy was tested during Storm Hannes, which felled an estimated 20,000 trees onto Elenia's overhead lines and left up to 76,000 customers without power at peak disruption across approximately 100 municipalities. Thanks to the resilience measures implemented, Elenia was able to activate crisis response and restoration systems — mobilising field crews, contractors and aerial resources to address more than 3,000 repair tasks. Despite severe conditions and widespread damage, electricity supply was restored to over 60,000 customers within 24 hours. While sections of the network with remaining overhead infrastructure experienced prolonged outages and, in some cases, required partial reconstruction, in areas with underground cables, the essential functions and services remained secure demonstrating greater resilience and faster recovery, highlighting both the progress achieved to date and the continued need for systematic grid hardening as climate-related hazards intensify.

Scaling Potential

Strong potential for replication across other regulated infrastructure sectors. The core features of this solution, long-term equity ownership paired with systematic integration of resilience measures into long-term capital investment cycles, translate well to other regulated infrastructure sectors, such as water utilities, gas distribution networks, district heating systems, and transport infrastructure. In any asset class characterized by long economic lives, stable revenue mechanisms, and predictable cost recovery, resilience interventions can be embedded into planned modernization or replacement cycles. This reduces dependence on concessional finance and enables adaptation to be funded through existing regulatory and investment frameworks. The long term nature of equity financing creates strong incentives for equity owners to focus on resilience.

Scalability may be greatest in jurisdictions with strong regulatory environments. This model is particularly suited to geographies with credible regulatory institutions and transparent tariff frameworks. Cost-recovery rules determine whether new investments can be added to the regulated asset base, the speed at which utilities recover expenditures from customers, and the allowed return on capital. Where these mechanisms are predictable and consistently applied, resilience CapEx can be incorporated into routine planning. Mature markets with long-standing regulatory practices may therefore be best placed to scale this model, whereas jurisdictions with volatile tariff regimes or weak enforcement capacity may face challenges in sustaining investor confidence. As EMDEs strengthen regulatory systems and expand private participation in infrastructure, similar models may become viable.

From Barriers to Solutions

Barriers

Long payback periods demand patient capital. Major resilience investments — such as widespread undergrounding — require substantial upfront capital, but deliver benefits over many decades and often do not show up as immediate financial returns. For many traditional investors with shorter horizons, this disincentives proactive resilience investments.

Need for regulatory clarity. In regulated utility environments, resilience spending is highly reliant on there being sufficient regulatory clarity. Ambiguity about future regulatory treatment or uncertainty around tariffs can deter investors from committing capital. Without predictable regulatory rules, even clearly needed climate-resilience upgrades may struggle to secure financing.

Solutions

Long-term capital allocation strategy. The long-duration ownership model used by MAM meant that resilience investments could be evaluated based on their contribution to the long-term value and stability of the asset rather than near-term earnings. This enabled the consortium to prioritize multi-year CapEx plans, accelerate undergrounding timelines, and treat adaptation measures as core components of asset stewardship.

Predictable regulatory frameworks supporting financing. In Finland, legally defined service-reliability requirements provided a stable regulatory foundation for financing resilience investments. The explicit outage-duration limits established in national regulation served as a clear signal that major grid modernization and hardening were necessary.

Need for strong operational and execution capacity. Climate adaptation in infrastructure is logistically complex. Undergrounding requires managing remote terrain, seasonal construction windows, and safety risks. Large programs risk operational/execution issues which can erode investor returns.

Enhanced operational execution and delivery capabilities. Active oversight from MAM helped Elenia enhance health and safety protocols, project management and coordination. By improving planning, procurement, and operational supervision, the investment consortium reduced workplace health, safety, and environmental (WHSE) risks and uncertainty around timelines and costs. This increased confidence in the deliverability of the resilience program and made financing easier to sustain.

Difficulty demonstrating the near-term benefits of adaptation investments. Adaptation programs often span decades. Without clear evidence that resilience upgrades are working, investors may de-prioritize funding, especially when benefits are contingent on future extreme-weather events or are difficult to attribute.

Demonstrated performance validated resilience investment. When severe weather affected the network, modernized and undergrounded segments consistently showed fewer failures and faster recovery times. These real-world stress testing validated the investment strategy, strengthened stakeholder confidence, and provided a credible foundation for continued financing of the remaining adaptation measures. Demonstrated resilience under stress can play a critical role in sustaining capital commitments over time.

Lessons Learned

Adaptation requires investment horizons aligned with climate risk timeframes. Long-duration climate risks often exceed the time horizons of conventional financing models. Structures that allow investors and operators to plan over decades, rather than years, enable the type of capital commitments needed for resilient infrastructure.

Resilience is maximized when physical upgrades and digital capabilities evolve together. Adaptation strategies are most effective when hardening measures (e.g., reinforcing or undergrounding assets) are paired with digital tools that enhance system visibility, automation, and rapid response. This dual approach can multiply the value of each investment.

Adaptation depends not only on capital but also on implementation capability. Even well-designed resilience plans can falter without strong operational capacity. Project execution, contractor coordination, workforce skills, and safety management are critical enablers of successful adaptation.

Stress-testing, whether modeled or real, reinforces the value of resilience investment. Demonstration of how infrastructure performs under extreme conditions provides powerful validation of adaptation spending. Stress tests can build confidence among regulators, investors, and operators, supporting continued or expanded investment in resilience measures.

MUFG

Catalyzing blended finance for climate adaptation through the GAIA Climate Loan Fund

Global

Mitsubishi UFJ Financial Group (MUFG) is Japan's largest bank. MUFG has been a major provider of Environmental, Social and Governance (ESG)-linked loans and bonds, with more than 578 sustainable finance transactions supporting over 130 GW of renewable energy capacity globally. In adaptation and resilience, MUFG has helped advance blended finance approaches to mobilize private capital where risks, market constraints, or limited credit depth have historically prevented commercial financing, particularly in emerging markets and developing economies (EMDEs) that face acute climate exposure and constrained fiscal capacity.

Blended finance and risk sharing

Supporting the scaling of financing solutions

The **GAIA Climate Loan Fund (GAIA)** is a blended finance platform that provides loans to predominantly climate adaptation projects in EMDEs. GAIA was co-founded by MUFG, FinDev Canada, and Green Climate Fund (GCF), with Climate Fund Managers (CFM) serving as manager for the Fund.

Nature of Risk Exposure

EMDEs face elevated exposure to physical climate risks, including floods, droughts, extreme heat, and coastal hazards, which increasingly threaten critical infrastructure, natural resources, and essential public services.

These risks can disrupt economic activity, damage productive assets, and impose significant fiscal burdens on governments, with impacts often cascading across sectors and disproportionately affecting vulnerable populations. Unlike more localized or insurable risks, climate-related hazards are often systemic, recurrent, and spatially correlated, meaning that losses can accumulate over time and affect entire regions simultaneously.

Solution Overview

Geography	Targeting 19 countries across Africa, Asia, and Latin America
Year	2025-Present
Solution Type	Blended debt finance; EMDE financing
Applicable Sector(s)	Banking; MDBs and DFIs; Sustainable agriculture; Water management; Ecosystem resilience; Climate-smart infrastructure

Description

MUFG has played a key role in designing, structuring, and mobilizing capital for the GAIA Climate Loan Fund, a blended finance debt platform aimed at attracting private capital for adaptation and resilience projects in EMDEs.

Launched in 2024, GAIA provides long-term loans to sovereign, sub-sovereign, quasi-sovereign, and state-owned entities, including municipalities, development banks, and utilities, across 25 countries in Africa, Asia, and Latin America. At least 25% of capital is allocated to Least Developed Countries (LDCs) and Small Island Developing States (SIDS), where financing needs are most acute. The fund is targeting a total size of US$1.48 billion, with an initial close of US$600 million completed in November 2025 and final close anticipated in 2027. At least 70% of capital is dedicated to adaptation, focusing on water, food security, resilient infrastructure, and ecosystem protection, with the remaining 30% allocated to mitigation.

GAIA's structure combines concessional capital from public and development finance institutions, primarily the GCF and FinDev Canada, with commercial capital commitments, including from MUFG. This blended structure enables concessional capital to play a catalytic, risk-absorbing role, improving the risk–return profile and enabling private investors to participate on commercially viable terms.

Specifically, GAIA employs a multi-layered capital stack, comprising a US$310 million junior first-loss tranche funded by concessional partners, a US$1.17 billion senior tranche for institutional investors, and an unfunded guarantee/insurance facility of up to US$300 million. This structure is further supported by additional credit enhancement mechanisms, including (i) a reserve account (capped at 5% of fund size) that absorbs senior-level losses using surplus income, and (ii) dedicated facilities to address key investment constraints, including an up to US$50 million technical assistance (TA) facility to support project preparation and an up to US$20 million foreign exchange (FX) hedging facility to enable local currency lending.

Fund governance is structured to balance commercial and impact objectives, with a private-sector-led Credit Committee overseeing investment decisions and a public-sector-led Climate and ESG Committee ensuring alignment with climate and development outcomes.

Approach

MUFG has supported GAIA across multiple functions, including fund design, capital provision, and active origination.

1 Fund co-creation	MUFG co-founded the GAIA Fund alongside FinDev Canada and the Green Climate Fund (GCF), with Climate Fund Managers (CFM) acting as fund manager and Pollination supporting delivery. A defining feature of the fund's development was the active co-creation of its structure between concessional and commercial partners.
2 Senior capital provider	AIA uses a layered blended finance structure combining concessional and private capital to realign risk-return dynamics. A junior tranche funded by GCF and FinDev Canada absorbs first-loss risk, while a senior tranche enables participation from commercial investors, including MUFG. This is complemented by a FX facility to enable local currency lending and a TA facility to strengthen project preparation and ESG readiness. Together, these mechanisms address key constraints, including currency risk and limited project development capacity. The allocation of capital across tranches reflects differentiated mandates, with institutions such as FinDev participating across both concessional and commercial layers.
3 Active origination	MUFG acts as an active origination partner, leveraging its global network and working with local financial institutions to source and structure opportunities. Local partners provide underwriting expertise, market knowledge, and access to pipelines, often leading to co-financing arrangements. This approach helps convert resilience needs into investable opportunities, particularly at the sub-sovereign level.

GAIA Capital Structure

GAIA vision is to create an attractive investment vehicle with a risk profile aligned with private investors' requirements. This approach includes:

- **Blend of different capital sources** to match investors to risk-return profiles
- **A multitiered fund structure by** tiering capital with different risk profiles
- **Credit enhancement features and reserve account**

TIERED CAPITAL STRUCTURE

- **Senior Capital Tranche:** Dedicated to and funded by institutional investors that benefit from protection.
- **Junior Capital Tranche:** First-loss facility, funded by impact and concessional fund providers.
- **Guarantee/Insurance Facility:** Second-loss optional unfunded insurance/guarantee tranche. Provided directly to the senior investors and will cover losses up to a cap of US$300 million in excess of the total First-loss Junior Capital Tranche committed.

RESERVE ACCOUNT AND FACILITIES

- **Technical Assistance Facility:** Dedicated parallel facility to enhance origination efficiency by structuring viable projects and measuring their SDG impact.
- **FX Hedging Facility:** Subsidises the hedging cost to support lending in local currency
- **Reserve Account:** Protection-top-up mechanism funded through the excess income produced by the platform, absorbs Senior interest and principal losses before Junior Capital Tranche.

Upon full deployment, GAIA aims to benefit 19 million people and create more than 11,000 jobs; avoid ~30 million tonnes of emissions per year, deliver ~700 MW of renewable energy capacity and ~36,000 GWh of clean generation annually, and improve the resilience of over 5,000 km^2 of natural resources.

Scaling Potential

Replicable structure. GAIA was purposefully designed to be a replicable model for channeling blended finance towards adaptation projects across multiple geographies and sectors. Specifically, GAIA's fund design (e.g., first-loss sizing, FX facility, TA facility) is replicable across different markets and fund vintages, and the clear separation of roles between concessional, development, and commercial capital (e.g., use of first-loss capital to crowd in private investment) can be replicated with different anchor providers or regional development banks. This replicable model reduces structuring friction, enabling faster fund launches and more efficient scaling as stakeholders become familiar with a proven blended finance model.

More targeted fund strategies may exhibit greater scaling potential. While the GAIA model is broadly scalable, future iterations may benefit from more targeted strategies, such as focusing on specific themes or a narrower set of geographies. Greater focus can help address investors' mandates which are usually constrained by theme and/or region.

Pipeline development as a binding constraint. Scaling depends not only on mobilizing capital but on building a robust pipeline of investable projects. A persistent challenge is the gap between projects with strong climate rationale and those that meet investor requirements. Addressing this requires continued investment in origination capacity, technical assistance, and local financial partnerships, without which capital may remain under-deployed.

Investor landscape constraints. Scaling adaptation-focused blended finance will depend on expanding the institutional investor base. However, blended finance does not yet function as a clearly defined asset class, and in many asset-owning institutions sustainability initiatives are not embedded within core portfolio allocation strategies. As a result, these vehicles often lack a clear home within investment mandates, making it difficult to identify potential investors or estimate the potential size of the market for adaptation-focused blended finance.

Regulatory and structural constraints. Complex regulatory environments across jurisdictions can constrain investor participation in blended finance structures. For example, certain structures risk classification as securitization under EU rules, restricting insurer participation under Solvency II. These constraints often require funds to be tailored to specific investor bases, reducing flexibility and limiting scalability. Greater regulatory clarity and standardization are therefore important scaling enablers.

From Barriers to Solutions

Barriers

Misalignment between impact ambition and investability: Blended finance structures often face a tension between ambitious, highly specified impact requirements from concessional providers and the practical constraints of investors and project developers. Detailed and resource-intensive impact metrics can limit investor participation and slow deployment when applied too rigidly.

Risk-return misalignment: Adaptation projects in EMDEs often exhibit risk-return profiles that are misaligned with the needs of commercial investors. Revenues may be indirect or linked to avoided losses rather than cash-generating assets, while exposure to climate hazards and long tenors increases perceived downside risk. As a result, purely commercial finance frequently views adaptation as unbankable.

Pipeline constraints: A commonly cited barrier to adaptation finance is the perceived lack of scalable, investment-ready projects, particularly in EMDEs. This perception may be driven by insufficient origination, structuring capacity, and local market engagement rather than a lack of underlying demand.

Innovative blended finance structures may struggle to gain internal traction within large FIs: Within large FIs, new financing models can remain confined to sustainability teams unless they are integrated into core investment and capital allocation processes. Without strong institutional backing, complex blended finance initiatives may fail to progress from concept to implementation.

Regulatory and structural constraints can limit participation from institutional investors: Differences in regulatory treatment across jurisdictions (such as rules affecting how blended finance vehicles are classified) can restrict participation by certain investor groups and complicate fundraising.

Limited institutional familiarity with adaptation-focused blended finance: For many institutional investors, large-scale adaptation funds represent a relatively new asset class, particularly when structured as blended finance vehicles. Limited track records, unfamiliar governance arrangements, and uncertainty around impact measurement can deter participation.

Solutions

Collaborative fund design to balance impact credibility and investability: GAIA was co-created by concessional and commercial partners, enabling alignment between impact objectives and market realities. Early private sector engagement helped ensure that impact requirements remained credible but operationally feasible, while structuring terms that could attract private capital.

Blended finance structure with targeted de-risking mechanisms: GAIA uses a layered capital structure with concessional first-loss capital, alongside FX and TA facilities. These mechanisms improve project bankability, strengthen preparation and ESG readiness, and help bridge the gap between climate impact and commercial viability, converting resilience needs into investable opportunities.

Active origination and local partnerships: MUFG plays an active origination role, leveraging its global network and partnerships with local financial institutions to source and structure transactions. This approach strengthens pipeline development and supports the translation of adaptation needs into scalable investment opportunities.

