CFRF CLIMATE FINANCIAL RISK FORUM

CFRF AWG ADAPTATION FINANCE-RELATED CASE STUDIES

October 2024

Case Study Contents

These case studies include a mixture of physical risk assessments to identify adaptation needs as well as a mix of investments undertaken, products developed, and policy solutions focused on improving adaptation deal flow. We also provide capacity building examples, which are important for contingency planning.

Asset/sector analysis

These case studies focus on using physical risk assessments to identify adaptation needs.

Run-of-river hydro power plant resilience – Coalition for Climate Resilient Investment (CCRI)

In response to the increasing need for bridging the adaptation finance gap, the Coalition for Climate Resilient Investment (CCRI), convened key industry players, led by Mott MacDonald, to develop the Physical Climate Risk Assessment Methodology (PCRAM).[1] The overall approach is to provide a strategic review of assets to optimise and enhance investment appraisal practices to improve investment decision making. It enables a rigorous interpretation of climate risk and climate data to assess the operational, commercial, and financial materiality of an infrastructure asset. PCRAM guidelines have been prepared for infrastructure asset developers, managers and providers of capital.

The methodology combines three distinct fields to incorporate physical climate risks into the appraisal of infrastructure assets, namely (a) climate science, (b) infrastructure asset management and engineering, and (c) infrastructure finance. PCRAM builds on good practice from each of these fields, including IPCC models with the Synthesis Report of the Sixth Assessment Report (AR6), ISO Standards on Climate Adaptation and the Asset Management Institute ASCE MPE 140. PCRAM is a four-step, industry-approved methodology for demonstrating the material value of investing in resilience.

To ground PCRAM in real-world scenarios across a range of asset types, it was tested with early adopters, including a run-of-river hydropower facility, which provides clean energy to more than 600,000 people. Through the four-step methodology, a materiality assessment identified drought and precipitation as the most material climate hazards to the project in terms of long-term asset valuation. Potential resilience options were then identified and shortlisted for a cash flow modelling assessment, where options were assessed against the asset objectives and the evidence provided for the preferred option supports investment decision making. Interestingly, the provision of 200 GWh/year of renewable energy was selected as a preferred option to smooth out the uncertainty in flow rates. Despite the 1-2% CapPEx expenditure, this was paid off by the significant improvement of downtime and secured the long-term resilience of the asset. Interestingly also, there is no insurance for hydropower projects for a lack of generation from drought, showing the importance of undertaking an assessment to best protect the asset from fluctuation.

Through this pilot, the CCRI were able to identify that the benefits of infrastructure can be articulated in both financial and non-financial ways. For example, through this project, the asset owner can now create social and environmental impacts by safeguarding 300 construction jobs over the project's lifecycle. In addition, the project emphasised that applying PCRAM at a portfolio and systems level can lead to a better understanding of the costs and benefits of resilience investment.

Resilience investment is a key risk for the early-adopter organisation and is integrated into their governance structures. The CCRI can demonstrate the scalability and applicability of PCRAM across sectors and asset levels.

[1] CCRI. (2021) *Physical Climate Risk Assessment Methodology (PCRAM)* https://storage.googleapis.com/wp-static/wp_ccri/c7dee50a-ccri-pcram-final-1p.pdf.

What next: PCRAM was tested with three further early adopters and rolled out globally, so that the best practice framework can be utilised across the built environment. In 2024 and beyond the Institutional Investor Group for Climate Change (IIGCC) is convening the development of PCRAM 2.0 engaging members to further test and strengthen the method. Mott MacDonald has been appointed as co-chair recognising the significant contribution to PCRAM 1.0.

Coastal wind farm resilience – CCRI

One of the assets used during the testing phase was a Coastal Wind Farm in SouthEast Asia, which is projected to provide 159 GWh/year of energy for a major city. PCRAM's four-step methodology enabled the early adopter to identify that the wind farm is exposed to sea level rise, due to the risk of substation floods, but is not significantly exposed to decreases in average daily wind speed. The asset owner was able to use PCRAM to test the financial viability of an existing resilience measure, that was factored into the original design whereby the substation was raised. Through the PCRAM, it was determined that the impacts of incorporating the resilience option would lead to significant cost savings in the long-term. Through the PCRAM, it was determined that the impacts of incorporating the resilience option would lead to significant cost savings in the long-term, giving further confidence to invest in resilience in the future.

Through this pilot, the CCRI were able to align with robust, existing asset-level analysis and prove the financial case for investing in resilience options.

PCRAM can be applied to different asset types at different points in the lifecycle. Organisations with increased maturity can use PCRAM to evidence the benefits of investing in resilience and improve asset valuation.

What next: This case study, along with three others, were used to develop and test PCRAM. Since then there have been global adoptions with some high profile and strategic organisations utilising the industry benchmarked methodology. The Institutional Investor Group for Climate Change (IIGCC) has since taken on a leadership role, bringing members together to further develop PCRAM 2.0. Mott MacDonald has been appointed as co-chair recognising the significant contribution to PCRAM 1.0.

Heat and flood-related apparel supply chains risk – Schroders

We mapped the supply chain footprint of six global apparel brands across four focus production centres – Dhaka (Bangladesh), Ho Chi Minh (Vietnam), Karachi (Pakistan) and Phnom Penh (Cambodia) – and then assessed the exposure of each brand's assets to heat stress and flooding in 2030 and 2050. The analysis then goes on to explore the associated Value-at-Risk (VaR) from these climate impacts, driven by decreases in worker productivity and disruption to the functioning of factories.

