Annex A. Case studies

The following case studies showcase existing initiatives working both with and through the private sector to scale the mobilisation of private finance into adaptation activities. They demonstrate the potential of private finance for adaptation and identify pathways for development actors to further unlock this. The case studies are referred to throughout Section 4.4.

Case study 1: Systematic Observations Financing Facility (SOFF)

Surface-based observational data represents the basis for weather forecasts and climate predictions on which societies and economies around the world depend to effectively respond to the risks of climate change and extreme weather events. The economic impact of such data access is significant: cost-benefit ratios of investment in additional surface-based observations are estimated at 1:26 (WMO, 2020[1]). In LDCs as well as in SIDS, current weather and climate-related data gaps are severe, and negatively impact the ability to adequately predict extreme weather events (WMO, 2021[2]). Indeed, LDCs and SIDS provide less than 10% of required, basic weather and climate observations (WMO, 2022[3]). To address this problem, at COP26 the World Meteorological Organization (WMO), the UN Development Programme (UNDP) and the UN Environment Programme (UNEP) announced the creation of the Systematic Observations Financing Facility (SOFF). SOFF aims to fill pertinent data gaps by supporting countries' efforts to improve data collection, processing, and exchange for more effective adaptation action and enhanced resilient development, in particular in LDCs and SIDs (Nordic Development Fund, 2022[4]).

Development (and public sector) partners

SOFF is established as a UN multi-partner trust fund, co-created by WMO, UNDP and UNEP and was operationalised in June 2022. SOFF is a foundational element and delivery vehicle of the UN Early Warnings for All initiative, announced by UN Secretary-General Antonio Guterres in 2022, that aims at covering every person on earth with early warnings within five years. As part of this UN initiative, the SOFF funding requirements correspond to USD 400 million, with a target size of EUR 200 million in the first three years. Initial funders include Austria, Denmark, Finland, Iceland, Ireland, the Netherlands, Norway, Spain, the Unites States as well as the Nordic Development Fund (NDF) (Nordic Development Fund, 2022[4]). SOFF will provide long-term and results-based grant finance and technical assistance to beneficiary countries, in particular LDCs and SIDS, to improve compliance with the requirements of the Global Basic Observing Network (GBON) – a new international agreement by the World Meteorological Congress to improve the international exchange of observational data and which defines basic standards of surface-based observations (e.g., the required frequency and density of observations) (WMO, 2022[5]).

SOFF is implemented through institutions of the multilateral development system, among them the World Bank, other MDBs as well as UN organisations like the UNDP, UNEP and the World Food Programme. These implementing entities are members of the Alliance for Hydromet Development that was formed at COP25 to unite efforts to close the capacity gap on high-quality weather forecasts, early warning systems, and climate information as the foundation for resilient and sustainable development (SOFF 2021). SOFF technical assistance is provided by advanced national meteorological offices on a peer-to-peer basis. WMO and the NDF serve as co-chairs of the SOFF steering committee, the main decision-making body, and co-decision maker along with the funding partners. UNDP and UNEP co-chair the multi-stakeholder

SOFF advisory board along with up to 15 members. Members of the advisory board are stakeholders already active in the fields of adaptation, risk and resilience. The advisory board produces recommendations for the steering committee, aims to create synergies with existing adaptation and resilience initiatives and seeks to link SOFF with policy and investment decisions (SOFF, 2021[6]).

Private sector partners

An important private sector partner is the Association of Hydro-Meteorological Equipment Industry, which represents the views of the hydro-meteorological instruments and systems industry in SOFF and is part of the multi-stakeholder advisory board. Depending on the country-specific context, the private sector can also function as a pivotal partner in the generation of observational data, thus contributing to a foundational pillar of climate adaptation efforts. SOFF envisions varying degrees of involvement of private partners in the operation of the observation infrastructure and telecommunications. For instance, private partners may operate the infrastructure while the ownership remains in public hands[1], may jointly own and operate respective infrastructure with public institutions, or both fully own and operate the infrastructure while providing observational data to the public (SOFF, 2021[6]).

Challenge and solution

The economic benefits of expanding the generation of surface-based observational data are enormous. Research suggests strong cost-benefit ratios and global socio-economic benefits in the order of USD 160 billion per year, of which USD 66 billion can be attributed to improved global disaster risk management (Kull et al., 2021[7]). Lack of data in one region or country affects global systems of climate and weather forecasts. SOFF addresses these gaps, and in doing so recognises the importance of the private sector. Three channels can be identified through which adaptive capabilities, in the context of improved observational data generation, impact the private sector.