Institutional support can elevate blended finance initiatives to strategic priorities. At MUFG, GAIA was a strategic initiative part of the Group's overall business strategy, rather than a niche ESG project. This institutional backing enabled internal alignment across teams and helped translate the concept into a viable fund structure capable of mobilising significant capital.

Careful fund design and early investor engagement: GAIA's structure was developed through close collaboration between public and private partners, ensuring that the fund's governance, risk-sharing arrangements, and capital stack could accommodate the regulatory requirements of multiple investor groups.

Strong governance frameworks and credible institutional partners: GAIA established a Climate and ESG Committee and a Credit Committee, which gave both public and private investors oversight of portfolio development, risk management, and impact performance, and was pivotal to the fundraising process. Participation from established concessional partners further strengthened credibility by signaling high standards for climate impact and development additionality.

Key Design Considerations

Adaptation is investable when risks are properly allocated. Despite the perception that adaptation is primarily a public finance challenge, private capital can be mobilized when risks are appropriately structured and managed. In many cases, the key constraint to scaling adaptation finance may not be a lack of demand, but the absence of financing structures that translate resilience needs into investable opportunities.

Narrowing the gap between climate impact and bankability is also key. A strong and investable project pipeline is essential for effective deployment, but in practice there is often a gap between projects with high climate impact and those that meet investor requirements. Addressing this requires early-stage groundwork, including active origination, partnerships with local institutions, and investment in project preparation to convert resilience needs into bankable opportunities.

Alignment across the capital stack is critical. The success of blended finance structures depends on aligning institutions with different mandates, return expectations, and risk appetites around a shared investment thesis. Misalignment, particularly between concessional impact requirements and commercial return expectations, can constrain investor participation and capital deployment.

Standardization and origination capacity are key to scale. Scaling blended finance hinges on the ability to originate and structure transactions efficiently. Standardized approaches, along with strong local partnerships and technical expertise, can reduce transaction costs and support more consistent deployment across markets.

Flexibility in fund design supports capital mobilization. Blended finance structures should be adaptable to evolving investor expectations. Adjustments to concessional buffering, risk allocation, and governance arrangements can be key to attracting capital.

PIDG and Ninety One

Mobilizing debt financing for climate-resilient water infrastructure

Rwanda, Africa

Ninety One is a global investment manager with deep experience in emerging and frontier market debt. Headquartered in Johannesburg and London, the firm manages strategies across public and private markets and has expertise in infrastructure debt, sovereign risk analysis, and long-duration investing.

The Emerging Africa and Asia Infrastructure Fund (EAAIF) is a blended infrastructure debt fund, part of the Private Infrastructure Development Group (PIDG), that mobilizes long-term public and private capital for infrastructure projects across Africa and Asia, combining donor-backed equity with debt facilities raised from development finance institutions and private institutional investors. Since 2016, Ninety One has served as external fund manager.

PIDG is an innovative infrastructure developer and investor, mobilising private investment in sustainable and inclusive infrastructure in sub-Saharan Africa and south and south-east Asia for 25 years. Apart from debt through EAAIF, it offers technical assistance, project development and guarantee solutions to make EMDE projects more bankable.

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

Rapid population growth and economic expansion have placed increasing strain on existing groundwater-based water systems across much of Africa. Climate change projections for Rwanda indicate prolonged dry seasons and higher evaporation rates, increasing the risk of water scarcity and seasonal shortages. Continued reliance on groundwater alone heightens exposure to depletion under drought conditions, creating vulnerabilities for households, industry, and public services.

At the same time, increased rainfall intensity and more frequent extreme weather events raise the risk of flooding and elevated sediment and pollution loads in river systems. These dynamics can overwhelm aging treatment infrastructure, degrade water quality, and disrupt service delivery. Without modern treatment capacity and integrated catchment management, climate variability could lead to more frequent service interruptions and higher operating costs.

Solution Overview

Geography	Rwanda
Year	2017-Present
Solution Type	Blended debt finance; EMDE financing
Applicable Sector(s)	Asset management; MDBs and DFIs; Water management

Description

Launched in 2001, the Emerging Africa & Asia Infrastructure Fund (EAAIF) is a blended infrastructure debt fund that mobilizes long-term public and private debt capital for infrastructure projects across Africa and Asia, combining donor-backed equity with debt facilities raised from development financial institutions (DFIs) and private institutional investors. The Fund is part of the Private Infrastructure Development Group (PIDG), a multi-donor organisation with members from six governments, with the UK, Dutch, Swedish and Swiss Governments acting as anchor shareholders for the Fund.

Since 2016, and following a competitive mandate, EAAIF has been externally managed by Ninety-One and fully integrated into Ninety One's emerging market alternative credit investment platform. As manager, Ninety-One carries out origination, credit assessment, portfolio management, and capital mobilization from DFIs and private institutional investors.

In addition to the anchor shareholding from the UK, Dutch, Swedish and Swiss Governments, Ninety-One periodically raises debt for EAAIF from private investors, including Allianz Global Investors, Standard Bank, and Standard Chartered, as well as DFIs, such as the African Development Bank (AfDB), the Dutch Development Bank (FMO) and German Development Bank (KFW). Ninety-One currently manages approximately US$1.6 billion on behalf of EAAIF.

In 2017, EAAIF acted as the lead arranger for the Kigali Bulk Water Supply Project, a public-private partnership (PPP) project designed to expand and secure potable water supply to Rwanda's capital and the first competitively tendered Build-Operate-Transfer (BOT) bulk water PPP in Sub-Saharan Africa. The project was designed to expand and secure potable water supply to Kigali by developing a bulk water treatment facility delivering approximately 40 million liters of treated water per day.

Following a competitive tendering process, Metito — a global water infrastructure and utility provider — was chosen to build and operate the facility under a 27-year PPP agreement, selling treated water to Rwanda's national Water & Sanitation Corporation (WASAC) under a long-term offtake contract. EAAIF led the arrangement of US$40.6 million of the US$60.8 million required to finance the project. The debt package included two tiers of capital: EAAIF provided US$2.6 million in junior debt and US$19 million in senior debt, while the AfDB matched EAAIF with another US$19 million of senior debt. The loans were issued with 18-year tenors and the balance was provided as equity finance by Metito.

Approach

Established as part of the Private Infrastructure Development Group (PIDG), EAAIF is a blended infrastructure debt fund designed to mobilise long-term public and private capital into infrastructure projects across Africa and Asia. EAAIF combines donor-backed cornerstone capital with funding raised from DFIs and private institutional investors, enabling it to extend long-tenor financing in markets where commercial lenders often face balance-sheet, liquidity, or risk-appetite constraints.

Since inception, EAAIF has committed more than US$3 billion across 130+ infrastructure projects spanning 25+ countries and 10 sectors. Between 2024–2025, the Fund secured US$620 million in new commitments from global institutional investors, including Allianz, ABSA, Standard Bank, SMBC, and Swedfund. These commitments are expected to catalyse approximately US$1 billion of additional investment in next-generation infrastructure across Africa and Asia by 2028.

In 2017, EAAIF signed an agreement to act as Mandated Lead Arranger for the Kigali Bulk Water Supply Project, Rwanda's first competitively tendered Build-Operate-Transfer (BOT) bulk water concession, which remains an active exposure within the Fund's portfolio. This transaction combined several elements including:

1 Blended capital structure	EAAIF structured and arranged US$40.6 million of the US$60.8 million total financing required for the Kigali project. This included US$38 million in senior debt and US$2.6 million in junior debt, both with 18-year tenors, positioning EAAIF as the primary debt provider and Mandated Lead Arranger. The AfDB co-financed alongside EAAIF, while the private sponsor, Metito, provided the remaining capital through equity contributions. The project also benefited from a US$6.25 million viability gap funding from PIDG's Technical Assistance Facility (TAF), a separate PIDG-managed pool of concessional capital. This viability gap support strengthened transaction preparation, reduced upfront cost pressures, and helped preserve affordability while maintaining bankability.
2 Structured PPP framework	The project was Rwanda's first competitively tendered BOT water supply and treatment concession, with clear allocation of risks between public and private parties. Construction risk was borne primarily by Metito under fixed-price engineering and procurement arrangements, while operational risk was allocated to the operator for the duration of the concession. Demand risk was mitigated through a long-term bulk water offtake agreement with WASAC, providing predictable revenue visibility. Standard infrastructure finance protections (including financial covenants, reserve accounts, step-in rights, and defined termination provisions) were incorporated to meet institutional lending standards.

3 Climate-resilient infrastructure design	Climate resilience was integrated into the project's core investment and engineering logic from the outset, rather than treated as an add-on or ancillary feature. The facility was structured to diversify Kigali's water supply away from sole reliance on groundwater toward abstraction from the Nyabarongo River, reducing exposure to prolonged dry periods. Design measures included elevated control centres, flood-resilient cabling, and riparian buffer revegetation to limit erosion and sedimentation. Treatment capacity was also engineered to manage higher sediment loads associated with heavier rainfall events.
4 Hydrological data collection and monitoring	Metito was tasked with collecting, monitoring, and evaluating water levels and rainfall patterns in the Nyabarongo River basin. This data is particularly valuable in a context where climate-related data has historically been limited, supporting more informed operational management and longer-term water planning and adaptation strategies.
5 Integration with PIDG Climate Taxonomy	As part of PIDG, EAAIF is responsible for assessing all transactions against the Group's Climate Taxonomy and for reporting on the proportion of the portfolio that qualifies as climate finance, including adaptation.

Scaling Potential

First-mover demonstration effects support scaling potential. As Rwanda's first water PPP, the Kigali Bulk Water Supply and Treatment Project generated important first-mover lessons that are informing subsequent PPP transactions in the region. The successful close demonstrated that water PPPs in EMDEs can reach financial close, blended structures can crowd in private capital, and resilience features can be integrated without undermining bankability. These demonstration effect can strengthen government confidence in private participation models, reduce perceived risk among investors, and inform similar bulk water and wastewater PPP discussions across the region, helping to expand the pipeline of bankable resilience projects over time.

Successful scaling will require network readiness investments to preserve project economics. Increasing bulk water supply without corresponding upgrades to aging or leaking distribution networks can exacerbate system pressure, increase non-revenue water, and undermine both financial and operational outcomes. Coordinated planning between bulk supply projects and downstream network rehabilitation is therefore essential to achieving intended service outcomes and sustaining long-term performance.

Replicability across other sectors in climate-vulnerable geographies. Beyond water, this transaction offers a replicable model for mobilizing long-term capital into climate-vulnerable infrastructure in EMDEs. This approach is applicable across sectors such as sanitation, wastewater, renewable energy, and climate-resilient transport, where durable cashflows, long-lived assets, and clear contractual frameworks underpin investment viability. Replicability may be more challenging in contexts with extremely weak utilities, unstable tariff frameworks, or smaller municipalities that lack aggregation mechanisms.

Embedding adaptation within conventional infrastructure finance can help broaden the potential investor base and avoid isolating resilience as a niche asset class. By mobilizing capital through established infrastructure funds, rather than creating new dedicated adaptation vehicles, funds such as EAAIF enable climate-relevant infrastructure to be financed alongside other core assets under familiar governance, risk-management, and underwriting standards, aligning more closely with institutional investor decision-making.

Growing institutional appetite for resilient infrastructure debt. Between 2024–2025, EAAIF secured US$620 million in new commitments from global institutional investors including Allianz, ABSA, Standard Bank, SMBC, and Swedfund. This suggests that, when supported by strong governance, clear risk allocation, and blended risk-sharing mechanisms, resilient infrastructure debt is increasingly being viewed as a scalable and investable asset class across EMDEs.

Governance and preparation as critical enablers of scale. Water PPPs are complex and politically sensitive, and successful replication depends as much on governance and project preparation as on capital structure. Scaling similar projects in climate-vulnerable regions is most likely where risk allocation (particularly around demand and payment risk) is clarified early, tariff frameworks are transparent and predictable, concessional capital is used strategically to de-risk first-mover transactions, and robust project preparation and hydrological modelling are undertaken.

From Barriers to Solutions

Barriers

High perceived risks associated with public utilities. A key barrier for this type of project is the high perceived credit, demand, and payment risk associated with public utilities, including weak utility balance sheets which constrain offtaker strength in many markets. This high risk perception can deter institutional investors even where long-term demand fundamentals are strong.

Tariff sensitivity and affordability constraints. Water tariffs are politically sensitive and closely linked to public health outcomes, limiting the scope for full cost recovery. Passing higher capital or resilience costs through to end users is often neither feasible nor socially acceptable.

Project preparation gaps. Water PPPs require extensive upstream technical, legal, and environmental work. Inadequate preparation can delay financial close and undermine investor confidence.

Structural constraints on long-tenor infrastructure debt in EMDEs. Large-scale infrastructure projects in EMDEs often struggle to access financing aligned with long concession lifecycles. Domestic banking systems often provide shorter maturities due to balance sheet/liquidity constraints, creating a mismatch between infrastructure asset lives and available debt tenors.

Lack of market precedents for private participation in water PPPs. In markets with limited experience of privately financed water infrastructure, the absence of successful precedents increases perceived risk and slows capital mobilisation, even where infrastructure needs are acute.

Investor reluctance to take concentrated single-project exposure in frontier markets. Many institutional investors avoid direct exposure to individual projects due to concentration risk, limited local knowledge, and monitoring capacity.

Solutions

Blended finance architecture and robust PPP structuring. The project addressed these risks through (i) a strong blended structure combining long-tenor senior debt from EAAIF and AfDB with viability gap funding directly from PIDG, (ii) a well-structured PPP framework with clear risk allocation between public/private actors. Long-term offtake agreements, clearly defined responsibilities, and standard lender protections provided revenue visibility. The separation of bulk water production (private) from downstream distribution (public) clarified operational roles and reduced demand risk. EAAIF's role as Lead Arranger further signaled structuring discipline and helped crowd in additional capital.

Viability gap funding helped preserve affordability. A US$6.25 million grant from PIDG's TA Facility reduced upfront cost pressures and tariff strain, enabling the project to remain affordable while maintaining commercial bankability.

Strong sponsor with sector expertise. The project benefitted from Metito's 60+ years of global water sector experience, which helped enhance technical credibility, ensure compliance with high operational standards, and build investor confidence.

Long-tenor debt aligned with project economics. EAAIF provided 18-year debt aligned with the 27-year PPP concession, helping bridge the maturity mismatch typical in EMDE infrastructure finance. This was enabled by its blended structure, combining donor-backed capital with funding from DFIs and institutional investors with long-duration liabilities. Unlike commercial banks constrained by short-term funding, EAAIF can lend on a portfolio basis, extending longer tenors while managing risk via diversification and concessional support.

First-mover transaction de-risked through development finance participation. As Rwanda's first competitively tendered water PPP, the project faced a lack of precedents. This was mitigated by strong DFI involvement, which provided structuring expertise, long-tenor capital, and transaction credibility. Their participation helped strengthen investor confidence and enable financial close despite first-of-kind risks.

Diversified fund structure with professional oversight. EAAIF enabled investors to participate in the Kigali project as part of a broader infrastructure portfolio, supported by professional credit assessment, ongoing monitoring, and governance mechanisms.

Lessons Learned

Adaptation in infrastructure may be most scalable when embedded within core investment theses. Embedding resilience within the fundamental investment logic of an infrastructure project (e.g. framed around asset durability, service reliability, and long-term cashflow protection) may be more scalable than treating adaptation as a niche vertical, as this approach aligns more closely with how infrastructure investors assess value and risk.

There are also benefits from explicitly labelling projects as adaptation, even when their core logic sits in other areas, such as helping mobilize climate-dedicated pools of capital, strengthening reporting and accountability, and highlighting the growing adaptation investment opportunity.