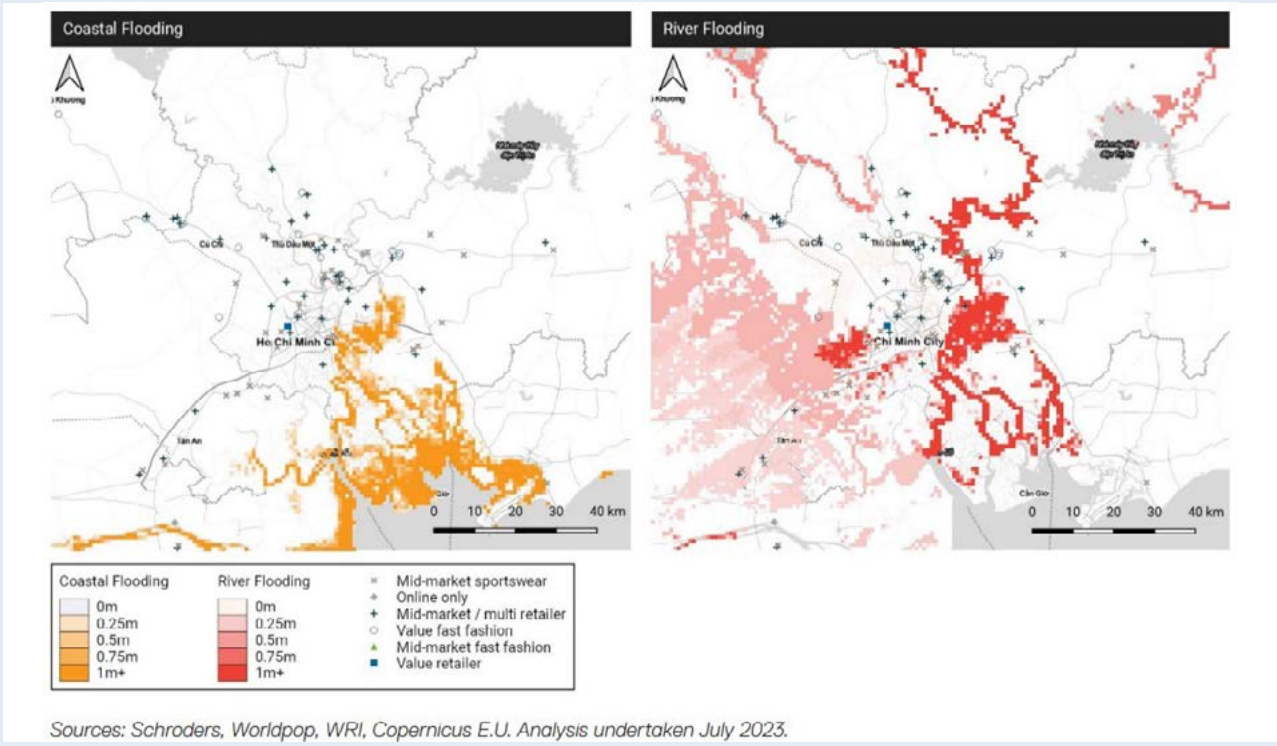
For heat stress, we used wet-bulb globe temperature (WBGT) and daily maximum surface air temperature data as proxies, with data sourced from 10+ CMIP6 models from Copernicus and SSP2-4.5 as the chosen scenario. For flooding, we used WRI's Aqueduct coastal and riverine/rainfall flooding models built around RCP 4.5/SSP 2. The full methodology is set out from p.57 in our long report found here.

Our analysis identifies Vietnam as one of the largest fashion hubs that are most vulnerable to climate physical risks, per the geospatial analysis of flooding risk in Figure 1. However, few manufacturers with operations in Vietnam have explicitly acknowledged and addressed these risks in their ESG reports, nor have they provided transparency on what measures they are taking to adapt to these heightened risks.

On this basis, we conducted site visits and engagements with apparel original equipment manufacturers (OEMs) with factories in Vietnam to better understand what stage they are at in anticipating and adapting to physical climate-related risks. We found that while some have conducted a qualitative assessment of the risk exposure, the use of scenario analysis, evidence of quantitative physical risk impact assessment, and the implementation of adaptation measures appear lacking within the industry. Notably, it is rare to see OEMs apply physical risk assessment criteria to their suppliers.

What next: Schroders used these insights to develop a set of adaptation-specific engagement questions for investors to help companies in high-risk areas, such as Vietnam, to think about and improve their resilience to physical risks. This continues to be a focus area of engagement for Schroders.

Figure 1: Brand exposure to Ho Chi Minh coastal and riverine flooding in 2030.[2]



Sources: Schroders, Worldpop, WRI, Copernicus E.U. Analysis undertaken July 2023.

[2] Schroders. (2023). *Higher ground: How fashion supply chains are being impacted by extreme heat and flooding*. https://www.schroders.com/en-gb/uk/institutional/insights/higher-ground-how-fashion-supply-chains-are-being-impacted-by-extreme-heat-and-flooding/

Investments

These case studies focus on fully private and also public-private investment examples.

Catalyst Climate Resilience Fund – Climate Policy Initiative

The Catalyst Climate Resilience Fund (CCRF) is an impact fund and accelerator supporting pre-seed tech startups that are building a climate resilient future in Africa. The fund blends capital from concessional and commercial equity investors to invest $200,000 in selected pre-seed portfolio companies. It combines capital and venture building support and will have significant reserves to make follow-on investments at Seed and Series A in selected portfolio companies. The Fund announced in September 2023 an initial close of $8.6 million towards a target $40 million fund size.

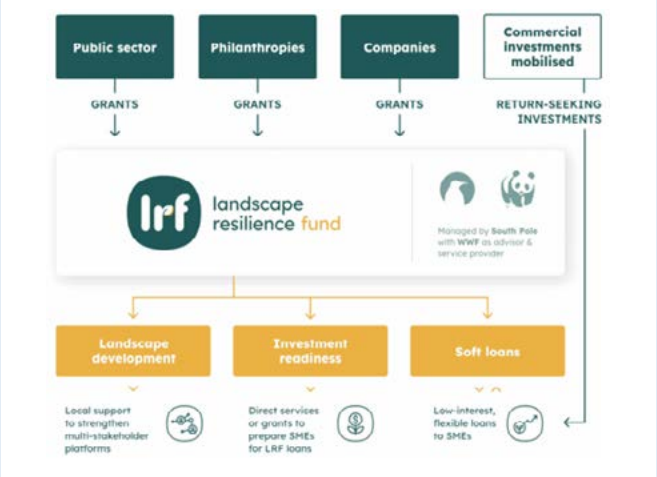
The fund provides blended capital and capacity building support. The CCRF, which was designed by the Climate Policy Initiative, is accompanied by a grant-funded facility called the Catalyst Ecosystem Hub that promotes shared learnings, builds communities, and engages ecosystem actors to create a more vibrant, informed, and effective climate resilience ecosystem in Africa.

What next: The fund plans to invest in adaptation across sectors including fishery management, food systems, cold chains, and water management. To date, the fund has invested in 10 startups from six countries including Egypt, Senegal, and Morocco.