The private sector as a producer of observational data

As highlighted above, where applicable, SOFF envisions a role of the private sector to generate GBON-compliant surface-based observations on behalf of the government (WMO, 2022[5]). Private enterprises may already have some capacity or own necessary infrastructure (e.g. in the telecommunication sector) to produce or transmit data satisfying potential demand e.g. by agri-businesses or insurers. A key aspect of basic surface-based observational data is its treatment as a public good which can improve global climate and weather forecasts. Correspondingly, a key metric of SOFF's measure of success lies in increased exchange of surface based observational weather and climate data. Relying solely on (private) data providers with commercial interest can be risky, in particular if licensing arrangements adversely impact global climate and weather data dissemination (Kull et al., 2021[7]). Collected and analysed data which goes beyond "core data" may be suitable to advance commercial interests and, given the potential economic benefits, a strong business case can be made for additional activities to be performed around data collection and analysis. The generated data enabled by SOFF can set the foundation for additional private business models.

The private sector as a user of observational data

Adaptation to the effects of climate change fundamentally includes coping with an environment characterised by changing weather patterns and extreme weather events, and dealing with an altered risk environment. Improving access to observational weather and climate data is critical for the private sector to adjust to this changed risk environment. The insurance and agricultural sectors may be particularly important users of observational data. Improved access to weather-related data points can help insurance companies enhance risk assessment, pricing of insurance products, and potentially improve and expand access to insurance products for individuals or companies in LDCs and SIDS (SOFF, 2020[8]). The need of insurance companies to adapt to the changed risk landscape is in line with current thinking in the

community of risk managers. According to a recent survey conducted by the Society of Actuaries and others, climate risk has been the top emerging risk for risk managers for the third consecutive year (Rudolph, 2022[9]). Reliable access to weather data and the improved ability of insurance providers to estimate the impact of weather events on agri-businesses' crop yields) can help farmers tap into insurance products to protect themselves from extreme weather events (Tsan et al., 2019[10]). Improving understanding of seasonal trends can also help them make informed decisions on the planting and harvesting of crops, potentially improving crop yields.

Enabling environment

Finally, by improving data access SOFF may support the catalysation of private sector investment in realms of local data processing and forecasting, and may improve the availability of risk management products (SOFF, 2021[6]). Improved access to weather data could also potentially help financial institutions better understand seasonal trends and the impact these may have on business models and markets. For instance, accessible weather data may help financial institutions assess farmers' creditworthiness) with the potential to improve lending decisions and access to finance (Tsan et al., 2019[10]).

Case study 2: Asia-Pacific Climate Finance Fund (ACliFF)

A report by WMO in 2020 highlights the lives lost and the damage done to infrastructure by extreme weather events such as floods, storms, and droughts throughout different regions of Asia. The damage has severe socioeconomic costs and threatens sustainable development in the region (WMO, 2021[11]). At the same time, in developing countries, many such risks are uninsured. Estimates suggest that only 7% of losses from natural catastrophes in low- and middle-income countries were insured (Hott and Tran, 2020[12]). The changing nature of the risk landscape, as well as the need to increase climate investment in developing countries, evokes the use of new financial risk management tools. These can potentially address uncertainties around new climate technologies and strengthen resilience to extreme weather events (ADB, 2017[13]). By addressing respective interlinkages between sustainable infrastructure development and financial risk management products, they can increase climate resilience.

To address the low penetration of financial risk management products in developing countries, ADB member countries founded ACliFF in 2017, with the intention to fund and implement financial risk management products (ADB, 2017[13]). ACliFF is a multi-donor trust fund, which aims to facilitate the development and implementation of financial risk management products by sovereign and non-sovereign institutions to remove barriers to climate investments and to increase adaptive capabilities and resilience in ADB developing member countries. Rather than focusing on new products, ACliFF focuses on types of products which already demonstrated viability elsewhere but have not attained commercial viability in the region (ADB, n.d.[14]).

The fund will deploy different financial instruments. For instance, ACliFF will provide technical assistance to identify, prepare and support financial risk management products as well as finance costs of expert services needed for the development of such tools. Among other things, grants will be distributed to cover consulting and legal fees and can also be used for the acquisition and development of data. Other ADB products can be used if agreed upon by the ADB and the fund's contributors (ADB, 2017[13]).

Financial risk management products that are supported by ACliFF need to contribute to at least of one four objectives:

1. Accelerate adoption and financing of climate technologies (e.g., through risk-transfer products dealing with technology and performance risk).
2. Scale private sector climate financing (e.g., managing risks of new and innovative financial models).
3. Promote and accelerate investments for climate adaptation and resilience.