Resilience narratives are most compelling when framed in financial and operational terms. Institutional investors typically respond more to arguments around predictable cashflows, credit quality, clear risk allocation, and regulatory stability, than to avoid losses over distant time horizons.

Blended finance is most effective when it targets specific structural constraints. Viability gap funding and technical assistance can play a focused role in addressing affordability and project preparation challenges, while preserving incentives for private capital participation and maintaining commercial discipline. Even small amounts of funding, correctly targeted can be sufficient to get projects off the ground.

Early integration of resilience into project design materially improves bankability. Incorporating climate and hydrological considerations at the early structuring stage can help protect long-term asset performance and reduce operational risk.

Diversified fund structures can help mobilise institutional capital in higher-risk markets. Exposures to entire portfolios can concentration risk for investors and may enable participation in infrastructure projects that may otherwise be difficult to finance on a single-asset basis.

PIMCO

Enhancing the resilience of a high-risk portfolio company through financing and long-term engagement

PIMCO

United States, North America

PIMCO is an active fixed income investment manager working across public and private markets. It manages over US$2.2 trillion in assets for central banks, sovereign wealth funds, and investors globally. It has a global footprint, with offices in the Americas, Europe and Asia.

PIMCO's approach to adaptation and resilience combines physical risk assessment, targeted capital allocation, and long-term engagement with portfolio companies to strengthen resilience across climate-exposed sectors. As a starting point, PIMCO evaluates how climate-driven hazards affect portfolio companies' long-term creditworthiness, using a suite of proprietary tools that go beyond traditional credit models or rating agency assessments. Leveraging its position as a key bondholder, PIMCO engages with portfolio companies in highly exposed sectors over the long term, such as utilities, infrastructure, and real estate, to encourage adaptation planning and steer capital toward projects that reduce their exposure to physical climate risks.

- Physical risk data and risk modeling
- Active client engagement & stewardship
- Supporting the scaling of financing solutions

Nature of Risk Exposure

PIMCO's analysis identified several overlapping risks facing the utility company: i) acute climate hazards, including wildfires and heat, drought, and wind events, ii) infrastructure vulnerabilities as a result of dependence on aging transmission and distribution lines in high- risk corridors, and iii) credit risk as a result of wildfire-related liabilities.

Solution Overview

Geography	United States
Year	2020-Present
Solution Type	Engagement; Labelled bonds; General purpose financing
Applicable Sector(s)	Asset management; Fixed income; Utilities

Description

Over several years, PIMCO worked with a large electric utility operating in a wildfire-prone region to strengthen its climate resilience. After a series of devastating fires, the utility filed for bankruptcy in 2019. PIMCO worked with a group of bondholders to provide the financing required for the utility to successfully exit bankruptcy in 2020.

Since the company's emergence from bankruptcy, PIMCO has engaged the utility over multiple years to help reduce the company's risk exposure. This engagement includes:

> Conducting physical risk analysis to inform engagement and guide resilience improvements:
>
> PIMCO used its proprietary physical risk exposure framework to analyze the utility's evolving exposure to wildfire risk. This analysis, combined with on-site validation and regular dialogue with the company, enabled PIMCO to provide targeted recommendations to reduce exposure to wildfire risk.

Providing and enabling financing for targeted resilience measures:

Starting in 2022, the utility issued labeled bonds to support wildfire mitigation. The utility developed a sustainable financing framework that includes eligible projects dedicated to climate adaptation such as large-scale undergrounding of distribution lines. PIMCO invested in two labeled bonds: (1) a wildfire cost-recovery bond issued in response to state legislation following the 2017/2018 wildfires, with proceeds used to recover costs already incurred for wildfire mitigation measures, and (2) a sustainability bond issued under the company's sustainable financing framework.

By investing in these issuances, PIMCO helped to provide the company with capital needed to execute risk-reducing measures without excessive pressure on its balance sheet. These measures, in turn, improved market confidence in the company's resilience, supporting tighter credit spreads over time. Importantly, PIMCO's engagement on physical risk and adaptation was not confined to labeled instruments — resilience considerations cut across different financing types, including securitized and conventional issuances.

Approach

1 Proprietary physical risk framework

PIMCO has developed a proprietary framework to assess physical risk across its corporate issuer portfolio. PIMCO assesses an asset's exposure to physical hazards, largely using third-party, IPCC-aligned climate data and scenarios and informed by the geolocation of assets. PIMCO overlays this with a bottom-up assessment of operational and governance readiness, drawing on a set of internally defined KPIs. These indicators assess how prepared an issuer is to manage its physical risk exposure. At the operational level, KPIs are highly localized. For the utility, PIMCO tracked progress on undergrounding (such as miles completed and capital deployed annually). At the governance level, more generalizable metrics include whether companies are aware of their exposure, whether they have conducted climate stress tests under severe but plausible climate scenarios, like the IPCC's RCP 8.5 pathway, and whether they have developed adaptation plans accordingly. Exposure and readiness inputs are layered into a five point scoring framework that identifies issuers that are more or less exposed and more or less prepared. These scores are available across PIMCO and are used jointly by credit analysts and ESG specialists to support credit risk assessment.

2 Long-term engagement and validation of progress towards resilience

Leveraging insights from its physical risk framework PIMCO pursued engagement over multiple years. This built on their existing relationship with the utility and responded to the utility's changing needs and risk profile. Throughout this period, PIMCO maintained constant contact with the company, including many discussions with the management team to help them better understand the importance of managing physical risk. Engagement also consisted of direct discussion with the company's operational teams, to better understand the monitoring and tracking of resilience-enhancing measures, and dialogue with external stakeholders to ensure improvements were appropriately understood by the market. The engagement recognized and respected the utility's expertise in engineering solutions, and it prioritized ensuring sufficient focus and attention was being given by the firm to resilience issues.

3 Adaptation-linked financing

As part of its broader adaptation strategy, the utility issued two labeled bond structures:

- A wildfire cost-recovery bond issued in response to state legislation enacted following the 2017/2018 wildfires. The bond proceeds were used to recover costs already incurred for wildfire mitigation investments, such as undergrounding and grid hardening. Repayment was secured through a dedicated charge applied to all customer bills, with a built-in "true-up" mechanism that automatically adjusts the charge to ensure sufficient revenue is collected to meet debt service obligations, which helped provide investors with repayment certainty;
- A sustainability bond issued under the company's sustainable financing framework. While this bond did not include explicit adaptation-linked use-of-proceeds, it supported broader environmental and social objectives, including investments in its transmission and distribution system.

By investing in these issuances, PIMCO helped provide the company with capital needed to execute adaptation measures without excessive pressure on its balance sheet. Importantly, resilience considerations were embedded across PIMCO's engagement with the utility and cut across all financing types, not just labeled instruments. PIMCO's engagement on physical risk extended to securitized and conventional issuances as well.

Credit spreads tightened over time as resilience measures were implemented and priced in by the market. As the utility implemented adaptation measures that reduced vulnerability to wildfire risk, the market reassessed the issuer's risk profile and credit spreads tightened, improving the company's access to affordable financing and making more capital available for funding resilience enhancements. This was driven in part by improved physical risk disclosure by the utility — including around governance structures and progress on adaptation measures — which helped improve transparency and enabled the market to more accurately assess and price the company's evolving risk profile and resilience trajectory.

Scaling Potential

Robust physical risk assessment methodology. The physical risk assessment framework used in this case, combining physical risk exposure with a bottom-up assessment of readiness and vulnerability, has been developed for use across PIMCO's corporate issuer universe, and is already being applied to other utilities. The framework is most readily replicable for asset-intensive sectors with direct exposure to climate hazards, where risks can be linked more directly to physical assets and operations. For issuers with fewer hard assets, physical risk may manifest more indirectly (e.g., through supply chains), requiring tailored KPIs and greater reliance on qualitative bottom-up research.

Long-term engagement model. PIMCO's engagement approach can be applied across geographies and sectors. The approach is particularly effective where physical risks are financially material, where issuers demonstrate willingness to engage, and where PIMCO has expertise as an investor. The model's emphasis on combining quantitative risk assessment with qualitative engagement and clearly defined KPIs provides a replicable template for driving resilience improvements in climate-exposed portfolio companies.

Resilience-enabling financing structures. The utility's use of bond financing to address wildfire risks illustrates how adaptation-aligned financing can support resilience investments in sectors facing rising physical risk. Similar use-of-proceeds instruments can be applied to other resilience measures based on issuer-specific needs. While labeled instruments with clear adaptation use-of-proceeds can enhance transparency and strengthen investor demand by providing a clearer connection between capital raising and resilience investment priorities, resilience considerations are relevant across all financing types and are not confined to labeled products. PIMCO's engagement demonstrates that physical risk assessment and adaptation dialogue can be effectively integrated across securitized, labeled, and conventional financing structures.

From Barriers to Solutions

Barriers

Limited transparency on physical risks. Most corporate issuers provide limited detail on how physical climate hazards affect their assets, operations, or credit profile, limiting investors' ability to price risk accurately.

Difficulty converting physical risk measures into credit-relevant metrics. Physical risk data is often disconnected from credit analysis, making it challenging to assess implications for spreads, default risk, and other credit factors.

Solutions

Proprietary risk framework and bottom-up engagement. PIMCO applied its proprietary physical risk framework to assess the utility's wildfire exposure and engaged with senior leadership and operations teams to understand adaptation progress. This encouraged improved disclosure and clearer articulation of future adaptation plans, helping restore market confidence.

Integration of risk metrics into quantitative scoring. PIMCO layered exposure analysis with readiness and governance indicators, incorporated forward-looking scenario analysis, and developed a five point scoring framework. These scores were then integrated into broader credit assessments to highlight physical risk alongside other fundamentals.

Issuers may face high borrowing costs or constrained capital access after climate losses. After its bankruptcy, the utility faced a wildfire risk premium, which kept credit spreads elevated and potentially limited its ability to efficiently raise funds for wildfire mitigation measures.

Adaptation-linked financing to reduce risk premiums and improve market confidence. PIMCO conducted physical risk analysis to validate the issuer's adaptation plan and invested in wildfire mitigation-linked bonds. This signaled confidence in the utility's resilience strategy and helped validate resilience measures to the broader market, contributing to improved market confidence, helping lower borrowing costs and creating a positive feedback loop for further resilience investment.

Lack of standardized KPIs for tracking resilience progress. Without clear metrics, it is difficult to monitor whether adaptation measures are being implemented effectively and to hold issuers accountable.

Operational and governance KPIs to track progress. PIMCO tracked localized operational KPIs (such as miles of undergrounding completed and capital deployed) and governance-level indicators (such as climate stress testing and adaptation planning). Regular dialogue validated progress in real time.

Disconnect between strategic commitment and operational execution. Resilience improvements require both executive commitment and operational implementation. Without strong alignment and accountability between leadership and operational teams, adaptation efforts can stall.

Engagement to strengthen governance and operational alignment. PIMCO engaged senior leadership to ensure that strategic resilience priorities translated into tangible investments, and engaged operations teams to better understand progress over time , emphasizing the importance of strong executive oversight and clear operational execution.

Lessons Learned

Sustained engagement can drive meaningful resilience outcomes. Rather than disengaging from high-risk entities, long-term, structured engagement can support the development of credible adaptation strategies, governance improvements, and operational resilience. This approach can be more effective than divestment in addressing underlying climate vulnerabilities.

Financial materiality of physical risk can catalyze action. When climate-related hazards have clear and measurable financial impacts investors and issuers alike are better placed to integrate resilience into decision-making and risk assessments. For example, exposure to wildfires and other physical risks can significantly influence the cost and availability of insurance coverage, which may in turn affect a company's credit profile and its ability to access capital on favorable terms. However, such direct financial linkages are not always evident, particularly for risks with longer time horizons or more diffuse, indirect effects.

Improved disclosure can enhance market confidence in a company's resilience. Clear, decision-useful disclosure of physical risk exposure, governance, and progress on adaptation measures plays a central role in reducing information asymmetries between issuers and investors. By improving market transparency, enhanced disclosure helps translate resilience investments into credit-relevant signals that investors can assess and price, supporting confidence in an issuer's forward-looking risk profile.

Resilience enhancements require both operational change and credible financing pathways, supported by top-down leadership and bottom-up execution. Resilience investments are capital-intensive and often need to be front-loaded to materially reduce exposure. This case underscores the need for top-down governance, leadership, and strategic direction to be aligned with bottom-up operational implementation. Senior leadership commitment, including effective executive oversight, can help set priorities and restore investor confidence, while improved adaptation planning and financing structures are key for mobilizing capital and implementing resilience measures at scale.

Resilience considerations cut across all financing types, not just labeled instruments. While labeled bonds with dedicated adaptation use-of-proceeds can be effective in improving transparency and investor understanding of resilience investments, engagement on physical risk and adaptation does not need to be confined to these instruments. PIMCO's approach demonstrates that resilience considerations are relevant across securitized, conventional, and labeled financing structures. Where labeled instruments are used, clearly linking proceeds to adaptation measures can strengthen investor demand and provide a clearer connection between capital raising and the issuer's resilience investment priorities.

Rabobank

Improving climate resilience and land restoration in Brazil through 'Renova Pasto'

Brazil, South America

Headquartered in the Netherlands, **Rabobank** is a global financial institution with a focus on food and agribusiness financing. With expertise in agriculture and rural banking, Rabobank plays a leading role in supporting supporting agricultural systems that comply with environmental regulation and promote improved land use practices and financing transitions in high-impact agricultural sectors. In Brazil, Rabobank operates as a specialized agricultural lender, serving medium and large producers across key commodities.

The **AGRI3 Fund** was created by the United Nations Environment Program and Rabobank, along with the Sustainable Trade Initiative (IDH) and Dutch Entrepreneurial Development Bank (FMO). The Ministry of Foreign Affairs of the Netherlands is a donor to AGRI3 Fund. The Fund works with commercial banks, development finance institutions, impact investors and institutional investors and provides credit enhancement tools and technical assistance to projects which actively prevent deforestation, stimulate reforestation, and contribute to efficient sustainable agricultural production and value chains.

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

Brazil's cattle sector is increasingly exposed to climate-driven drought, soil degradation and extreme weather variability, all of which reduce pasture productivity and increase farm-level credit risk. Degraded pasture amplifies vulnerability to climate shocks, while continued ecosystem conversion creates transition risk as deforestation regulations tighten and supply chains demand deforestation-free production.

For lenders, these risks translate into heightened default risk, collateral impairment and reputational exposure. Financing pasture renovation and forest compliance is therefore both a climate risk mitigation strategy and a credit risk management tool.

Solution Overview

Geography	Brazil
Year	2022-Present
Solution Type	Blended debt finance; Credit line
Applicable Sector(s)	Banking; MDBs and DFIs; Agriculture

Description

Renova Pasto is a long-term blended finance credit line launched in 2022 to support the rehabilitation of degraded pastureland and accelerate compliance with Brazil's Forest Code, which mandates the preservation of native vegetation and restoration of legally protected areas. The program combines long-term loans provided by Rabobank with partial credit guarantees from the AGRI3 Fund and technical assistance delivered by IDH and local implementation partners.

The concept for Renova Pasto originated with a 2020 transaction in which AGRI3 provided a partial guarantee that enabled Rabobank to extend a 10-year loan to a cattle producer for pasture restoration, productivity improvement, and Forest Code compliance. The partial guarantee enabled Rabobank to extend longer-tenor financing, beyond its standard risk appetite for such investments. Rabobank's standard risk/return expectations due to the longer tenor and inclusion of non-revenue-generating activities, such as forest conservation and restoration.

Recognizing that bespoke blended transactions are slow and operationally intensive, Rabobank and AGRI3 subsequently developed Renova Pasto as a standardized and replicable credit product. The program incorporates pre-negotiated eligibility criteria, defined environmental safeguards, and structured monitoring requirements that are fully embedded within Rabobank's credit approval process.