Landscape Resilience Fund – South Pole and WWF

The Landscape Resilience Fund (LRF) was launched in June 2021 to target climate adaptation in developing countries. It supports small and medium-sized enterprises (SMEs) within sustainable agricultural and forestry supply chains to improve the resilience of smallholder farmers, using technical assistance grants and low-interest loans. Low interest, flexible loans are provided to local small and medium-sized enterprises, funded by $25m in grants from Chanel and $1.3m for Global Environment Facility for pre-investment support.

Figure 2.



The LRF was co-developed by South Pole and WWF, who act as Fund manager and Fund advisor, respectively.

Climate Resilience Bond – European Bank for Reconstruction and Development

The European Bank for Reconstruction and Development (EBRD) launched the first ever dedicated climate resilience bond, raising US$ 700 million BNP Paribas, Goldman Sachs, and Skandinaviska Enskilda Banken AB acted as joint bookrunners, which saw demand from approximately 40 investors in 15 countries. The EBRD's Climate Resilience Bond was issued in conformity with the four core principles of the Green Bond Principles, while the projects earmarked for the Use of Proceeds are selected and managed in alignment with the Climate Resilience Principles, published by the Climate Bonds Initiative (CBI). Outcomes include climate resilient infrastructure, business and commercial operations and climate-resilient agriculture and ecological systems.

The bond follows Green Bond Principles[3] and CBI Climate Resilience Principles.[4]

Belize Blue Bond Resilience Wrapper – WTW

Type of intervention: Debt-for-nature swap and insurance.

Structure: At the end of 2020, Belize was struggling to service its public debt, which had reached US$2.1 billion. This was around the same time Belize suffered major flooding in the aftermath of Hurricane Eta while simultaneously battling the COVID-19 pandemic. Belize faced an overwhelming challenge; the country needed swift resources for disaster response while still meeting their debt servicing obligations and long-term sustainable development priorities. The Nature Conservancy's NatureVest unit, along with Credit Suisse, assisted the Government of Belize to restructure their outstanding privately held debt, amounting to over US$500 million, resulting in the issuance of a 20-year blue bond. The blue bond was protected by a Resilience Wrapper designed and placed by WTW, along with political risk insurance provided by the U.S. Development Finance Corporation. The Resilience Wrapper triggers for the most impactful events (>~20% GDP impact expected based on historical analysis) including severe hurricanes; multiple hurricanes in the same season; and particularly wet hurricanes. If the policy is triggered, the pay-out replaces the next semi-annual debt serving payments due to be made by the Government of Belize.

Success criteria: Belize benefited from a direct debt reduction and reduction in the cost of capital, as well as a Sovereign credit rating boost by S&P by three steps, from CC to B-.

What next: The Resilience Wrapper was renewed at the end of the original term for a three year period from 1 May 2024.

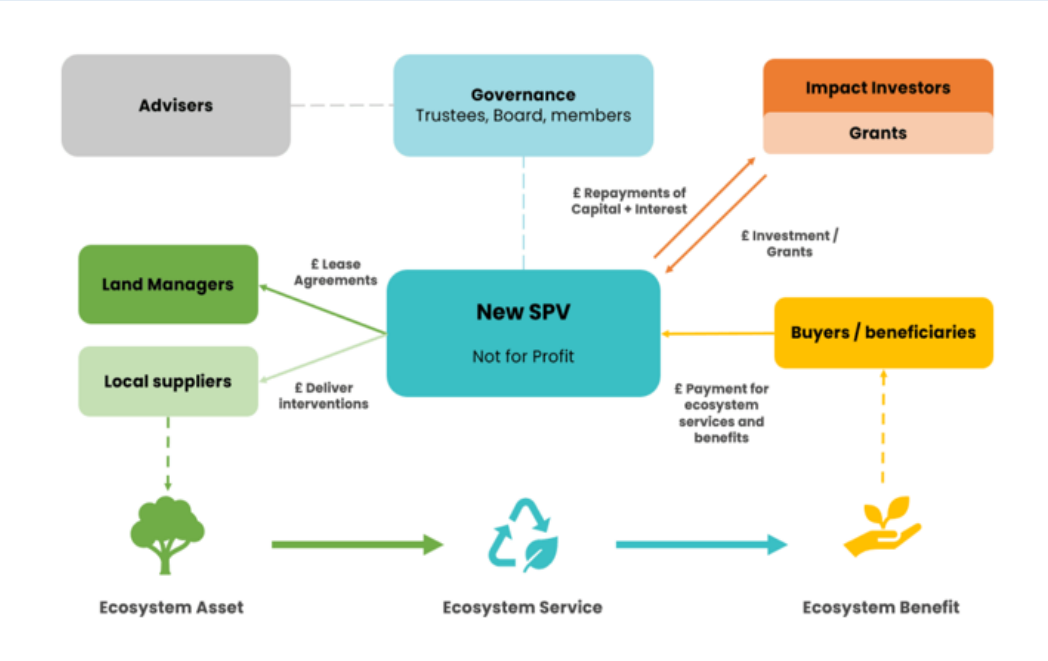
[3] Green Bond Principles. (2022). *Voluntary Process Guidelines for Issuing Green Bonds* https://www.icmagroup.org/assets/documents/Sustainable-finance/2022-updates/Green-Bond-Principles-June-2022-060623.pdf.

[4] Climate Bonds Initative (2019). *Climate Resilience Principles A framework for assessing climate resilience investments* https://www.climatebonds.net/files/page/files/climate-resilience-principles-climate-bonds-initiative-20190917-.pdf.

Wyre Catchment – Community Interest Company

The Wyre Catchment Natural Flood Management Project will deliver more than 1,000 targeted measures to store, slow and intercept flood water and prevent peak flow in a catchment in England. Beneficiaries of the reduced flood risk are paying for the interventions, and the Project's Community Interest Company (CIC) has successfully raised a nine-year £850k private loan facility to help fund the interventions. Click here to watch a showcase of the Project that was hosted by GFI Hive and goes into more detail on how it reached a stage of investment readiness.

Figure 3.



To cover the £1.5m of up-front costs, a mix of public and private funding was used.

Grants of £627,500 were issued for tree planting and hedgerow creation from the Woodland Trust via the Northern Forests Grow Back Greener programme, as part of Defra's Nature for Climate Fund. These grants will be issued over the first three years of the Project. Private investment for the remaining £850,000 was agreed in the form of a nine-year loan. The loan is split into two complementary facilities that bring nine investors together.

The first tranche of investment is the 'Institutional Loan Facility' that holds £650,000 from five impact investment funds. The first and largest contribution came from the Esmée Fairbairn Social Investment Fund, which originally issued grants to the Project at its pilot stage and helped to bring in the other four fund investors.