4. Address extreme weather events (e.g., through disaster insurance tailored for MSMEs) (ADB, n.d.[14]).

Available figures show that the fund has disbursed USD 7.95 million to private sector operations and USD 2.73 million to public sector operations. The majority of funds have been distributed to the sectors of energy (USD 4.88 million) and disaster resilience (USD 4.18 million). Regionally, the majority of funds have been distributed to entities in the Pacific (USD 4.7 million) (ADB, 2021[15]).

Development finance (and public sector) partners

Development finance partners include the ADB, which has established and administers the fund (ADB, 2017[13]). The German Government via the Federal Ministry for Economic Cooperation and Development has provided USD 33 million in financial support for the fund (ADB, 2021[16]).

Private sector partners

ACliFF envisions private sector participation along different dimensions. Private firms can benefit from ACliFF support to facilitate the development and implementation of their financial risk management product offering. Such firms could be reinsurers, guarantee providers or financial institutions. Downstream, the development of an improved ecosystem of risk management solutions can support climate and development projects, which may facilitate investment by private (and public) actors (ADB, 2021[15]).

Challenge and solution

In the face of a changed climate risk environment, ADB points out the tremendous financing needs for ADB developing member countries. Accounting for the costs of climate adaptation and mitigation, about USD 1.7 trillion is needed for infrastructure financing annually in the respective ADB member countries (ADB, 2017[17]). Attracting private investment for sustainable infrastructure development is likely to be impeded in the face of the negative interlinkages between an environment of heightened climate risk on the one hand and insufficient risk-management tools on the other. ACliFF recognises this predicament by supporting the development and implementation of viable financial risk management able to achieve objectives relevant to improved adaptation. ACliFF makes three important contributions:

1. **Contributing to technology and knowledge diffusion.** The penetration of risk management tools tends to be lower in developing member countries of the ADB (ADB, 2017[13]). As ACliFF explicitly focuses its support on types of solutions which have already proven their viability elsewhere but have failed to reach widespread commercial viability in the region, ACliFF makes an important contribution to global knowledge and technology diffusion by closing significant gaps in the offering of financial risk management products.
2. **Creating downstream effects on climate investment.** By improving risk management offerings which can help address uncertainties (e.g. around climate technology, or the development and performance of infrastructure), ACliFF contributes to the creation of an economic environment able to attract climate investment in segments that were underserved so far (ADB, 2017[13]).
3. **Improving resilience through financial risk management tools.** By increasing access to financial risk management products, ACliFF also contributes to climate resilience. For instance, ACliFF has provided a USD 1.5 million technical assistance grant for a pilot project which aims to expand the offering of insurance products by microfinance institutions. The pilot is rolled out in four regions of India and includes training for loan officers in microfinance institutions as well as campaigns to raise awareness among the local population on the benefits of such insurance. The insurance coverage will improve resilience among low-income households by protecting these from the impacts of climate disasters (ADB, 2021[18]).

Case Study 3: Lightsmith group: Adaptation SME Accelerator Project

Small and medium-sized enterprises (SMEs) are of vital importance, in particular in emerging economies where they make vast contributions to employment and GDP (World Bank, n.d.[19]). Importantly, SMEs can be also a critical component for improving the climate adaptation landscape. Their presence throughout developing economies and their ability to reach dispersed communities makes them important actors in improving climate resilience and adaptive capabilities (Terpstra and Ofstedahl, 2013[20]). Some recent empirical research in the developing country context further suggests that SME spending on R&D is positively associated with a measure of climate change vulnerability – suggesting that SMEs, perhaps to cope with the effects of climate change, may become drivers of innovation (Alam et al., 2022[21]). However, while SMEs are key for economic prospects, climate adaptation and innovation, they also tend to be viewed as riskier compared to their larger counterparts and tend to have more difficult access to financial services and face trouble in reaching sufficient scale (CPI, 2018[22]). SMEs are typically more vulnerable to climate change given that they have fewer resources at their disposal than larger counterparts.

Recognising these barriers as well as the importance of SMEs for innovation for climate adaptation, ASAP led by the Lightsmith Group, a global private-equity and venture-capital investment platform, seeks to facilitate the availability of SME-led climate adaptation solutions. ASAP follows three pillars in promoting SME-led adaptation innovation:

1. It identifies adaptation SMEs, using an elaborate taxonomy and maps firms that provide adaptation solutions.
2. It creates a network of adaptation SMEs and stakeholders.
3. It incubates and accelerates Adaptation SMEs (Trabacchi et al., 2020[23]).