Under the program, Rabobank provides eligible farmers with loans of 10 years' tenor, with a 3-year grace period during which no repayments are due (though interest is charged on the outstanding amount). These loans are supported by partial guarantees from AGRI3, covering the final 3 years of the transaction. This enables Rabobank to extend financing beyond its typical tenor. The longer tenor allows for less stringent repayment requirements for the farmer, supporting investment in non-revenue-generating activities.

Environmental requirements are directly integrated into loan contracts, with farmers receiving a standardized Environmental and Social Action Plan. Clients must comply with a range of environmental safeguards, contractually committing borrowers to no deforestation (i.e. no conversion of native vegetation) in the financed area, monitored using CAR registry data, satellite imagery and on-farm verification processes where the renovation project is implemented and a target of conservation of native vegetation across their entire land portfolio. Non-compliance is subject to contractual remediation measures and monitoring under the loan agreement.

Recommended farming methodologies are aligned with technical recommendations issued by Embrapa (Brazilian Agricultural Research Corporation), a state-owned enterprise under Brazil's Ministry of Agriculture and Livestock. Technical assistance by IDH and local partners provides on-the-ground advisory support to ensure good agricultural practices, strengthen compliance, and monitor environmental and productivity outcomes.

Approach

MUFG has supported GAIA across multiple functions, including fund design, capital provision, and active origination.

1 Blended finance and risk sharing	Renova Pasto offers long term financing of up to 10 years — with a 3-year grace period — to eligible medium — and large-scale producers within Rabobank's existing client base. These loans are used to finance activities which sustainably renovate degraded pastureland and support borrowers in progressing towards compliance with Brazil's Forest Code, including restoration of legal reserves and preservation of native vegetation. The loans are provided by Rabobank and supported by partial guarantees from AGRI3, which cover the final 3 years of the transaction. The guarantee is structured as a bank guarantee issued to Rabobank, which qualifies as collateral and provides capital relief under regulatory frameworks. While the guarantee improves the risk-adjusted profile of the transaction, it does not reduce the cost of lending to the client.
2 Technical assistance	In addition to financing, Renova Pasto offers clients a tailored package of Technical Assistance, which is funded through the AGRI3 TA Facility and delivered by IDH and other implementation partners. This includes the provision of local advisory services and farm visits by agronomists to support the implementation of good agricultural practices (such as rotational grazing and regenerative agricultural practices), impact monitoring, and compliance with Brazil's Forest Code. As part of this package, AGRI3 works with the service provider Produzindo Certo to strengthen on-farm impact measurement for reporting to investors.
3 Streamlined credit process	Renova Pasto was deliberately designed with pre-agreed parameters. Criteria for client eligibility (e.g. restrictions on client size and historical deforestation/conversion) and financial criteria for risk exposure and loan tenor were pre-negotiated between Rabobank and AGRI3 and are fully integrated into Rabobank's regular credit approval process. The product is currently available only to existing clients, as the 10-year tenor and environmental commitments require a high degree of trust and familiarity with the borrower's track record.

4

Measurable environmental performance and monitoring

Environmental safeguards are directly embedded in loan contracts. To access the loans, clients must commit to specific environmental conditions, including: zero deforestation on the land parcel where the renovation project is implemented, conservation of native vegetation across their entire land portfolio, and accelerated Forest Code compliance. To validate and monitor these, the program draws on Brazil's Rural Environmental Registry (CAR), satellite imagery, GIS systems, and on-farm verification processes, while Rabobank is responsible for collecting data from clients.

Renova Pasto are deliberately aligned with AGRI3's standard set of KPIs that includes indicators such as land restored, protected ecosystems and estimated GHG emissions outcomes, subject to ongoing methodology development

As of 2026, the program has deployed approximately US$5.4 million. These transactions are expected to contribute to more than 1,500 hectares under improved management; more than 950 hectares of avoided legal deforestation; and an estimated yield improvements of 1–5 heads per hectare. These figures represent expected outcomes based on project-level assumptions and may vary depending on implementation conditions

Scaling Potential

From proof-of-concept to programmatic deployment. Renova Pasto has progressed from initial pilot transactions to broader integration within Rabobank's agricultural lending portfolio. The early deals validated the blended capital structure, environmental covenant design, and monitoring architecture under real market conditions. This demonstrator approach reduces uncertainty around credit performance and impact delivery, creating a foundation for scaled deployment. Other institutions could adopt a similar pipeline strategy, using early transactions to test and refine risk-sharing mechanisms, monitoring systems, and underwriting criteria before transitioning to programmatic capital allocation.

Expansion across other agricultural segments. Initially focused on mid- to large-scale cattle producers in Brazil's Cerrado and Amazon regions, the program is expanding eligibility to additional farms and production systems, including degraded cropland restoration and integrated crop-livestock models. These systems improve soil health, provide year-round ground cover, and enhance resilience to climate variability. By broadening eligibility criteria, Renova Pasto can both broaden its addressable market and strengthen its role as a cross-sector agricultural credit platform.

Operational and technical capacity constraints may limit scaling. Replicating this model requires sufficient agronomic and monitoring capacity. Renova Pasto relies on embedded technical assistance from agronomists and specialized service providers to support implementation and compliance. Scaling across new geographies or sub-sector may require expanded technical expertise, updated standardized criteria, and continued refinement of monitoring and data systems.

Policy alignment as a key scaling enabler. A defining feature of Renova Pasto's scalability is its alignment with Brazil's Forest Code. The legal obligation to preserve and restore native vegetation creates underlying demand for compliance-linked financing. By embedding these regulatory requirements directly into loan structures, the program converts policy mandates into structured capital deployment. Other jurisdictions seeking to scale land-use finance could follow a similar model: pairing enforceable land-use regulation with credible monitoring systems and enabling financial institutions to integrate compliance obligations into standardized credit products. Where governments establish clear restoration mandates and enforce them consistently, financial institutions are better positioned to mobilize private capital at scale.

Capital stack should evolve over time. In its early phase, partial guarantees are critical to enabling longer-tenor lending and absorbing incremental transition risk. As repayment performance and impact data accumulate, reliance on guarantee-based risk-sharing may decline. A gradual shift toward greater participation from commercial capital would signal maturation into a more conventional agricultural infrastructure-like lending product.

From Barriers to Solutions

Barriers

Maturity mismatch and uncertain returns. Land restoration requires multi-year investment before productivity gains materialize. Many of these activities do not generate immediate cash flow. Conventional rural credit structures are typically short-tenor and structured around near-term revenue, making it difficult for banks to finance longer-horizon, non-cash-generating investments outside their standard risk appetite.

High transaction costs make bespoke deals difficult to scale. Deal-by-deal negotiation of eligibility criteria, covenants, documentation, and monitoring frameworks can be operationally impractical within commercial banks workflows. This often limits blended structures to pilots rather than products.

Implementation risk and limited technical capacity. Pasture renovation and regenerative practices are highly specialized activities. Without technical guidance, producers may fail to achieve productivity gains or meet environmental commitments, increasing both impact risk and credit risk.

Monitoring complexity. Renova Pasto requires borrowers to commit to zero deforestation on the financed land parcel, conserve native vegetation across their entire land portfolio, and accelerate Forest Code compliance. These layered, portfolio-wide requirements strengthen environmental integrity but increase monitoring complexity.

Solutions

Blended finance structure enables extended tenor and better risk allocation. The partial guarantee from AGRI3 functions as a catalytic risk-sharing mechanism that improves the risk-adjusted profile of loans. This enables Rabobank to extend loans with tenors of 7-10 years, beyond its standard appetite and in line with the time horizon required for land restoration.

Pre-negotiated parameters streamline deployment. Renova Pasto embeds uniform and pre-agreed eligibility criteria and deal parameters. Rabobank conducts an initial screening against these thresholds, after which AGRI3 performs a focused review of key parameters. This reduces administrative friction and transaction costs compared to bespoke blended structures.

Embedded technical assistance. Technical support in pasture renovation, regenerative practices, and compliance planning strengthens borrower capability and reduces performance risk. By integrating advisory services into the loan product, Renova Pasto improves productivity outcomes, supports regulatory compliance, and enhances credit quality over the life of the loan.

Robust monitoring and verification systems. Ensuring compliance across geographically dispersed landholdings has required strengthened data systems and ongoing validation through satellite monitoring and other tools. Close collaboration between partners has also been key, with Rabobank systematically collecting data from clients and AGRI3 working with Produzindo Certo to enhance on-farm impact measurement.

Lessons Learned

Blended risk-sharing can unlock structural credit constraints. In sectors where investments require longer tenors and involve non-cash-generating activities, conventional lending frameworks may be misaligned with real-world implementation timelines. Partial guarantees and other risk-sharing mechanisms can expand lender appetite by reallocating risk without undermining commercial underwriting discipline.

Standardization can be key for moving from pilots to scale. While bespoke blended transactions can demonstrate viability, they are rarely scalable within commercial banking systems. Developing upfront agreement on eligibility criteria, documentation templates, and monitoring frameworks significantly reduces transaction costs and internal friction.

Technical assistance can function as a structural credit enhancer. In agricultural and lang use finance, operational capability directly influences repayment capacity. Integrating technical assistance improves productivity outcomes and reduces credit risk, aligning environmental impact with financial performance.

Monitoring and data systems are key to credibility. Portfolio-wide commitments and impact-linked structures require robust monitoring frameworks. Strengthened data systems, satellite verification, and coordinated partner oversight are essential to ensure enforceability and maintain investor confidence. Weak monitoring can undermine both environmental integrity and financial risk management.

Regulatory clarity can drive demand for adaptation finance. Clear and enforceable regulatory frameworks increase certainty around environmental obligations and land-use standards. Where deforestation restrictions, restoration mandates, or sustainability requirements are actively monitored and enforced, compliance becomes a necessity. This can help create sustained demand for financing solutions that enable borrowers to meet regulatory expectations. On the supply side, regulatory clarity also strengthens lender confidence by providing a more predictable environment for long-term capital deployment.

SEADRIF

A regional platform for mobilizing private reinsurance in sovereign disaster risk financing

Lao PDR, Asia

The Southeast Asia Disaster Risk Insurance Facility (SEADRIF) is a regional platform that provides participating nations with advisory and financial services, to strengthen preparedness and financial resilience to climate and disaster risks. SEADRIF is established and owned by ASEAN+3 countries through a trust in Singapore. It was established with financial support from the Governments of Japan and Singapore and technical support from the World Bank.

The SEADRIF Insurance Company is incorporated in Singapore and licensed as a general insurance company regulated by the Monetary Authority of Singapore. While incorporated as a private insurer, it operates as a de facto publicly owned, not-for-profit entity, working closely with member countries to develop financial solutions that protect against disasters and climate shocks.

Blended finance and risk sharing

Supporting the scaling of financing solutions

Nature of Risk Exposure

ASEAN countries are disproportionately exposured to natural disasters, such as droughts, floods, cyclones, earthquakes, tsunamis, and landslides. Disaster financing is often slow, uncertain and insufficient with governments relying on budget re-allocations or external aid after disasters. With the majority of the losses uninsured, governments and communities bear the cost.

In Lao PDR recurrent flood and storm events, limited fiscal space, high debt levels, and heavy reliance on post- disaster financing from donors leave the government with little capacity to respond quickly or predictably to shocks.

Solution Overview

Geography	Southeast Asia (Lao PDR, Cambodia, Myanmar, with expansion to other ASEAN+3 countries)
Year	2019-Present
Solution Type	Regional risk pool; Parametric insurance; EMDE financing
Applicable Sector(s)	Reinsurance; Public finance; MDBs and DFis; Disaster risk financing

Description

SEADRIF is a regional disaster risk financing platform that provides ASEAN countries with pre-arranged, rules-based financing to strengthen resilience against climate shocks. As disaster frequency and severity increase, governments face growing fiscal pressure, with post-disaster financing often delayed and insufficient. SEADRIF addresses this by shifting disaster financing from reactive to proactive, enabling governments to access rapid and predictable liquidity when shocks occur.

SEADRIF blends public capital and private reinsurance to translate disaster risk into parametric insurance products that protects vulnerable communities and countries from the economic and fiscal impacts of natural disasters. Governments pay premiums, and payouts are triggered based on predefined conditions, allowing funds to be disbursed within days rather than months. Since 2021, SEADRIF successfully mobilized US$29.5 million in private risk capital through insurance contracts with multiple reinsurers, and has paid out US$6.5 million, all within days of the triggers being reached.

Application in Lao PDR

In Lao PDR, SEADRIF has co-developed a multi-peril parametric insurance product with the Ministry of Finance, covering floods, tropical cyclones, earthquakes, and landslides, with payouts delivered directly to the government to support emergency response and early recovery. The policy introduces several structural innovations that set it apart from conventional risk transfer approaches:

> The policy uses a trigger based on the cumulative number of people affected by disasters, as reported by the government under national law, aligning payouts with government-observed and reported impacts, reducing basis risk and ensuring the government can verify and explain payouts using their own data systems.

> The policy is multi-peril and multi-year and operates on an annual aggregation basis, allowing the cumulative impact of multiple smaller events to trigger payouts alongside large catastrophes. This aligns with the budget impact felt by the government, where many small events can also deplete resources.

> Payouts are linked to a pre-agreed contingency plan, which was developed jointly by the government and the World Bank and applies the institution's Environment and Social Framework to safeguard the implementation of funds. This ensures funds are directed toward priority response activities, such as emergency relief, infrastructure repair, and continuity of essential public services and enables governments to act more quickly and decisively, minimizing disaster impacts and accelerating recovery.

In September 2025, SEADRIF disbursed US$2 million to the Government of Laos within 6 days, following the impacts of Tropical Cyclones Wutip and Wipha, along with associated flooding and seasonal monsoon rains.

Approach

The FloodAction Coalition seeks to become a market-building platform for natural flood and drought management in UK and beyond. The core model (under development) consists of:

1 Regional platform with diversification potential over time	SEADRIF functions as a regional platform with an operational reinsurance pool. Individual country risks (such as Lao PDR's) are structured and transferred to reinsurers, with the SEADRIF Insurance Company retaining a portion and ceding the rest to the reinsurance market via a broker (currently Gallagher Re). By expanding products and offerings to member countries and building a larger portfolio, SEADRIF enables diversification benefits to emerge over time across transactions, as reinsurers participate in multiple policies issued through SEADRIF. Engaging with more member countries across a wider range of products supports more consistent market engagement, reduced transaction costs, and the gradual development of diversified exposure across the region.
2 Context-specific product design	Currently, SEADRIF's primary insurance offering is parametric insurance, designed to deliver rapid, rules-based payouts based on predefined triggers. In Lao PDR, SEADRIF initially launched a product based on a flood risk monitoring tool, which combined multiple datasets to estimate flood severity and assign return periods (e.g., 1-in-8-year or 1-in-20-year events), with payouts linked to these thresholds. In practice, modelled estimates did not always align with observed impacts on the ground. In response, SEADRIF and Lao PDR co-developed a new product (#PEOPLE) based on government-reported impact data, which was formalized in 2025 through a two-year, multi-peril sovereign disaster risk insurance policy providing up to US$16 million in coverage. Representing a shift from traditional parametric approaches, the policy uses the cumulative number of people affected, reported by the National Disaster Management Office (NDMO) under national law, as the sole trigger for payouts. It operates on a 12-month aggregation basis, whereby impacts across floods, cyclones, earthquakes and landslides are accumulated, with payouts triggered once

	predefined thresholds are reached, and disbursed progressively as higher thresholds are crossed. Payouts are verified by an independent calculation agent (Gallagher Re), and disbursed within 10 business days at most, and can be triggered while events are ongoing, enabling timely liquidity for both large-scale catastrophes and the cumulative impact of smaller, more frequent events. Payouts are integrated into national disaster response systems through a pre-agreed contingency plan, ensuring that funds are not only delivered quickly but also deployed effectively, supporting emergency relief, infrastructure repair, and continuity of essential services.
3 Development insurer model using a blended capital structure	SEADRIF combines limited public capital with private risk capital from reinsurance through a layered structure. SEADRIF retains a portion of risk and transfers the majority to global reinsurers, typically via brokers such as Gallagher Re. Public capital, provided by donors such as Japan and Singapore, plays a catalytic role, absorbing higher-risk layers and reducing pricing. This improves affordability for governments while enhancing the risk-return profile for reinsurers. Crucially, this crowds in private capital, similar to the blended financing model for development financing. It brings new risk to markets and makes products from data-scarce environments or frontier markets insurable. SEADRIF's concessional capital is limited and deployed strategically to crowd in private capital.
4 Market intermediation and operational integration	SEADRIF connects governments and other entities holding public risk to global reinsurance markets, structuring solutions that translate public sector needs into insurable risk and reduce engagement complexity. Over time, this track record allows reinsurers to build confidence in the platform and experience with public sector clients, supporting sustained market participation.
5 Regional market building	SEADRIF's strategic ambition extends beyond insurance placement to becoming the preferred centre of excellence for climate and disaster risk finance in Southeast Asia, facilitating the flow of expertise, solutions, and capital across the region. This includes advisory services to help member countries design financial instruments tailored to their specific risk profiles, as well as targeted training, peer learning, and knowledge exchange programmes to build technical capacity within finance ministries and disaster management agencies. Since joining SEADRIF in 2021, Lao PDR has received US$6.5 million in total payouts. In 2024, SEADRIF delivered a US$3 million payout: the first payment of US$750,000 within 5 days and the remaining US$2.25 million a week later, supporting over 350,000 people affected by Typhoon Yagi. In 2025, SEADRIF disbursed US$2 million within six days of multiple disaster events. Between 2021-2025, SEADRIF successfully mobilized US$29.5 million in private risk capital through insurance contracts with multiple reinsurers.