Dan Hird, Principal and Founder of Nature Finance, comments: "In the impact investment market, many of the investors work collaboratively and are happy to share investment opportunities, learnings, and due diligence findings."

The funds also have representation at the Wyre CIC Board. The interest rate is set at 6%, and the impact investors have agreed to an 'incentive reduction' in the interest rate of 1% if the interventions deliver certain biodiversity targets, with part of these savings passed onto the land managers.

The second tranche is the 'SITR Loan Facility' and holds £200,000 from four high-net-worth individuals, who each contributed £50,000 and were introduced to the project by Triodos Bank UK. The facility ranks junior to the Institutional Loan Facility and effectively functions as equity with a 6% return. However, the investors benefited from Social Investment Tax Relief (SITR), which was launched in 2014 for the social impact sector and offers a 30% tax refund on any qualifying investment. The Wyre NFM Project was the first nature-based investment project to qualify for SITR. However, as of April 2023, the SITR scheme has ended.

Together, the two tranches offer £850,000 with the funds drawn down over three years and repayments due in Years Four to Nine. For more details see the GFI Hive Case study.

Natural Flood Management (NFM) (Gissing, Norfolk) – Aviva

Amidst a winter of exceptionally high rainfall in Norfolk, the River Waveney Trust (RWT) and Norfolk Rivers Trust (NRT) joined forces, in collaboration with WWF and Aviva, to proactively protect the village of Gissing, in south Norfolk, from flooding. Through effective collaboration with the local community, landowners and parish council, the two trusts successfully delivered a Natural Flood Management (NFM) project in October 2023, using low-cost natural solutions to make the landscape more flood resilient. NFM uses natural processes, such as restoring wetlands, reconnecting floodplains, planting trees and improving soil health, to slow down, store and filter water.

In Gissing, this included lowering the stream banks in strategic places to allow peaks of high water to escape onto the surrounding meadow land. It also installed a leaky dam, reconnected a dry, historic channel and created new shallow depressions, called scrapes, to slow and store water. The NFM faced its first significant test during the arrival of Storm Babet. The deluge of rain, resulting in high volumes of surface water, found refuge in an adjacent meadow, where it could be temporarily stored and released gradually to reduce the flood peak.

What next: This is a relatively simple and low-cost project that will have far-reaching, positive impacts for the local community. The farmers involved could potentially be rewarded through the government's Environmental Land Management Scheme (ELMS) programme, for providing an ecosystem service for public good.

Resilient Glenderamackin – nature-based projects that reduce flood risk and benefit nature & society – Lloyds Banking Group

Lloyds Banking Group are a founding business partner of Projects for Nature, an online platform connecting businesses to nature recovery projects. The West Cumbria Rivers Trust is a project where farmers on a whole catchment scale deliver nature-based projects that reduce flood risk to Keswick and benefit nature and society. The aim is to deliver a range of nature-based measures to alleviate flooding and enhance biodiversity. This includes creating ponds and wetlands; reconnecting rivers with their floodplains; tree and hedgerow planting and restoration; improving soils; installing leaky dams and increasing water storage through low bunds. The project also creates an innovative financial model that links investors, buyers, and sellers of ecosystem services.

KPIs for the project include the number of farmers and businesses engaged, kilometres of rivers restored, number of hedgerows planted, reduction in peak flow and improved water quality.

What next: A business engagement officer will be appointed to bring together private sector buyers of ecosystem services to help increase sector capacity, capability, and learning. Nature-based solutions to flood risk will be tested in the Keswick area, with the long-term ambition of scaling up in other locations.

Port Clarence and Greatham South flood coastal erosion scheme[5] – Environment Agency

Costing almost £16 million, the Port Clarence and Greatham South project has increased flood protection to Port Clarence residents from the River Tees and Greatham Creek while also creating new habitat the size of over 90 football pitches for local wildlife. The Environment Agency joined forces with local industry to build the scheme with multinational company SABIC UK contributing £3.8m and INOVYN ChlorVinyls offering land to allow the creation of the new habitat. Combined with flood defences that were completed at Port Clarence in 2015, the project reduces the risk of flooding to 350 homes and 32 businesses in Port Clarence and the Seal Sands Industrial Complex. Contractors BMMJV (BAM Nuttall and Mott MacDonald Joint Venture) carried out the work on behalf of the Environment Agency. Phase 1 of the scheme saw new flood defences built in Port Clarence, consisting of a mixture of earth embankments, flood walls, and a raised section of the road on the approach to the Transporter Bridge. In addition, the Environment Agency worked together with local business Wilton Engineering to install removable steel flood defences along the River Tees to improve flood protection while still allowing Wilton to operate from the river.

Throughout the project the Environment Agency has worked closely with the Royal Society for the Protection of Birds (RSPB) and Natural England to create a scheme which maximises benefits for the internationally designated habitat which includes rare birds as well as seals.

What next: In the 2020 budget the UK government doubled its investment in the flood and coastal erosion risk management (FCERM) scheme. They committed a record £5.2 billion between 1 April 2021 and 31 March 2027. The aim is to protect 336,000 homes and non-residential properties. In the previous 6-year investment programme (2015-2021) 60% of FCERM schemes required partnership funding. In the current programme (2021-2027) 58% of FCERM schemes require partnership funding. The partnership funding need is £1.730Bn to deliver the 200,000 properties better protected target. There remains a substantial private finance gap.

[5] Environmental Agency (UK Government). (2018). *£16 million Teesside flood scheme complete*. GOV.UK. https://www.gov.uk/government/news/16-million-teesside-flood-scheme-complete.

Coastal erosion scheme – Environment Agency

An artificial dune of nearly 2m cubic metres of sand was created on the Norfolk coast to slow coastal erosion. In the £20m Sandscaping scheme, sand dredged from existing North Sea seabed extraction sites off Great Yarmouth were ferried to the rapidly eroding coastline beside the large gas terminal at Bacton. The Bacton gas terminal brings ashore 20% of the UK's gas needs and is designated critical national infrastructure. Villages to the south of Bacton have blamed increased erosion on the concrete sea defences around the gas terminal. These have prevented the natural movement of sediment from sandy cliffs drifting southwards to replenish neighbouring beaches. The new mobile defences work with the longshore drift which will carry the sand southwards where it will protect other coastal villages that are increasingly vulnerable to the climate crisis.

Two-thirds of the £20m British scheme has been funded by the owners of Bacton gas terminal – including Shell – with £5m from the Environment Agency and additional funding from councils.

What next: The Dutch engineering company that designed the project has identified up to 20 coastal locations where sand scaping could be used, including Lincolnshire and the shingle coast at Aldeburgh in Suffolk.

Other similar case studies:

- Contribution to the Humber scheme from CEMEX UK of materials, South Ferriby, South Lincolnshire.
- Pocklington Flood Alleviation Scheme, East Riding of Yorkshire. Persimmon Homes contributed as major housebuilding in the area at risk.
- Killingworth, Longbenton, and Forest Hall Surface Water / Sustainable Urban Drainage Systems Scheme – Phase 1, North Tyneside. Contribution from Northumbria Water.
- Clarice Cliff School flood alleviation scheme, Stoke. Severn Trent Water contributed.
- Selly Park North (River Rea) Flood Alleviation Scheme, Birmingham.

Milwaukee river risk and resilience initiative (M3RI)[6]

The aim of the Public-Private Partnership (PPP) was to utilise the insurance mechanism to capture and scale the economic benefits of nature-based risk reduction projects across the Milwaukee River watershed. The Metropolitan Milwaukee Sewerage District (MMSD) is a long-time leader in deploying nature-based solutions to address water quality and flood management challenges. Recently, they entered into a larger-scale program with Ducks Unlimited (DU) to restore 4,000 acres of wetlands and plant six million trees to reforest the Milwaukee River watershed. In an effort to document and monetise the flood reduction benefits of these projects, Guy Carpenter is working with MMSD and DU to reconcile their modelling of the hydrological impacts of the new vegetation with more traditional insurance catastrophe risk modelling by working with leading (re) insurance companies to structure a parametric-based community-level insurance program that would be re-priced each year — up or down — to reflect the new risk factors.

What next: If successful, the program should create a scalable model for capturing the positive externalities of nature-based flood mitigation projects. The M3RI continues to seek funding partners for the effort, as well as other private sector actors — including farmers, shippers, and railroad companies — that can contribute to reducing flood risk even further throughout the watershed.

[6] Marsh McLennan. (2023). *Building a Climate Resilient Future*. https://www.marshmclennan.com/content/dam/mmc-web/insights/publications/2023/december/Marsh_McLennan_Building_A_Climate_Resilient_Future.pdf.

Product innovation

These case studies focus on innovative products across insurance, reinsurance, loans and bonds.

Urban Infrastructure Insurance Facility (UIIF) – Local Governments for Sustainability (ICLEI – Germany)

The Urban Infrastructure Insurance Facility (UIIF) is a multicity pooling concept that aims to facilitate access to climate finance, transfer catastrophe-level exposures, and identify pre-event risk reduction initiatives. Sponsored by Local Governments for Sustainability (ICLEI), the program has now selected and on-boarded its 10th participating city, each of which will undergo a thorough seven-step process of identifying, managing, and financing climate risks.

UIIF is financed by KfW Development Bank on behalf of the German Federal Ministry for Economic Cooperation and Development.

What next: The goal is to expand this programme to other cities and form a diverse risk pool across the 10 cities, cover at least 7.5 million poor and vulnerable people and deploy at least 100M Euro of insurance limits across the insured cities.

Community-Based Catastrophe Insurance (CBCI)[7] – Marsh Mclennan

A local non-profit home ownership organisation, The Center for NYC Neighborhoods, secured a parametric risk transfer cover that — if triggered — allows them to activate an assistance program of emergency cash grants. These grants cover immediate post-flood needs for the most vulnerable New York City neighbourhoods.

Constructing the program required a diverse set of capabilities and important local sponsorship. The Environmental Defense Fund, the Center for NYC Neighborhoods, the New York City Mayor's Office of Climate and Environmental Justice, SBP, Guy Carpenter, Swiss Re, and ICEYE.

What next: Since the completion of this initial pilot, several communities across the country have expressed interest in utilising a similar structure to enhance community resilience, particularly among lower income and underinsured populations.

[7] Marsh McLennan. (2023). *Building a Climate Resilient Future*. https://www.marshmclennan.com/insights/publications/2023/december/building-a-climate-resilient-future.html.

Quintana Roo Reef Protection – State Government of Quintana Roo

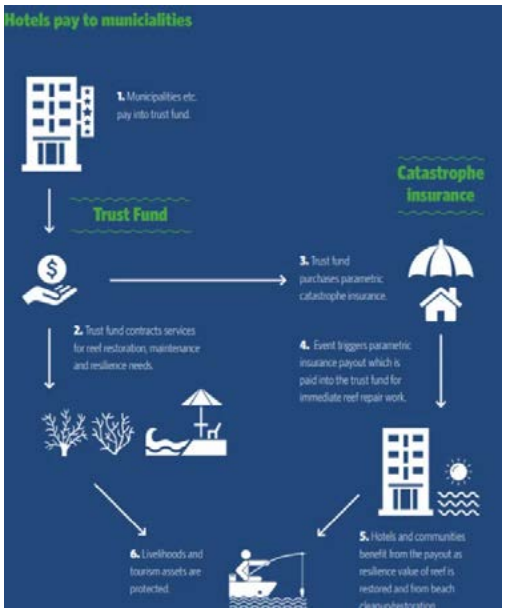
In 2018, the world's first insurance solution to preserve a natural ecosystem was launched, using a parametric mechanism. The claim payment release is triggered when hurricane wind speeds reach a certain level, allowing the policy holder to repair the area's coral reef quickly. The policy helps to maintain the reef and, by extension, the community that relies on it.

There are several stakeholders involved in this parametric insurance structure which include coastal property owners, municipal governments, State Government of Quintana Roo and Coastal Management Zone Trust (CMZT) and insurance companies.

Private sector taxes and government funding combined into a Trust, responsible for maintaining the reef. Insurance premium paid by Trust, with fees generated through public/private sources.

What next: Since launching this innovative design, Swiss Re is working to replicate this model elsewhere in the world. This includes coral reefs but also other types of natural ecosystems, such as mangroves.

Figure 4.



Mesoamerican Reef Protection – Insurance Programme – MAR Fund and WTW

Type of intervention: Insurance and pooling risk.