Scaling Potential

Expansion to additional perils and geographies. SEADRIF was designed as a regional platform capable of serving multiple member countries. The multi-peril structure developed for Lao PDR can be extended across hazards and adapted to different national priorities. The success of the Lao PDR program, including the shift to government-reported triggers, provides a blueprint that can be scaled across the region. For example, SEADRIF is working with the Philippines to develop a similar model to support the continuity of critical public services such as healthcare and education.

Developing sector-specific regional mechanisms. SEADRIF is developing two sector specific regional mechanisms: i) the Regional Agricultural Insurance and Sustainable Economies Facility (SEADRIF-RAISE), a regional agricultural risk finance facility to strengthen food security and build agriculture market infrastructure across Southeast Asia, and ii) the Sovereign Asset and Fiscal Empowerment Facility (SEADRIF-SAFE), which embeds disaster insurance into development-financed public infrastructure and protects essential public services against climate and disaster shocks.

Building confidence in commercial markets through repeat engagement. As SEADRIF continues to demonstrate successful risk transfer placements, private reinsurers are gaining confidence in the platform. While reinsurers typically underwrite country-specific risks, participation across multiple SEADRIF policies allows them to build diversified exposure incrementally. The involvement of global reinsurers, facilitated by brokers such as Gallagher Re, signals that sovereign disaster risk can become a viable asset class when supported by technical expertise, strong governance, and consistent execution.

Replication of blended finance architecture beyond sovereign risk. Beyond disaster risk financing, SEADRIF's model of combining public capital, regional pooling, and private reinsurance offers a replicable template for addressing market failures in other sectors. This includes applications in agriculture insurance, financing for public infrastructure, and broader climate adaptation finance, where coordination challenges and high perceived risks often limit private sector participation.

Potential for integration with other regional risk pools. Globally, similar solutions include African Risk Capacity (ARC), CCRIF (formerly the Caribbean Catastrophe Risk Insurance Facility), and Pacific Catastrophe Risk Insurance Company (PCRIC). There is potential for integration across these regional pools to further enhance diversification and reduce costs. In March 2026, SEADRIF convened with ARC, CCRIF SPC, and PCRIC to explore the development of a joint risk pools solution. This could be expanded to collaborating with countries' domestic insurance schemes managing public risk to further build efficient scale.

From Barriers to Solutions

Barriers	Solutions
Limited access to timely post-disaster financing. Governments often rely on budget reallocations or external aid, which can be slow, uncertain, and insufficient, particularly in the critical early phase of disaster response. Delays can exacerbate economic losses and impacts.	**Pre-arranged financing enables rapid access to liquidity.** SEADRIF enables fast, rules-based payouts ensuring governments can access funding when it is most needed and respond immediately to needs after a disaster.
High cost of insurance and limited affordability for sovereigns. Commercial insurance often includes profit margins and capital costs that make coverage unaffordable for fiscally constrained EMDE governments.challenging.	**Blended finance improves affordability and enables market participation.** SEADRIF combines donor-funded capital with private reinsurance to absorb higher-risk layers, reduce pricing, and make coverage more accessible while maintaining financial sustainability. As a member-owned, not-for-profit insurer, any surpluses are reinvested to strengthen the platform aligning incentives with affordability and benefits for members rather than profit.
Limited private sector participation in emerging market disaster risk. Perceived risk, small deal sizes, and transaction complexity deter reinsurers from engaging directly with sovereign clients, particularly where exposures are concentrated and lack diversification at the individual transaction level.	**Credible intermediation enables private sector participation.** SEADRIF reduces the barriers that prohibit engagement between public sector and commercial markets. SEADRIF translates complex sovereign risk into a transaction private markets are confident to underwrite, via brokers such as Gallagher Re. By transferring risk on a policy-by-policy basis this creates a pipeline of transactions enabling reinsurers to participate incrementally and build diversified exposure over time.
Inability to capture cumulative impacts of frequent, smaller disasters. Conventional insurance structures focus on large, infrequent events, leaving governments exposed to the aggregate impact of smaller shocks.	**Aggregation structures enable coverage of cumulative impacts.** The Laos PDR policy accumulates impacts over a 12-month period and triggers payouts as thresholds are crossed, enabling coverage for both major disasters and smaller, frequent shocks.
Mismatch between modelled triggers and real-world impacts (basis risk). Traditional parametric products based on hazard proxies may not align with actual damage, reducing trust and effectiveness.	**Impact-based triggers align payouts with real-world impacts.** SEADRIF's Lao PDR product uses official NDMO-reported population impacts, reducing basis risk and improving usability and credibility for governments.

High transaction costs and weak coordination between governments and insurers. Sovereign insurance transactions are often bespoke, complex, and resource-intensive, with limited standardization and unfamiliarity on both sides.

Trusted intermediary reduces transaction complexity. SEADRIF sits between the public and the private sector, building efficient long-term engagement on both sides of the market, lowering costs and complexity. For governments, SEADRIF is a trusted pre-competitive actor to work together in product design, to public sector timelines. For insurers, SEADRIF is an industry standard counterpart, speaking the language of insurance and bringing products to markets in more private sector aligned timelines.

Lessons Learned

Blended structures can make high-risk markets investable. Public capital can play a catalytic role by absorbing higher-risk layers, reducing pricing, and supporting product development. Rather than displacing private capital, well-designed blended finance structures can improve the risk-return profile sufficiently to crowd in commercial participation, particularly in markets where risks are perceived as too high or complex.

Insurance only delivers value when payouts align with real-world impacts. Traditional parametric approaches based on hazard indicators (e.g., rainfall or wind speed) can diverge from actual losses. Aligning triggers with government-reported impact data reduces basis risk, strengthens confidence, and ensures payouts reflect realized outcomes.

Development-focused insurers can move markets. The use of government-reported impact data as a trigger represents a first-of-its-kind approach that commercial markets would not have developed independently. SEADRIF's investment in validating and operationalizing government data, absorbing early uncertainty, and demonstrating viability enabled international reinsurers to participate in a product they had not previously priced, creating replicable model for the region.

Building markets requires iteration. Developing effective financial solutions in data-constrained or emerging markets often requires iterative refinement through real-world application. Initial product designs may reveal limitations, which can be addressed through subsequent adaptations. Sustained iteration over time builds confidence, improves usability, and demonstrates viability to both governments and markets.

Aggregation and progressive payout structures can address more frequent, moderate shocks. Conventional mechanisms focus on large, infrequent events, leaving the middle layer of smaller but frequent shocks uninsured. The cumulative impact of these events can be as fiscally damaging as a single catastrophe, without triggering a conventional payout. Annual aggregation and progressive payout mechanisms allow financing to respond to cumulative impacts, providing more consistent and relevant coverage.

Alignment with government systems is critical for adoption. Solutions must be transparent, explainable, and compatible with government systems to support both uptake and effective deployment. Integration in fiscal and budget frameworks allows for the sustainable allocation of premium funds. Integrating financial instruments with pre-agreed contingency planning ensures that rapid liquidity translates into tangible outcomes.

Access to global reinsurance markets requires credibility and sustained engagement. Reinsurers are more likely to participate when they have confidence in the counterparty and the data underpinning the transaction. This confidence is built over time through repeat engagement and demonstrated execution.

Intermediation is critical to bridging public–private market gaps. A persistent barrier in adaptation finance is the disconnect between public sector needs and private sector offerings. Effective intermediaries translate demand into investable products, reduce transaction costs, and align incentives across stakeholders.

Standard Bank

Mobilizing commercial bank capital for climate-smart agriculture in Sub-Saharan Africa

Namibia, Africa

Active client engagement & stewardship

Supporting the scaling of financing solutions

Standard Bank Group is Africa's largest bank by assets, operating in 21 countries across sub-Saharan Africa and serving over 16 million clients across its Personal and Private Banking, Business and Commercial Banking, and Corporate and Investment Banking divisions. Standard Bank has set a target to disburse R7 billion in climate-smart agriculture finance by 2030, and disbursed R7.3 billion between 2022 and 2025 across renewable energy, sustainable water management, precision farming equipment, and conservation agriculture practices. Standard Bank Namibia is a regional subsidiary providing banking and financing services to individuals, businesses, and agricultural enterprises across Namibia.

Nature of Risk Exposure

Namibia is one of Africa's most arid countries, with declining rainfall, extreme heat, and recurring drought creating significant challenges for agricultural productivity. The Kavango East region is among the country's most climate-vulnerable areas, with agricultural production historically dependent on rain-fed systems that are increasingly exposed to rainfall variability and climate shocks. At a structural level, the region faces limited access to modern farming technologies and low agricultural productivity, constraining participation in higher-value commercial and export agriculture.

Across sub-Saharan Africa more broadly, about 95% of cropland is rain-fed, leaving the agricultural sector, which employs approximately 60% of the regional workforce, highly exposed to climate-driven disruptions to growing conditions, water availability, and food security.

Solution Overview

Geography	Namibia
Year	2025
Solution Type	Working capital and capital expenditure financing; Climate-smart agriculture finance
Applicable Sector(s)	Agriculture; Food security

Description

In 2025, Standard Bank provided N$40 million in financing to Namibia Berries to support the expansion of its large-scale hydroponic blueberry farming operations in the Kavango East region. The facility combined capital expenditure financing — which enabled the development of additional hectares under cultivation and optimization of the company's existing packing and cold storage infrastructure — with working capital to sustain operations through the production cycle. Structured to unlock equity from existing assets, the transaction enabled Namibia Berries to scale its export-driven growth strategy while maintaining operational liquidity. The deal reflects Standard Bank's broader mandate to finance high-impact agribusinesses that advance Namibia's agricultural export capacity, drive economic diversification, and create employment opportunities.

Specifically, the N$40 million facility was structured as a combination of an N$10 million overdraft facility, N$10 million in working capital financing, and a N$20 million medium-term loan with a five-year tenor — reflecting the dual financing needs of a capital-intensive agricultural transition: working capital to sustain operations through production cycles, and longer-term capex financing to fund the infrastructure required for climate-smart production at commercial scale. At a later stage, an additional N$5 million vehicle and asset finance facility with a ten-year tenor was provided to fund solar power installation.

The facility enabled Namibia Berries to invest in a bundled package of climate-smart infrastructure, including:

- Expansion of production under protective netting, providing a controlled growing environment that reduces exposure to extreme heat and weather variability
- Hydroponic production systems enabling precise, water-efficient cultivation that reduces dependence on rainfall and soil conditions
- A fully operational on-site packhouse and cooling facility, while help ensure post-harvest handling meets the stringent temperature chain requirements of international blueberry export markets
- Solar power installation, reducing dependence on Namibia's unreliable electricity grid and lowering operating costs

A defining feature of the transaction was its orientation toward international export markets, including Europe (Germany, Austria, and Spain), Asia (Japan, China, and Malaysia), and the Middle East, as the primary commercial anchor. The production infrastructure financed was calibrated specifically to international export standards, and the resulting access to premium pricing and stable buyer demand generated the cash flows needed to service the financing on fully commercial terms, making the investment self-sustaining without subsidy. The transaction has supported Namibia Berries' emergence as a competitive player in global blueberry markets while creating 300 permanent jobs and over 3,000 seasonal positions in one of Namibia's most economically marginal regions.

Approach

Standard Bank's N$40 million financing of Namibia Berries illustrates how a commercial bank with deep agricultural sector expertise can structure financing that enables climate-smart production on commercial terms, without the need for concessional support or development finance involvement. The transaction was structured around three key components:

1 Formal physical and transition risk assessment

As part of the credit underwriting process, Standard Bank conducted a property valuation that included a comprehensive assessment of both physical and transition climate risks, ensuring that the farm's climate exposures were formally evaluated and incorporated into the financing design. This assessment informed both the structure of the facility and the selection of climate-smart technologies financed, grounding the transaction in an evidence-based understanding of the specific climate vulnerabilities facing large-scale horticulture in the Kavango East region, including drought exposure, heat stress, rainfall variability, and infrastructure unreliability.

2 An integrated working capital and capital expenditure facility tailored to the investment profile of climate-smart agriculture

Standard Bank structured the N$40 million as a combined working capital and capital expenditure facility, deliberately designed to match the investment profile of a climate-smart agricultural transition. The facility comprised an N$10 million overdraft facility, N$10 million in working capital financing, and a N$20 million medium-term loan with a five-year tenor. The working capital components supported Namibia Berries' ongoing operational costs through production and harvest cycles, while the medium-term loan funded the longer-horizon infrastructure investments required to establish commercial-scale climate-smart production (e.g. protective netting, hydroponic systems, cooling facilities). Structuring both within a single integrated facility reduced transaction complexity for the borrower, aligned repayment with the company's revenue profile, and reflected Standard Bank's approach to agricultural clients: deploying specialists with deep sector knowledge who spend time understanding the specific production cycles, capital requirements, and market dynamics of individual businesses.

3

Climate-smart technology investments delivering production resilience and export-market readiness

Informed by the climate risk assessment, the capital expenditure component financed a carefully designed package of interconnected climate-smart technologies, selected to address the specific production challenges of large-scale horticulture in an arid, infrastructure-constrained region. These include:

- **Protective netting** across 88 hectares (established to date, within a planned 500-hectare development over 6-7 years) — creating a controlled growing environment that moderates temperature and reduces crop exposure to weather variability, enabling consistent production quality.
- **Hydroponic systems** — providing water-efficient, soil-independent cultivation using proven, high-performing blueberry varieties that are both more productive per hectare and more resilient to the rainfall variability characteristic of the Kavango East region.
- **Solar power installation** — removing dependence on an unreliable electricity grid, ensuring consistent energy supply for irrigation, cooling, and packing operations.
- **On-site packhouse and cooling facility** — ensuring blueberries meet the stringent temperature chain requirements of international export buyers from the moment of harvest. The first blueberry harvest has been successfully graded, cooled, and packaged through this facility.
- **Responsible water management practices** — reducing water consumption in one of Africa's most arid countries.

Scaling Potential

The integrated working capital and capex model is replicable across crop types and geographies. The core financing structure — combining working capital and capex within a single facility tailored to the investment horizon of a climate-smart agricultural intervention — could be applied to support transitions to drip irrigation, agroforestry, conservation agriculture, or controlled environment production across a wide range of African agricultural sub-sectors. Replication will be most straightforward where borrowers have identifiable revenue anchors, such as export contracts, offtake agreements, or access to premium domestic markets, that support commercial debt service.

Export market integration offers a transferable commercial model for climate-smart agriculture in Africa. The Namibia Berries transaction demonstrates that where production infrastructure is calibrated to international export standards, access to premium markets can generate the revenue base needed to service climate-smart agriculture financing on fully commercial terms. This export-anchored model is transferable to other high-value horticultural and agricultural sub-sectors across the continent where international demand, premium pricing, and stable buyer relationships can serve as the commercial foundation for climate-smart investment.

Blended finance could extend the model to less commercially mature contexts. This transaction required no concessional capital because the export market anchor provided sufficient commercial returns. In contexts where climate-smart agricultural investments have clear adaptation value but weaker commercial revenue profiles — such as smallholder transitions, rain-fed staple crops, or early-stage market development — partial guarantees, first-loss tranches, or technical assistance from development finance institutions could extend the reach of similar commercial bank structures to contexts where they would not currently be viable on purely commercial terms.

Standard Bank's programmatic approach demonstrates that climate-smart agriculture finance can be deployed at institutional scale. The bank has disbursed R7.3 billion in climate-smart agriculture finance between 2022 and 2025 across water management, precision farming, and conservation agriculture. This portfolio approach — building sector expertise, accumulating performance data, and refining underwriting criteria across multiple transactions — reduces per-deal origination costs and improves risk assessment over time, creating the conditions for further scale.

From Barriers to Solutions

Barriers

Climate-smart agriculture requires significant upfront capital expenditure, with benefits that take significant time to materialize. Conventional agricultural credit is typically structured around short operating cycles and near-term revenue, creating a structural mismatch with the investment horizons required for climate-smart agriculture.

Commercial lenders may perceive climate-smart agriculture as difficult to underwrite, given the technical complexity of newer production systems, limited comparable transactions, and uncertainty about how climate risks affect creditworthiness in specific agricultural sub-sectors.

Climate-vulnerable agricultural regions often face compound disadvantages, such as arid conditions, unreliable electricity, limited infrastructure, and weak market linkages, which collectively make agricultural investment appear unviable, even where targeted interventions could be effective.

Need to ensure commercial viability. Without access to markets that offer sufficiently high prices to justify the higher costs of climate-smart production, investments in climate-resilient agriculture may not generate commercially sustainable returns, limiting replicability to contexts where concessional support or impact subsidy is available.

Solutions

Integrated working capital and capital expenditure financing. Combining short-cycle operational funding and longer-horizon capital investment within a single facility aligns repayment with actual investment timelines and reduces transaction costs. The Namibia Berries facility comprised an N$10M overdraft, N$10M working capital, N$20M medium-term loan (five-year tenor), and a subsequent N$5M asset finance facility (ten-year tenor) for solar.

Deep sector expertise and integrated climate risk assessment. Deploying agricultural specialists who understand clients' production systems, climate exposures, and market linkages — combined with embedding physical and transition climate risk assessment into standard credit underwriting — enables lenders to move from perceived complexity to evidence-based structuring.

Bundled interventions addressing multiple vulnerabilities simultaneously. By financing a package of interconnected climate-smart technologies (including protective netting, hydroponic systems, solar power, water management, and post-harvest cooling) the transaction addressed multiple production vulnerabilities at once, transforming a climate-exposed operation into one capable of meeting international commercial standards year-round.

Export market integration as a commercial anchor for climate-smart investment. By financing infrastructure that meets international export standards, Standard Bank enabled Namibia Berries to access global blueberry markets with premium pricing and more stable demand than domestic markets alone provide. This export market linkage generates the revenue base needed to service financing on fully commercial terms.

Lessons Learned

Deep sectoral expertise is critical for making complex agricultural financing possible. Climate-smart agriculture transactions require lenders to understand production systems, export certification requirements, regional climate risks, and infrastructure constraints. A relationship-driven, sector-specialist approach, in which banking teams engage clients on both financing and resilience opportunities, enables more accurate structuring and builds the trust needed for borrowers to invest in longer-horizon climate-smart transitions.

Embedding climate risk assessment within the credit underwriting process strengthens lending decisions and adaptation outcomes. When climate risk analysis is integrated into standard commercial underwriting, rather than treated as a separate sustainability overlay, it ensures that financing structures and technology choices are grounded in a formal evaluation of borrower-specific climate exposures.

Export market integration can help ensure the commercial viability of climate-smart agriculture. Climate-smart infrastructure is capital-intensive, and its commercial viability can depend on access to markets that generate sufficient returns to service the investment. Where production infrastructure is calibrated to international export standards, access to premium pricing and stable buyer demand can create a self-sustaining commercial model, eliminating the need for concessional support. This suggests that identifying and structuring around a credible commercial anchor is one of the most important determinants of whether climate-smart agriculture finance can work on purely commercial terms.

Integrating working capital and capital expenditure within a single facility reduces barriers to adoption. Climate-smart agriculture requires both short-cycle operational funding and longer-horizon capital investment, but requiring borrowers to source these separately, from different lenders on different terms, adds complexity and cost that can deter investment. Combining both within a single integrated facility simplifies execution, aligns repayment with the borrower's actual cash flow profile, and reduces the transaction costs that can make smaller or more complex agricultural deals uneconomic.

Climate-smart investment can improve the credit quality of an agricultural borrower, not just its sustainability profile. Technologies such as hydroponic systems, protective netting, and solar power reduce a borrower's exposure to weather variability and infrastructure unreliability. By reducing production variability and enabling consistent quality for premium buyers, climate-smart investment can make revenue profiles more stable and predictable, improving the borrower's creditworthiness over time.

Standard Chartered

Developing a guide to adaptation and resilience finance and financing resilient energy infrastructure

Global, China, Saudi Arabia, United Arab Emirates, and United States

Standard Chartered is an international banking group, serving clients across 54 global locations. It has a global footprint that connects high-growth and emerging markets in Asia, Africa and the Middle East with more established economies in Europe and the Americas. In 2023, Standard Chartered published The Adaptation Economy which examined the need for adaptation investment in 10 developing markets. The report highlighted the multiplier effect on economies that such finance would have. It has sought to integrate adaptation considerations across its business by assessing physical risks and identifying opportunities for financing adaptation solutions.

Knowledge building and classification systems

Blended finance and risk sharing

JinkoSolar is a globally leading PV module manufacturer and energy storage system integrator. JinkoSolar's products have cumulatively served nearly 200 countries and regions worldwide, with approximately 4000 customers.

Nature of Risk Exposure

Solar farms are vulnerable to a range of extreme weather events. In this case, the Standard Chartered transaction to finance resilience solar modules involved corporate buyers in Florida (US), UAE and Saudi Arabia, who are exposed to different risks. Tornadoes and tropical storms are common in Florida, with more than 46 tornadoes having occurred in 2024. UAE and Saudi Arabia are vulnerable to extreme wind, storms and sandstorms. JinkoSolar has a series of solar panels which are designed to be wind resilient to a level which is above the standard requirement for photovoltaic products.

Solution Overview

Geography	Global framework; Chinese corporate customer; Saudi Arabia, United Arab Emirates and US (Florida) based end-clients
Year	2024 — the Guide; 2025 — JinkoSolar transaction
Solution Type	Adaptation finance guide; Trade finance; Bank guarantee
Applicable Sector(s)	Banking; Energy manufacturing

Description

Standard Chartered identified a critical gap in the realm of adaptation finance: while physical climate risks are increasing rapidly, requiring new approaches to agriculture, industry, and infrastructure and investment in flood defences, early warning systems, and agriculture technology, there was a lack of robust and widely-used frameworks and taxonomies to define, assess, or finance adaptation and resilience. This lack of clarity has limited banks' ability to systematically identify opportunities, structure transactions, and scale capital toward adaptation.

To address this, Standard Chartered collaborated with KPMG and the United Nations Office for Disaster Risk Reduction (UNDRR), to produce a **Guide for Adaptation and Resilience Finance** ("The Guide"). The Guide sets out a recommended blueprint for financial market participants that simplifies the decision-making process when financing adaptation and resilience.

Drawing on this work, Standard Chartered completed an adaptation transaction for JinkoSolar, a manufacturer of weather-resilient solar modules designed to withstand extreme weather conditions. The bank provided a guarantee to facilitate the export of these modules to projects in Florida (US), the UAE, and Saudi Arabia.

By providing export credit finance they facilitated the delivery of resilient solar capacity, both supporting climate change mitigation and supporting clients in building resilience against major losses as a result of increasingly frequent weather-related events. The panels are built to withstand much greater pressure than industry baselines, making them particularly suitable for areas exposed to extreme wind, storms and sandstorms. Standard Chartered's guide allowed them to label this transaction as an adaptation finance deal and contribute to their firm-wide commitment to increase their financing of adaptation activities.

Approach

Standard Chartered identified a need to deepen its own understanding of adaptation and resilience and develop greater recognition of the investment potential of related activities. This was an issue across the financial sector, with investors, commercial banks, and other financial institutions lacking a clear framework to consider these themes in financial decision-making. To address this gap, Standard Chartered developed a publicly available Guide which set out to provide the clarity needed across the market to accelerate investment into adaptation and resilience. This was subsequently put into practice in a transaction which provided bank guarantees to an exporter of highly resilient solar modules.

1

Develop a firm wide framework for adaptation and resilience

Responding to a Call for Collaboration during COP28, Standard Chartered collaborated with KPMG and UNDRR to develop a Guide for Adaptation and Resilience. This aimed to unlock private sector capital flows into adaptation and resilience by providing a practical assistance to financial market participants and bringing clarity to the decision-making process. The Guide helps market participants assess whether an investment is eligible for consideration as adaptation and resilience finance and includes information on: eligible use of proceeds; assessing substantial contribution to adaptation and resilience; avoiding maladaptation; alignment with national or local adaptation strategies; and measuring and reporting impact. It also introduces a classification system covering over 100 eligible financeable activities across seven adaptation and resilience themes, and identifies associated environmental and social co-benefits, with the ambition of standardising understanding of adaptation and resilience opportunities for financial institutions. This includes activities such as climate-resilient crops, public hospital infrastructure investment, and mangrove conservation and replanting.

2

Apply it to a specific transaction — providing guarantees to JinkoSolar for export of resilient solar modules

Standard Chartered applied the principles of the Guide to a specific transaction — the provision of a bank guarantee to JinkoSolar to support their trade in highly resilient solar modules. JinkoSolar's Tiger Neo N-type solar modules are engineered to withstand extreme environmental stress, including wind loads above industry baselines, sandstorms, and high-temperature degradation. Physical risk considerations, alongside the enhanced resilience characteristics of the product, informed the bank's overall assessment of the transaction.

- **Activity Classification:** The transaction was identified as an adapted investment because the financing supports technology that directly responds to physical climate risks (e.g., extreme wind and storm resilience) to protect the asset's productivity.
- **Use of Proceeds Alignment:** The deal aligns with the resilient infrastructure theme defined in the Guide. It supports strengthening electricity infrastructure to enhance resilience against natural hazards.
- **Demonstrated Substantial Contribution:** JinkoSolar's Tiger Neo modules are more resilient to pressure than baseline requirements, significantly reducing the probability of damage during high-wind events and building long-term resilience into critical energy infrastructure.

Scaling Potential

The Guide can be used by the bank and other entities to help drive a focus on adaptation within their activities. Widespread use will help develop a common understanding of adaptation and resilience-related financing opportunities. The specific guarantee transaction is illustrative of how banks can provide a financial instrument which builds a market for resilient products. This is replicable across the solar industry and beyond.

Applicability across many sectors and activities. The Guide can be used by financial institutions across different parts of the financial system. This includes activities that can be financed through private lending and investment arrangements, and through public market capital raising. By providing a common taxonomy and recommended standardized framework, the Guide aims to accelerate the development and structuring of financial products focused on adaptation and resilience, such as loans, bonds, private placements, structured notes, letters of credit, and deposits.

Establishing evidence for the applicability of the Guide to real transactions. The specific JinkoSolar deal serves as a blueprint for other financial institutions and corporate clients. It demonstrates how standard trade finance tools (like bank guarantees) can be labelled as adaptation if certain key conditions are met. This deal demonstrates how banks can respond to the growing demand for resilient infrastructure to mitigate economic losses caused by extreme weather events.

Illustrating how guarantees can help scale the market for resilient products. The guarantee acts to reduce risks faced by the customers of JinkoSolar. The enhanced resilience of the product supports confidence that the underlying assets are better positioned to withstand certain physical climate risks. This approach illustrates how financial instruments can support the adoption of resilient products and help build familiarity with adaptation-relevant financing structures.

From Barriers to Solutions

Barriers	Solutions
Absence of common language on adaptation: The lack of standardised definitions can make it difficult to get agreement on what types of activities can be considered as adaptation.	**Development of common set of criteria:** In the Guide, Standard Chartered provided a set of criteria for adaptation and resilience finance and applied it to specific activities. They classified over 100 activities as being adaptation and resilience, illustrating the breadth of potential investment opportunities beyond coastal flooding and government-led resilience projects. With that classification system in place they were able to approach JinkoSolar and understand what features a transaction would need to have to constitute adaptation and resilience finance.
Difference in methodologies creates uncertainty: Without commonly agreed way to measure physical risk and assess the benefits of adaptation it can be difficult to systematically integrate these considerations.	**Consistent methodology, applied in practice:** The Guide is publicly available for all firms to apply to their activities. It provided a clear, step-by-step roadmap for assessing physical climate risks and selecting eligible projects. The transaction moves Standard Chartered from theory to practice by applying the methodology outlined in the Guide, making it more usable in the future for other firms and in other transactions. Standard Chartered have also applied the Guide to projects within their portfolio and found a range of existing transactions that meet the criteria and can be classified as adaptation finance.
Lack of internal capacity and technical expertise: A cross-firm focus on adaptation requires front line bankers and relationship managers to have a good understand of climate issues.	**Training to assist front line bankers:** Standard Chartered ran an extensive internal training program which increased skills and expertise across the bank. Highlighting the importance of adaptation and resilience from both a risk management and as a source of future opportunities has supported front line bankers in understanding the relevance of the issues to their day-to-day operations. The Guide gave a clear structure for that training and acted as a resource to support ongoing conversations with clients.

Understanding whether a product is resilient requires complex modeling: Assessing an exposure to physical risk and the benefits of enhanced resilience requires an assessment of both the potential exposure and the product's ability to withstand risks.

Combining desk based modeling with engineering data: Standard Chartered used advanced modeling to assess the end-client exposure to physical risk in the locations that the solar panels would be placed. They supplemented this modelling with JinkoSolar's engineering data which illustrated the resilience of its products to extreme weather events (wind, storms, sandstorms). Taken together these data provided the evidence that the solar panels would make a substantial contribution to the resilience of the electricity system meeting Standard Chartered's requirements to label the deal as adaptation finance.

Perceived lack of commercial viability: Adaptation is often viewed as a cost rather than a path to profit.

Making the economic case: Standard Chartered analysis shows that every dollar spent on adaptation could generate up to 12 dollars this decade, including avoided losses and wider economic benefits. This transaction showed the benefits of a specific adaptation-related investment, illustrating that firms which produce resilient products can be a source of profitable opportunities for financial sectors firms, while reducing risk to consumers.

Lessons Learned

A structured, recommended framework can support the development and delivery of a firm-wide approach to adaptation. Standard Chartered has used the Guide to develop a strategic approach to adaptation and resilience and support the delivery of that strategy.