Structure: Developed by the Mesoamerican Reef Fund (MAR Fund) and WTW, with support from the InsuResilience Solutions Fund and the Ocean Risk and Resilience Action Alliance (ORRAA), the ground-breaking programme, which went live in 2021, uses parametric insurance to support rapid reef response following damaging hurricane events across the critically endangered 1,000km reef system. Amplified by global climate change, hurricanes are now a leading driver of coral loss in the region but, without dedicated budgets, reef response is difficult to mobilise quickly in the aftermath of extreme events. Despite their environmental, economic, and cultural value,

reefs remain some of the most threatened ecosystems in the world. The MAR Insurance Programme currently covers eleven key coral reef sites across Mexico, Belize, Guatemala and Honduras, ensuring that if a triggering event occurs, resources will be rapidly available to undertake reef response activities.

Success criteria: This award-winning programme proves the reliability, timeliness and effectiveness of parametric insurance to support ecosystem resilience.

What next: Soon to be in its fourth year, the MAR Fund is currently working to develop and implement a sustainable financing strategy to ensure the longevity of the programme. At the same time, the MAR Fund, WTW and partners are supporting the design of a similar programme for San Andrés and Providencia, Colombia.

Emergency Response Insurance – UNICEF and WTW

Type of intervention: Insurance and pooling risk.

Structure: Children and youth are a critically vulnerable population group that is among the most affected by disaster risk and climate change, including the effects of extreme weather events such as cyclones. In the context of UNICEF's increased recognition for climate action and need for innovative financing, UNICEF launched the Today and Tomorrow Initiative (TTI) to enhance the integration of disaster risk reduction and emergency response and pilot the use of pre-arranged and risk-informed finance such as parametric risk transfer. WTW supported UNICEF in developing the world's first child-sensitive parametric insurance solution to mobilise risk capital in support of its emergency response operations for tropical cyclones. Over the first 16 months of the 36-month term, the insurance policy has paid out more than USD 4.2 million in pay-outs for six UNICEF Country Offices in Africa, Asia, and the Pacific. The pay-outs provide UNICEF with quick and dependable financial flows and are implemented in alignment with UNICEF's broader resilience-building efforts, thereby working towards more comprehensive and sustainable protection for children and their families.

Success criteria: The bespoke insurance product not only brings parametric finance to humanitarian response operations, but has been a) tailored to reflect UNICEF's cyclone response needs for children and youth through child and youth-responsive exposure and risk analysis, b) incorporates the individual needs of the UNICEF country offices with respect to rapid financing; and c) pools cyclone risk across 8 Caribbean, African, Asian and Pacific Island countries. In addition, the pay-out scheme covers both extreme tropical cyclones and the compounding impact of smaller tropical cyclone events.

What next: As one of the most reputable and largest humanitarian organisations in the world, UNICEF is contributing to pioneering this proof of concept for other organisations.

Medellín, Colombia Disaster Risk Finance – WTW

Type of intervention: Insurance (city-level).

Structure: Colombia ranks prominently among nations susceptible to climate impacts, with about 84% of its populace facing exposure to multiple climate-related dangers such as floods and landslides. Floods alone account for a significant portion of Colombia's economic losses, comprising 56.8%, followed by earthquakes at 11.3%, and landslides at 8.3%. Cities like Medellín, with dense populations, face heightened risks owing to their geographical features and erratic rainfall patterns typical of mountainous areas. In collaboration with Global Communities and HannoverRe, WTW led the development of novel disaster risk financing product to support emergency response actions of the Municipality of Medellin's Disaster Risk Management Agency (DAGRD). As part of the product development, WTW worked closely with DAGRD to understand the specific hazard context of Medellín, and the suitability of trigger-based risk financing for supporting their risk management responsibilities for earthquake, extreme rainfall, and landslide perils; conducted data analysis and risk modelling to establish the frequency and impacts associated with these perils; identified areas of the city where vulnerable populations are located; and explored opportunities to tailor the product towards these groups.

Success criteria: This project demonstrated the value of collaborating with a range of stakeholders, integrating international and local data sources, and the importance of tailoring parametric products to specific hazard and sociopolitical contexts.

What next: WTW and Global Communities continue to liaise with the municipality, aiming to implement the tailored parametric insurance product in the near future.

Sustainability-link loans – Sale of ecosystem services to private and public beneficiaries – BBVA

BBVA Corporate & Investment Banking will support IREN (an Italian water utilities company) in its commitment to sustainability. BBVA and IREN worked together to link the new financing to utility company's water footprint. With this 5-year EUR 50 loan, IREN becomes the first company to close a "water footprint" loan in Italy. The margin of the loan is tied to two key indicators: water withdrawal and water leakage defined. The outcomes of this loan include reducing water withdrawals from the environment and significantly reducing network leaks.

The loan is tied to the sustainability goals of the client.

Sustainability-link loans – Link REIT

Link REIT, a leading real estate investment trust in Hong Kong, has emerged as a major player in the sustainability-linked loan (SLL) market and has delivered several innovations in SLLs for adaptation. An SLL is a credit facility that incorporates interest rate reductions linked to predetermined sustainability performance targets with a syndicated group of banks.

From 2020 – 2022, they issued seven SLLs amounting to $12.5 billion, with a syndicated group of banks.

Link REIT's strategy aims to protect their own investments from climate change, but also contribute more widely to societal adaptation through collaborations with policymakers and public financiers. Their investments enhance both the mitigation and resilience of retail and office properties in China's Greater Bay Area.

Link REIT harmonises its climate adaptation strategies with the requirements of capital providers and regional policies for maximum uptake.

Environmental Impact Bond (EIB)[8] – DC Water

In 2016, the District of Columbia Water and Sewer Authority (DC Water) released the world's first Environmental Impact Bond, a 30-year municipal bond issued for $25 million, to fund green stormwater infrastructure. The bond employs a pay-for-success approach that provides upfront capital to governments for resilience programs, and private investors are compensated based on measured outcomes. If the new green stormwater infrastructure exceeds performance expectations (that is, stormwater runoff reductions are greater than a predetermined threshold), investors are rewarded with a one-time additional outcome payment of $3.3 million, and vice versa, if it underperforms. If the performance is as expected, the EIB functions as a normal municipal bond with investors receiving the stated interest rate. This product incentivises adaptative behaviour by determining the bond return based on environmental outcomes.

What next: A five-year pilot of this project showed positive results with 20% stormwater runoff that met performance expectations, yielding social, environmental, and financial benefits to DC Water, investors, and the public. Similar models for financing green infrastructure can be replicated and expanded in other regions.