Adaptation is already happening — but not always labelled. Many adaptation-relevant activities are already being financed across the financial system, even if they are not being explicitly defined as such. In developing and deploying the Guide, Standard Chartered was able to ensure that adaptation-relevant activities were explicitly identified.

Measuring resilience benefits and substantial contribution criteria can be difficult. Central to many taxonomies is the idea of "substantial contribution". But what constitutes a substantial contribution depends on the local hazard and includes an element of intentionality which is hard to measure. The success of the JinkoSolar deal relied on matching specific engineering results to the specific risks of the target geographies.

Turning enhanced resilience into financing decisions remains elusive. Credit and transaction pricing models are complex and closely managed by firm management and credit committees. Systematically including physical risk and resilience metrics continues to act as a barrier to firms being able to stimulate additional demand and incentivising resilient clients.

Mitigation co-benefits can further incentivise transactions. Some projects can include co-benefits with other objectives, such as climate mitigation. By helping Standard Chartered deliver on both their net zero ambitions and on their adaptation objectives, this transaction was particularly attractive for the bank.

A clear adaptation strategy can be a point of differentiation amongst financial sector firms. When building relationships with real economy clients, the ability to offer expertise on physical risk and finance specific adaptation and resilience activities can serve to enhance a financial institution's offer to its clients. This can be especially useful when the client is also looking to achieve their own sustainability targets.

Tokio Marine

Applying insurance analytics and policy frameworks to enable port resilience investments

Japan, Asia

Tokio Marine Group is one of Japan's leading insurance groups and a global leader in property and casualty insurance, with significant operations across marine, cargo, aviation, energy, engineering, and commercial lines. The group has expertise in underwriting and managing risks associated with natural catastrophes, infrastructure assets, industrial facilities, and complex supply chains, supported by internal capabilities in catastrophe modeling, hazard analysis, and loss prevention engineering.

In Japan, Tokio Marine has a strong presence in marine and port-related insurance, including coverage for cargo, port facilities, logistics hubs, and industrial assets located in coastal and port-adjacent areas. As a result, the company has developed strong expertise in addressing risks associated with coastal flooding, storm surge, typhoons, and related business interruption risks.

- Physical risk data and risk modeling
- Supporting the scaling of financing solutions
- Active client engagement & stewardship

Nature of Risk Exposure

Japan's ports are economically critical assets, supporting trade, energy imports, manufacturing supply chains, and urban economies. At the same time, they are highly exposed to sea-level rise, storm surge, coastal flooding, and typhoon-related impacts, risks that have intensified in recent decades. A defining feature of port risk is systemic interdependence: even if an individual facility is protected, flooding can occur through adjacent, weakly protected neighboring assets, undermining the resilience of the entire port area. This weakest-link dynamic has historically complicated risk assessment, insurance underwriting, and investment decisions, creating uncertainty for insurers, lenders, and port operators alike.

Solution Overview

Geography	Japan
Year	2012-Present
Solution Type	Engagement; Insurance-enabled adaptation; Government policy and regulation
Applicable Sector(s)	Insurance; Ports and coastal infrastructure; Automobile manufacturing

Description

This case study illustrates how insurer-led resilience engagement can inform and be reinforced by national policy frameworks, creating a virtuous cycle that scales climate adaptation finance across an entire sector.

Transaction-Level Engagement

A key challenge in financing port resilience is that ports function as interconnected systems. Even when individual facilities are protected, flooding can occur via neighboring assets, complicating risk management and weakening incentives for individual asset owners to invest in resilience. For insurers and corporates, this systemic interdependence has historically made it difficult to assess asset-level risk, increased uncertainty around loss severity, and limited incentives to reward proactive resilience investments.

Tokio Marine encountered these challenges directly through its work with clients operating in port-adjacent areas. Following significant storm and flood losses at a major vehicle storage yard owned by a Japanese automobile manufacturer, Tokio Marine engaged the company to encourage it to reduce its exposure to sea-level rise, storm surge, coastal flooding, and typhoon-related impacts. Specifically, Tokio Marine assessed the site's flood risk and recommended raising the ground level of the storage yard. The company completed a capital investment in line with Tokio Marine's recommendation in 2012. Since then, subsequent heavy rainfall events have not resulted in comparable severe losses at the site.

National Framework Development

Subsequently, in 2025, the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT) convened a broad-based working group which convened academia, port authorities, infrastructure and logistics operators, and industry practitioners from multiple sectors, including Tokio Marine, to strengthen the resilience of Japan's ports. Drawing in part on practical lessons from industry experience, the working group introduced:

- A collaborative protection framework for ports, encouraging coordination across neighboring public and private assets and setting out guidance for system-wide identification of climate hazards and vulnerable facilities;
- Standardized methodologies for assessing and reporting physical risks for ports, using readily available hazard and exposure data aligned with TCFD- and ISSB-related disclosure expectations; and
- Tax incentives to encourage private port operators to invest in resilience measures such as seawalls, land elevation, and protective infrastructure.

This guidance has added clarity, consistency, and stronger expectations for proactive risk management across Japan's port ecosystem. Where earlier resilience measures reflected insurer-led risk prevention efforts undertaken through individual client relationships, the national framework reinforces that such action aligns with broader public policy objectives, creating standardized expectations and financial incentives that support scaling across the sector.

Approach

1

Tokio Marine Transaction

Following heavy rains in 2008 and a typhoon event in 2009, the automobile company experienced losses in the order of several million dollars at a critical vehicle storage yard, which stored ~8,000 completed vehicles awaiting export. As a concentrated node in the company's value chain, the site represented a material point of risk exposure.

Based on historical losses and claims data from the site, as well as Tokio Marine's broader experience working with nearly all major Japanese automobile manufacturers (many of whom operate port-adjacent storage yards), Tokio Marine proactively engaged the company and recommended raising the ground level of the storage yard to reduce flood exposures.

The manufacturer subsequently invested several million US dollars in the elevation project, which was completed in 2012. Since completion, subsequent heavy rainfall and high-tide events have not resulted in comparable severe losses at the site, despite continued exposure to storm-related hazards.

While Tokio Marine did not provide financing and/or offer explicit resilience-linked incentives, the engagement was embedded within the broader underwriting relationship. The resilience benefits of the ground raising measures were ultimately reflected in the company's premiums. By contrast, failure to take risk-reduction measures following significant loss events would likely have negatively affected future pricing.

2 Subsequent MLIT guidance	In 2025, MLIT convened a broad-based working group to strengthen climate risk management across Japan's ports. The group brought together academia, port authorities, infrastructure and logistics operators, and industry representatives from multiple sectors, including Tokio Marine. As an active participant, Tokio Marine drew on practical experience from transactions such as the automobile storage yard project to help inform discussions. The resulting guidance introduced: a collaborative protection framework encouraging coordination across interconnected public and private port assets; standardized methodologies for assessing and reporting physical risks, aligned with TCFD- and ISSB-related disclosure expectations; and targeted tax incentives to support private investment in resilience measures such as elevation and protective infrastructure

Scaling Potential

Tokio Marine has applied similar resilience-focused engagement models across multiple clients, with a particular focus on automobile manufacturers operating port-adjacent vehicle storage yards, which are often highly concentrated exposure points and especially vulnerable to storm surge, high tides, and rainfall.

Focus on where physical exposure is material but formal resilience standards remain underdeveloped. In industries that already operate under stringent protection requirements (e.g. chemical manufacturers), incremental insurer-led engagement may have limited additional impact. By contrast, coastal and port-adjacent sectors with lower baseline protection levels are strong candidates. In these contexts, national frameworks can reinforce and legitimize proactive private action.

Policy clarity as a catalyst for scale. Clear technical standards, coordinated planning frameworks, and targeted fiscal incentives reduce uncertainty around how resilience investments will be evaluated and treated, increasing the likelihood of proactive investment. Policy frameworks are most effective when informed by real-world transactions and industry expertise. When policy draws on practical industry experience, it is more likely to be operationally feasible and capable of accelerating private investment across jurisdictions.

System-level planning. The collaborative protection model introduced by MLIT helps mitigate interdependent vulnerabilities across port assets. This approach is transferable to other infrastructure systems, such as energy grids, transport corridors, logistics hubs, and industrial zones, where resilience is similarly dependent on coordinated action among multiple asset owners.

Standardized physical risk assessment methodologies. Other jurisdictions can also follow Japan's model of developing shared physical risk assessment methodologies anchored in national guidance. When corporates, insurers, lenders, and investors operate from a shared analytical framework, physical risk assessments become more comparable, repeatable, and decision-useful, creating the conditions for scale.

Insurers as providers of risk analytics and advisory services. Scaling depends on insurers drawing on their analytical capabilities beyond traditional underwriting. As providers of risk data, modeling expertise, engineering insight, and loss-prevention guidance, insurers can help standardize best practices across sectors. By integrating advisory functions with underwriting incentives, insurers can encourage proactive risk reduction while protecting long-term portfolio stability.

Capacity constraints. Broader scaling may be constrained by the need for specialized expertise. Flood risk assessment and loss-prevention advisory services rely on experienced risk engineers, who are limited in number and in high demand. As a result, engagement may be most effective when targeted toward material exposures, with national frameworks helping to standardize approaches.

From Barriers to Solutions

Barriers

Insurability and pricing pressures from intensifying physical risks. Rising exposure to sea-level rise, storm surge, and typhoons can lead to higher expected losses and strain insurance affordability and availability over time.

Insurer–client engagement may focus primarily on premium negotiation and claims management. Without deep familiarity of a client's exposure profile, operational context, and loss history, it can be difficult for insurers to introduce proactive resilience discussions or involve technical specialists early enough to shape capital planning decisions.

Corporates may lack specialized expertise in catastrophe modeling, flood simulation, hazard mapping, and loss quantification. Even when physical risks are identified, firms may struggle to translate these into clear financial metrics (e.g., avoided losses, payback, insurance implications) that justify resilience-related capital expenditure relative to competing priorities.

Private investment incentives may be weaker where adaptation benefits are shared. Resilience benefits often accrue across multiple port users (operators, tenants, logistics providers), which may weaken incentives for individual actors to invest.

Interdependence across interconnected assets. A key barrier to port resilience investments is the systemic nature of risk across interconnected assets. Even if one facility invests in protection, flooding can occur via adjacent, less-protected assets, undermining resilience investments and weakening incentives for individual actors to invest.

Lack of standardized methodologies and limited strategic prioritization of physical risk. Inconsistent modeling assumptions, metrics, and disclosure practices create uncertainty for corporates, insurers, lenders, and regulators. Without explicit reporting requirements, firms may face limited accountability to systematically quantify and actively manage exposure to physicals risks affecting operations. Without a shared analytical framework, physical risk assessments may lack comparability and decision-usefulness.

Solutions

Expanded insurer role as an ex-ante resilience enabler. Tokio Marine moved beyond ex-post risk transfer to ex-ante risk reduction, acting as a risk partner and advisor. By supporting adaptation before losses occur, it was able to help safeguard long-term insurability and portfolio stability.

Long standing relationship enabled proactive resilience discussions. Tokio Marine had a long standing pre-existing relationship with the automobile manufacturer. This meant that the insurer was familiar with the client's loss history and exposure profile, which allowed for proactive engagement on resilience.

Insurer-led physical risk analysis and quantification. Tokio Marine conducted site visits, scenario-based flood modeling, and translated its physical risk assessment findings into concrete financial metrics. By leveraging its risk modeling expertise, Tokio Marine supported more informed capital allocation decisions without requiring the corporate to invest heavily in the development of in-house modeling capacity.

Policy clarity grounded in industry expertise strengthened investment signals. In developing national guidance and incentives, Japan increased incentives for coordinated action. This reduced coordination failures, aligned public and private interests, and sent a strong signal that port resilience was a national priority, increasing confidence in proactive private investment.

System-level collaborative protection framework. Japan's MLIT-led framework promoted coordinated planning across port assets rather than isolated facility-level upgrades. By encouraging shared standards and joint responsibility, the framework reduced systemic vulnerability and improved the aggregate risk profile of ports.

National guidance and disclosure rules elevated physical risk into mainstream governance. Japan's implementation of TCFD- and ISSB-aligned disclosure standards created an expectation for firms to quantify, disclose, and explain how they manage physical risks, increasing demand for robust risk assessment and credible adaptation planning. MLIT guidelines provided further clarity by establishing standardized metrics and methodologies for assessing and disclosing physical risks for ports, creating a shared analytical language and improving data consistency.

Lessons Learned

Insurance can act as an ex-ante enabler of resilience. Insurance can move beyond post-loss risk transfer to support proactive risk reduction. By applying their expertise in catastrophe modeling, hazard simulations, and loss calculations, insurers can help firms quantify physical risks, identify cost effective risk mitigation measures, and translate technical findings into investments that increase resilience. This forward-looking engagement supports more informed capital allocation and strengthens long-term insurability.

Understanding avoided losses and pricing dynamics is critical. The financial value of resilience lies partly in losses and premium increases that do not occur. Absent resilience-enhancing measures, insurers may raise premiums to reflect higher expected losses, particularly following repeated climate events. While it is difficult to precisely quantify the counterfactual trajectory of premiums and losses, understanding avoided losses and the ways in which resilience enhancements can moderate pricing pressures is critical to clarifying the value of resilience investments.

Government frameworks are stronger when they draw on industry experience. Real-world transactions generate practical insights about what works in reducing losses. These insights can inform policy discussions and ensure that guidance, incentives, and methodologies are grounded in operational realities.

Standardized methodologies and clear policy signals can unlock private investment. Uncertainty around how to measure physical risk and how resilience investments will be treated can be a major deterrent to private capital. Establishing standardized risk assessment frameworks and providing consistent policy signals, for example, coordinated planning structures and fiscal incentives, can reduce uncertainty and address coordination failures.

Widespread climate disclosures can help mainstream adaptation action. The introduction of climate disclosure requirements can create additional incentives for corporates to improve physical risk management. Over time, a reinforcing cycle can emerge in which stronger disclosures drive better risk management, and improved adaptation strengthens the credibility of reported information.

Coordination across public and private actors is essential where risks are system-dependent, and governments can play a key role. In infrastructure and other interdependent systems, resilience outcomes depend on collective action. Without mechanisms for coordination, actors may underinvest. Structured collaboration frameworks can materially improve system-wide resilience. Governments can encourage action by private entities through policy, guidance and financial incentives.

Zurich

Risk analytics supporting a global logistics company making preventative resilience investments

Global

Zurich Insurance Group is a leading multi-line insurer serving people and businesses in more than 200 countries and territories. Beyond traditional risk transfer, Zurich has established Zurich Resilience Solutions (ZRS), a specialized global risk consulting unit. ZRS leverages Zurich's decades of probabilistic catastrophe modeling and on-site risk engineering expertise to provide data-driven, science-based insights that help customers manage climate, supply chain, and cyber risks.

A.P. Moller — Maersk is a global shipping and logistics company, founded in Svendbord, Denmark in 1904. It aims to become the "Global Integrator", offering fully integrated logistics solutions that connect, protect and simplify customers supply chains. It is increasingly considering climate change as an obstacle to supply chain resilience and is framing action as part of its financial resilience strategy.

Physical risk data and risk modeling

Supporting the scaling of financing solutions

Nature of Risk Exposure

Maersk's ports are typically located along open coasts or in low-lying estuaries and deltas, and so are vulnerable to windstorms, flooding and storm surge, which will be exacerbated by sea level rise. Operations can also be interrupted by fog and snow, while heat waves can restrict working conditions. In the past decade, Maersk has seen coastal flooding at their terminal in Port Elizabeth, New Jersey; flooding at the Salalah terminal in Oman; a cyclone hit their Pipavav terminal in India; and they face regular exposure to tropical windstorms to terminals in Miami, Florida, and Mobile, Alabama.