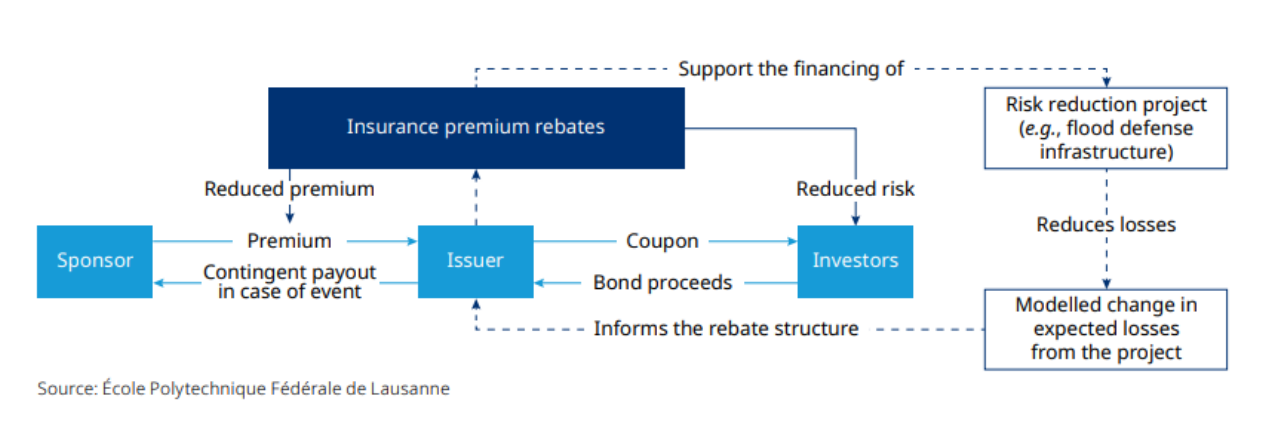
Resilience Bonds (conceptual case study)[9]

These are a hybrid of green and catastrophe bonds that bridge the gap between physical and financial resilience by combining insurance protection with risk reduction. Catastrophe models, which compare expected losses with and without the project, quantify the risk reduction value generated by the resilience project. This difference is then captured as a premium rebate. In this manner, funds for financing the project can be brought forward. The insurance component of the resilience bond functions like a regular catastrophe bond, with rapid payouts made to the sponsor, when a pre-defined catastrophe threshold is hit.

[8] US EPA (2016). *DC Water's Environmental Impact Bond: A First of its Kind* https://www.epa.gov/sites/default/files/2017-04/documents/dc_waters_environmental_impact_bond_a_first_of_its_kind_final2.pdf.

[9] Marsh McLennan. (2023). *Building a Climate Resilient Future*. https://www.marshmclennan.com/insights/publications/2023/december/building-a-climate-resilient-future.html.

Figure 5: Simplified structure of a resilience bond.



Despite their promise, these financial products struggle to gain traction due to a lack of regulatory frameworks and the complexities involved in modelling risk reduction.

What next: Defense infrastructure projects such as flood barriers make them suitable options for resilience bonds.

Flood Re[10]

Flood Re is a reinsurance scheme established as a partnership between U.K. insurers and the U.K. government. Flood Re underwrites high flood risk residential properties that insurers select to enter into the scheme, and it charges subsidised tariffs based on council tax bands rather than flood risk. FloodRe was designed with a finite lifespan and will exit the market in 2039. To help arm consumers with information with regards to flood risk over time and what it means for communities, Flood Re has workstreams underway in conjunction with Build Back Better including one on Flood Performance Certificates to provide homeowners with a view of their home's risk, including scoring methodology that underpins that.

What next: In 2040, the U.K. will be dealing with these projected increases in risk and also with the transition of the U.K. domestic insurance market at the end of the Flood Re scheme. It is vital the UK considers alignment of Flood Re scheme beyond 2039 with market incentives and alternative forms of collateral than assets for community-led defences.

[10] Moody's RMS. (2023). *Evaluating the Performance of UK Flood Defences Under Climate Change*. https://www.rms.com/customer-success-story/floodre.

Policy/regulation-driven opportunity

These case studies focus on policy solutions which improve adaptation deal flow.

China's 'Sponge Cities'[11] – Government of China

A Beijing based landscape architecture company, Turenscape, has developed hundreds of urban waters parks in China where runoff from flash floods can be diverted to soak into the ground or be absorbed into constructed wetlands. Conventional drainage infrastructure has not worked in China's cities with monsoon climates subject to extremely heavy bursts of rain. The sponge city program began with pilots in 16 cities in 2015 and has since expanded to more than 640 sites in 250 municipalities across China. Where enough land is not available to repurpose into wetlands and ponds, permeable pavement, green roofs and trenches called bioswales are being developed to channel storm water runoff and use vegetation to filter out debris and pollution.

Having enough land to repurpose into wetlands and ponds within the cities and municipalities is key to success. Policy direction to develop Sponge cities was also crucial to this programme. Cobenefits include recharging local aquifers and the cooling effect.

What next: Adoption of the sponge city concept in other cities around the world. Bangkok opened the Benjakitti Forest Park in 2022 which occupies more than 100 acres for example. In Copenhagen, Denmark, floodable parks are being used which are temporary ponds during heavy rains.

Severn Trent Water – Resilience and longevity of water supply

The UK's future water supply is at risk from the growing impacts of climate change, drought, and population growth. At the same time, Severn Trent is obligated to reduce the risk of water abstraction causing environmental harm. Severn Trent's supply-demand modelling shows that, without action, a deficit in water supply will arise of about 8% of daily production by 2030. Severn Trent has submitted a case for £678m of additional investment to Ofwat (the regulator) in its PR24 plans (2025-2030), as well as maximising benefits from base expenditure. This investment is needed to secure the region's future water needs and support a thriving environment. Severn Trent has identified several actions focused around 3 pillars:

- **Reducing demand:** Leakage reduction through mains renewal; a Smart Meter strategy to replace and install across both household and business customers; customer service system improvement & a water efficiency education programme; and efficiency programmes.
- **Replacing unsustainable supply & creating new supply:** Construction of two new links and transfer mains; raising a dam for increased reservoir capacity; and expansion of four water treatment works.
- **Investigations to reduce future uncertainty:** Ensuring feasibility of solutions against alternative pathway modelling to allow flexibility in planning; and development of Direct Procurement for Customers (DPC) scheme to improve on innovation and whole life cost.

[11] Schiffman, R. (2024, March 28). He's Got a Plan for Cities That Flood: Stop Fighting the Water. *The New York Times*. https://www.nytimes.com/2024/03/28/climate/sponge-cities-kongjian-yu.html.

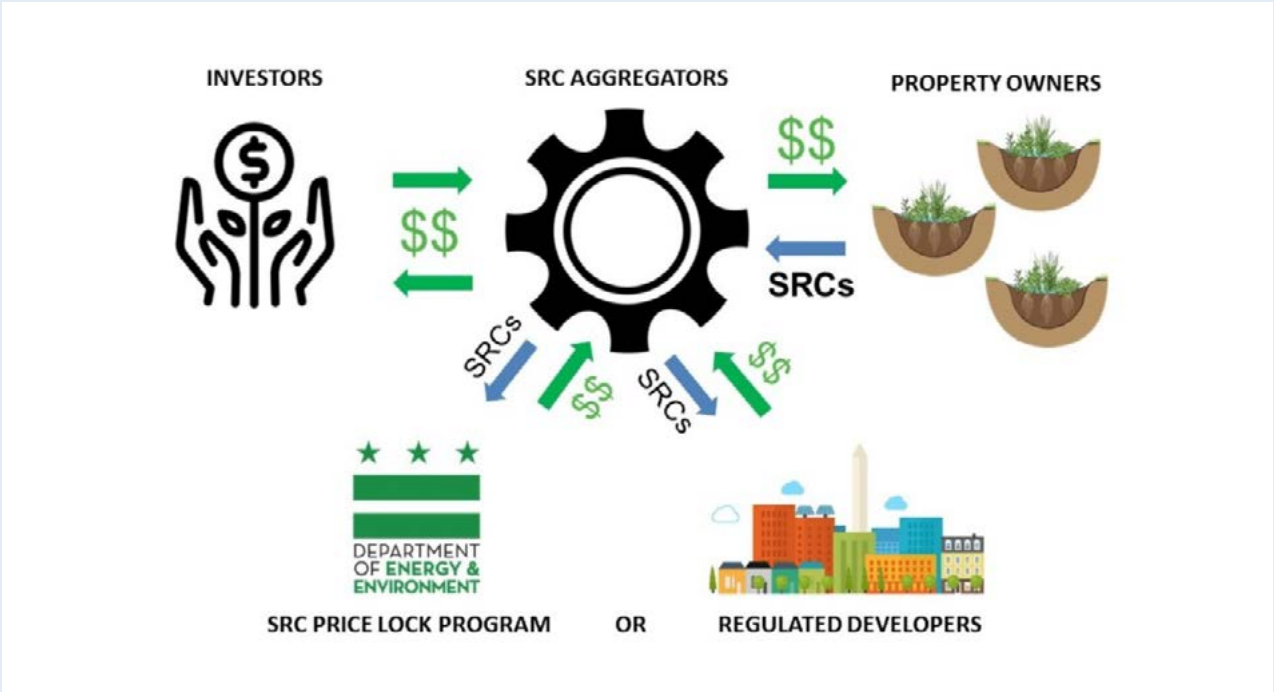
KPIs for the plans include customer feedback and customer service scores; leakage reduction % against 2017-2020 baseline; number of smart meters installed; reduction in per capita consumption ('PCC') of water.

What next: Severn Trent awaits Ofwat approval of its PR24 plans, however, £400m of investment is being accelerated and work has commenced. Future investment will continue to expand on and develop the work in progress now, with flexibility built in to adapt to changing scenarios, as the company invests for the long term in securing water resources for the future.

Stormwater Retention Credit Trading Programme – Washington's District's Department of Energy and Environment (DDOE)

Washington's District's Department of Energy and Environment (DDOE) was tasked with addressing stormwater run-off in the city and launched the Stormwater Retention Credit (SRC) trading program in 2013. Each SRC has a variable, market-driven price and corresponds to one gallon of stormwater retention for one year. Developers that want to purchase these as a way to meet their stormwater reduction obligations buy them directly from sellers. In 2020, $954,163.24 worth of credits were sold, with buyers paying an average price of $1.64. $12.75m was invested by the DOEE for this programme. The outcomes of this programme include reducing stormwater runoff and pollution of city waterways, creating new green spaces and green jobs.

Figure 6.



Capacity building

These case studies focus on community-level and regional-level capacity building and risk transfer.

Building resilience together Project (BRT) – Aviva

Groundwork and the British Red Cross have partnered with Aviva to a 3 year pilot of 'Building Resilience Together', a programme that aims to set up community resilience hubs across the UK for emergencies and severe weather events. These hubs will help people to get involved with effective emergency planning, response and recovery in the face of developing climate emergencies. The hubs will be recognised local centres with the goal of building local preparedness and resilience. There will also be hubs in several areas to act as spaces to coordinate resources before, during and after an emergency. They will bring together individual volunteers, community groups, voluntary organisations, local authorities, businesses and community resilience professionals in local and regional networks, enabling more joined up and effective approaches to community resilience that better utilise local assets and better manage local risks.

This is a community-level risk awareness effort to help the communities involved to build the skills, knowledge and resources that are needed to grow local and national resilience.

What next: This pilot could be expanded to other areas if successful.

Regional Risk Transfer – The Central Asia Regional Economic Cooperation Program (CAREC)

Type of intervention: Disaster risk financing.

Structure: The Central Asia Regional Economic Cooperation Program (CAREC) includes 10 countries (Afghanistan, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Pakistan, People's Republic of China, and Uzbekistan) that are highly vulnerable to climate-related disasters. The Asian Development Bank (ADB) is supporting CAREC in quantifying and managing risk, including through the use of insurance. WTW led a consortium to deliver consultancy on comprehensive risk quantification and management guidance across the 10 countries. This included developing Disaster Risk Profiles for each country presenting high resolution risk modelling and risk financing assessment; designing a short-term risk financing option, a "Disaster Relief Bond", a catastrophe bond conditional on implementing resilience-increasing risk reduction measures; and developing a long-term risk financing option, "CAREC Risk Facility", a regional risk pool facilitating access to risk transfer regionally.

Success criteria: Alongside the technical project outcomes, WTW led extensive stakeholder engagements including supporting six regional / sub-regional capacity building and engagement workshops with over 125 participants (27% women). This led to several country-specific engagements where regional risk modelling results were further interrogated, and country-specific financing options discussed.

What next: The ADB are building on this work, with the aim of implementing the developed risk financing options.