Solution Overview

Geography	Global
Year	2024-Present
Solution Type	Physical risk data and modeling; Consulting; Insurance-enabled adaptation
Applicable Sector(s)	Insurance; Ports and coastal infrastructure

Description

Zurich Resilience Solutions (ZRS), the risk advisory unit of Zurich Insurance Group, has sought to address a fundamental barrier to climate adaptation: the fact that resilience is often viewed as a sunk cost rather than an investment in future profitability. ZRS has developed an approach that promotes the use of the insurance industry's expertise in assessing hazards, risks and vulnerabilities, and turning those into financial metrics. Using this model, ZRS have worked with a wide range of clients to assess their resilience and make recommendations for investments that would reduce exposures and have positive financial payoffs in many future scenarios. This involves:

1 Making the case for investment in resilience:

ZRS has built a model that draws on Zurich's extensive expertise in risk analytics, risk modeling and engineering to provide services to clients to assess their risks and quantify the financial benefits to taking resilience measures. The foundation of this approach is Zurich's proprietary data that is based on claims and risk engineering data to develop robust, high-quality financial impact models and climate data.

2 Applying this model to a client's activities:

ZRS put this framework into practice by supporting the global shipping company, Maersk, in future-proofing its global port operations. ZRS conducted on-site climate assessments at critical terminals to identify specific vulnerabilities to sea-level rise, extreme wind events, and storm surges.

The assessments linked investments in resilience to future financial benefits in the event of extreme weather events, with loss expectancies translated into tangible site-level recommendations. Specifically, ZRS provided actionable investment recommendations for maintenance and infrastructure upgrades, which Maersk subsequently integrated as part of a multiyear investment program. To ensure internal alignment and effective implementation, ZRS also facilitated regular workshops to explain the assessments and outcomes to a broad range of Maersk stakeholders, strengthening collaboration across functions.

Approach

Zurich Insurance Group sees risk prevention as one of the most effective mechanisms for closing the adaptation finance gap. Undertaking physical risk assessments, identifying resilience measures, and making capital investments can materially reduce future losses from chronic and acute climate hazards and ensure businesses can thrive even when faced with climate impacts. Yet despite strong evidence of avoided-loss benefits, adaptation investments are largely treated as a cost rather than as a source of future value.

ZRS frames adaptation as a capital allocation decision grounded in probabilistic risk modeling and financial optimization. Drawing on the insurance industry's deep expertise in probabilistic modeling, handling large scale granular data sets, mapping physical risks to financial outcomes, and on the ground engineering, ZRS seeks to quantify avoided losses and translate physical climate exposure into decision-useful metrics. To operationalize this, ZRS was developed to provide three integrated capabilities:

1 Probabilistic catastrophe modeling	ZRS uses stochastic catastrophe models to assess the likelihood and severity of a range of climate-related events under multiple scenarios. Rather than relying on averages, these models evaluate full loss distributions, including tail risks and extreme events. This helps firms make informed decisions about their risk tolerance and CapEx priorities.
2 On-site risk assessment	ZRS deploys specialized risk engineers to conduct detailed on-site assessments. This may include drone surveys, structural inspections, material testing, and operational reviews to refine vulnerability analysis at the asset level. These measures help prioritize what interventions could be most valuable based on the specific physical features of assets and their role in generating economic value.
3 Monetizing avoided losses and assessing resilience benefits	ZRS translates exposures to climate perils into financial metrics, assessing the impact of resilience measures, and quantifying how they can shift loss curves under different scenarios. These models provide insights that can be applied directly to a company's risk management and capital expenditure decisions.

Maersk application

This approach was applied in ZRS's engagement with the global shipping and logistics company Maersk. With more than 67 port terminals, 300 inland facilities and 600 container ships, Maersk identified climate change as the biggest threat to its business. Ports are among the most exposed sites in the world, facing damage from physical losses and business interruption costs. The company projects that the combined costs could increase by approximately 130% by 2050 relative to 2020 levels.

To assess and manage this exposure, Maersk first used a third-party natural catastrophe and climate change risk tool to monitor their 1400+ physical assets, providing a clear understanding of where exposures exist. They then conducted deep-dive assessments with ZRS' specialist climate risk engineers, who undertook on-site assessments at five critical port terminals: Rotterdam, Port Said, Aqaba, Port Elizabeth, and Los Angeles. This was combined with work by a team of climate data experts to develop resilience solutions tailored to each port. This included: assessing the cost of inaction, establishing projected exposure to physical damage and business interruption under different scenarios; identifying site-specific resilience measures; and developing a financial case, setting out costs and benefits of undertaking the recommended resilience measures.

This approach enabled Maersk to integrate resilience considerations into strategic planning and capital allocation decisions. Maersk drew on the advice received from ZRS and has applied these recommendations to strengthen resilience across their terminal operations, with a particular focus on operational resilience, risk-informed planning, and investment in risk mitigation measures. Two out of five assessed terminals had either expansion projects or new concessions underway, allowing recommendations to be shared directly with project teams, supporting implementation. Alignment with active development cycles ensured that resilience considerations were embedded from the outset, enhancing the effectiveness and uptake of the proposed measures.

Maersk operates a captive insurance company, which retains a portion of the group's risk internally, while transferring residual risk to external insurers. When physical risk exposure is reduced through resilience measures, the expected losses borne by the captive decline. While Maersk's captive does not yet formally recognize long-term risk reduction benefits in internal coverage, climate change and risk engineering are fully integrated within their risk management approach. Lowering underlying exposure improves the economics of risk transfer, allowing the firm to retain less risk on its own balance sheet or to reduce the volume and cost of coverage purchased from external insurers.

Scaling Potential

Zurich's core insight — that long-term value preservation comes from risk prevention, rather than from short-term cost avoidance followed by future asset damage and business disruption — is widely applicable.

Insurance sector. Insurance companies possess deep capabilities in probabilistic modeling, granular data analysis, loss estimation, and risk engineering. These competencies, historically used for underwriting and premium pricing, can be extended into advisory services that help corporates quantify climate exposure and evaluate resilience investments. ZRS has seen demand for climate resilience services grow exponentially in recent years as more businesses urgently seek to define and deploy effective climate adaptation strategies to protect them. This suggests a replicable commercial model.

Real economy corporates. ZRS's risk assessment capabilities can help real economy companies like Maersk translate resilience actions into measurable financial outcomes, such as avoided losses, improved operational continuity, and potential reductions in insurance costs. Armed with this analysis, Maersk decided take action to strengthen its resilience. The same model could be applied across utilities, manufacturing, agriculture and many other sectors. Firms can also seek to use these resilience measures to secure savings in insurance premia.

System-level scaling. While insurers like ZRS can provide climate risk data and assessments, and corporates like Maersk can adjust their capital allocation on the basis of those assessments, systemic resilience requires supportive public frameworks. Updated building codes, infrastructure standards, and regulatory guidance are essential for systemically embedding climate risk data into mainstream construction and planning practices. This case underscores that private-sector innovation can demonstrate the financial case for prevention, but large-scale transformation depends on policy alignment that institutionalizes resilience standards across markets.

From Barriers to Solutions

Barriers

Difficulty making the commercial case for resilience. Adaptation investments are often seen as a cost and not as the basis for ensuring business resilience. Without clear financial articulation of benefits, resilience measures may be deprioritized relative to revenue-generating projects. Successful adaptation manifests as avoided losses, meaning the financial benefit is the absence of disruption or damage.

Complexity of modeling physical climate risks at asset level. Assessing exposure requires selecting appropriate climate scenarios, handling granular datasets, modeling hazard frequency and severity, and translating physical impacts into financial loss distributions. Many firms lack the in-house expertise to conduct this analysis rigorously.

Short-termism in financial planning. Investment cycles typically operate on 1 to 3 year horizons, while climate risks evolve over decades. This temporal mismatch discourages long-term resilience investments whose benefits accrue over extended periods.

Narrow asset-level assessments may overlook value-chain dependencies. An asset may appear resilient in isolation but still face operational disruption if surrounding infrastructure—energy grids, transport corridors, inland logistics networks—fails. Focusing only on physical damage to the asset underestimates broader business interruption risks.

Solutions

Reframing adaptation as a commercial opportunity. Zurich's approach demonstrates that adaptation can generate tangible value. For insurers, advanced risk modeling capabilities, historically developed for underwriting and premium pricing, create a commercial opportunity to provide risk analytics and advisory services to real-economy firms. For corporates, comprehensive risk assessments that quantify projected climate impacts and the financial benefits of specific resilience measures help transform adaptation into a financially grounded capital allocation decision vs a discretionary cost. Work to standardize reporting of avoided losses would help in reward firms that invest in resilience by allowance comparison with peers.

Drawing on interdisciplinary expertise and established underwriting and modeling expertise. Insurers have decades of experience conducting probabilistic catastrophe modeling and granular asset-level loss analysis for premium pricing and capital management. Zurich extended these capabilities into advisory services and integrated climate scientists, structural engineers, and insurance underwriters to ensure recommendations were scientifically robust, technically feasible, and financially viable. This approach enabled Maersk to access sophisticated modeling without building in-house teams.

Forward-looking probabilistic modeling extends planning horizon. Zurich's long-term scenario-based loss projections quantify how exposure may evolve under different climate pathways, including tail-risk events. By making future loss trajectories visible in present-value terms, ZRS helped Maersk justify multi-decade infrastructure upgrades and resilience investments. Maersk integrated recommendations into long-term resilience plans, with investments aligned to terminal concession periods (maximum 30 years) and managed through annual terminal budgets and dedicated funding processes for larger development projects.

Whole value-chain and asset-level risk perspective. ZRS applied a whole-value-chain risk perspective, extending analysis beyond the asset itself to assess the resilience of surrounding energy grids, transport routes and logistics networks. Alongside loss analyses, ZRS used asset-level data and risk-engineering assessments, bringing together internal stakeholders to align risk definitions and integrate datasets from multiple functions. This captures disruption-driven impacts, not just damage to physical infrastructure.

Resilience measures must be locally specific, but adaptation guidance is often generic. The effectiveness of interventions depends on geographic location, site orientation, workforce conditions, and regional hazard patterns. Desk-based assessments may fail to capture critical operational nuances and local conditions which may affect the risk, e.g. quality of infrastructure increasing flood risk, or energy reliability.

On-the-ground, asset-specific risk engineering. ZRS complemented probabilistic modeling with detailed on-site assessments (including engineering assessments and localized vulnerability analysis) to tailor recommendations to each facility's operational and environmental context. This ensured resilience measures were both technically appropriate and economically justified.

Limited integration of physical risk analytics into financing decisions. Even when risk assessments are conducted, they are often siloed from financial decisions. Without quantified exposure and resilience impacts, firms cannot optimize how much risk to retain on balance sheet vs transfer to external markets.

Empowering risk retention. This project enabled Maersk to make data-driven decisions about how much climate risk to retain through its internal captive insurance company versu how much to transfer to external markets. By quantifying exposure and resilience impacts, the assessment supported optimization of insurance capital allocation — a direct financial benefit beyond physical risk reduction.

Lessons Learned

Adaptation is highly context-dependent. The best-in-class complement standardized models and high-level risk maps with site-level engineering assessments to ensure that resilience investments are proportionate, effective, and operationally aligned.

Quantified resilience assessments can enhance capital efficiency. Adaptation is not only about reducing losses but also about optimizing risk retention, insurance purchasing, and overall cost of capital.

Adaptation assessments should move beyond a narrow focus on physical asset damage. Financial materiality often lies in business disruption and systemic interdependencies. A whole value-chain perspective better captures true exposure and informs more comprehensive resilience planning.

Simply walking away from high-risk geographic areas does not build global resilience, whereas adaptation strategies that prioritise risk reduction can contribute to long-term systemic resilience. Private sector engagement may be more constructive than risk-based exclusion.

A range of expertise is needed to make technically sound and financial viable recommendations. Building the business case requires drawing on a range of technical expertise including knowledge of climate scenarios, on the ground engineering knowledge, and financial modeling. Insurers are well placed to work with corporates to provide this expertise.

Annex

Definitions

This report uses the following terms to mean:

Adaptation	is the process of adjustment to actual or expected climate change and its effects, in order to reduce harm or take advantage of beneficial opportunities.
Resilience	is the capacity of a system to anticipate, absorb, adapt to, and recover from climate-related shocks while maintaining core functions.
Physical risk	refers to the financial and economic impacts arising from the physical effects of climate change, including both acute and chronic hazards.
Chronic impacts	are long-term, gradual changes in climate conditions that affect economic activity and asset performance over time, such as rising temperatures, sea-level rise, and water stress.
Acute impacts	are short-term, event-driven climate hazards that can cause sudden damage and disruption, such as storms, floods, wildfires, and heatwaves.
Tipping points	are thresholds where changes in one part of the system become self-reinforcing, leading to widespread and potentially irreversible impacts.
Financial institutions	refers collectively to banks, insurers, asset managers, pension funds, asset owners, and other providers of finance.
Companies (or corporates)	refers to organizations operating in the real economy.
Adaptation finance	refers to capital deployed to reduce exposure to physical climate risks, to build resilience to the realization of physical climate risks, or to finance products of services which enable others to reduce exposures or build resilience.

Financial institutions deploy many different approaches to physical risk assessment

Financial institutions deploy a range of complementary approaches to assess physical climate risks and identify adaptation opportunities. These include:

Hazard identification and scenario analysis	FirmsFinancial institutions typically begin by identifying relevant climate hazards (floods, heatwaves, droughts, storms, sea-level rise, etc.) that could affect specific assets or portfolios and . They then use utilize scenario analysis to examine how hazards may evolve under different climate futures (1.5°C, 2°C, 3°C warming) to understand the range of potential outcomes across multiple possible futures.
Top-down / portfolio-level analysis	Top-down analysis aggregates physical risk exposures across a portfolio of assets, clients, or geographies, helping to identify risk hotspots across large or dispersed portfolios. This approach involves mapping climate hazards to asset locations and quantifying the concentration of exposures to specific risks. Top-down analysis provides a strategic view of portfolio vulnerability, identifies priority sectors or geographies, and enables efficient resource allocation.
Bottom-up / asset-level assessment and on-the-ground assessment	Asset-level assessment examines the specific vulnerabilities of individual assets, facilities, supply chains, or borrowers. This combines site-specific climate hazard data (hazard maps, frequency/severity analysis) with asset-specific vulnerability characteristics (elevation, construction standards, proximity to hazards, exposure windows). This is often complemented with on-the-ground assessment by field experts (agronomists, hydrologists, engineers) with a practical understanding of how risks manifest at specific sites. Asset-level assessment enables detailed quantification of potential impacts and damages, supports identification of specific resilience measures, and helps structure targeted financing solutions.
Materiality assessment	Materiality assessment determines which hazards pose material risks to financial performance, distinguishing between chronic stresses (water stress, heat) and acute events (floods, hurricanes), and evaluating how hazards interact across supply chains and operations.
Technical analysis and modelling	Technical analysis employs specialized climate models and tools (such as models for flood and storm surge; drought and water stress; heat stress and cooling demand; wildfire risk; and supply chain disruption) to project physical impacts, and quantify damages in financial terms (avoided losses, business disruption, reduced yields).
Resilience options appraisal	This involves identifying and evaluating possible adaptation and resilience measures, including their technical feasibility, cost-effectiveness, and co-benefits. Resilience investments are appraised using financial metrics (net present value, return on investment, cost of capital) to quantify the business case for adaptation. This translates avoided losses and resilience benefits into investment returns, supporting capital allocation decisions.
Readiness assessments	Readiness assessments evaluate a client's capacity to plan, implement, and sustain resilience measures, including their governance, risk management, technical capability, access to finance, and regulatory alignment. It helps distinguish between entities that are exposed but prepared and those that are exposed and vulnerable.