ASAP focuses on two different categories of SMEs based on their service offerings. The first category encompasses SMEs which provide Climate Adaptation Intelligence used to identify and assess physical climate risks. This includes SMEs that provide services or products which identify physical and climate risks, specific to context and location and can be used to support decision-making. Other examples include climate data products to evaluate and monitor risks as well as climate and weather modelling. The second category of eligible SMEs address climate risks by providing Climate Adaptation Products and Services which improve resilience to climate risks. Examples include services which secure electricity supply or weather-indexed insurance products (Trabacchi et al., 2020[23]). In April 2022, the Lightsmith Group choose 16 startups in Asia and Africa from more than 300 applicants that provide solutions in diverse sectors such as in water, agriculture, risk analytics, supply chain, infrastructure, and insurance to strengthen climate adaptation and resilience (ASAP, 2022[24]).

Development finance (and public sector) partners

The development finance partners engaged in ASAP are the GEF which provides grant funding through its implementing agency, Conservation International (Trabacchi et al., 2020[23]). Further funding and support in the development of the adaptation solutions taxonomy was provided by IDB and IDB lab (IDB, 2020[25]). The Proadapt Program that has been co-financed by IDB/IDB Lab and NDF provided further funding. For ASAP, GEF provides approximately USD 2 million with USD 500 thousand in co-financing by IDB, Conservation International, other Development Banks and Accelerators/Incubators (GEF, 2019[26]).

Private sector partners

There are two main private sector partners. ASAP is led by Lightsmith Group, and in 2021 it also partnered with venture capital firm Village Capital (ASAP, 2021[27]). Firms which are selected for ASAP can join an online platform provided by Village Capital to match firms with investors and other resources (Village Capital, 2021[28]). Beyond the Lightsmith Group and Village Capital which lead the accelerator program,

key private sector actors are the SMEs in developing countries which participate in ASAP. Examples include Hiraya Water, which is based in the Philippines and offers water management products which reduce water loss and power consumption of water utilities, using artificial intelligence. India-based Aumsat Technologies LLP uses Artificial Intelligence (AI) and satellite-based analysis to help identify ideal locations for well digging, to improve resilience to droughts and water scarcity. Agromyx, based in Ghana, increases resilience in the agricultural system by creating shelf-stable food products from non-marketable post-harvest crops to reduce food waste (ASAP, 2022[24]).

Challenge and solution

ASAP identifies several barriers which SMEs face in developing and disseminating innovative solutions for climate adaptation and resilience. These range from lack of local support for SME ecosystems, lack of awareness surrounding both the risks and opportunities climate change represents or lack of available decision-making tools to deal with climate change and to incorporating information into decision-making processes. Importantly, there are also technology-specific challenges such as gaps in technology maturity as well as insufficient diffusion and technology transfer (Trabacchi et al., 2020[23]). To address these, challenges ASAP makes three main contributions:

1. **Facilitating adaptation solutions by SMEs.** Selected SMEs that are enrolled into ASAP receive technical assistance and support to overcome barriers to scale and commercialisation. Further, enrolled firms are connected to industry experts and investors (Guidebook for Just Financing, n.d.[29]). By carefully selecting, supporting, and easing access to resources, ASAP makes an important contribution to increasing the number of available innovative adaptation solutions.
2. **Enhancing knowledge diffusion by creating a network of adaptation SMEs**. While SMEs part of a current cohort in ASAP are important, they alone will not solve the large need for climate adaptation. By creating regional networks of adaptation SMEs and by connecting adaptation SMEs with each other, ASAP makes an important contribution to knowledge diffusion in the adaptation space, with the potential to facilitate the broad uptake of organizational practices and business models which increase resilience (GEF, 2019[26]).
3. **Facilitating investments for adaptation SMEs.** By developing a clear taxonomy which determines what an “adaptation SME” is – and which can be applied outside of the realms of ASAP to SMEs in different sectors – ASAP provides an important tool for investors wanting to invest in SMEs engaged in adaptation and looking for guidance in the selection process (Trabacchi et al., 2020[23]). ASAP has also created an Adaptation SME Directory for investors, a global network with over 400 adaptation SMEs (Guidebook for Just Financing, n.d.[29]).

Case Study 4: Climate Investor 2

Climate adaptation funds are scarce. The financing needs of the water sector in particular are immense, yet the financial resources devoted to this sector, especially by private actors, remain limited (OECD, 2019[30]). Climate Investor 2 (CI2) is a blended finance facility set up by CFM which addresses this problem. CFM is an investment manager set up as a joint venture between the Dutch Entrepreneurial Development Bank (FMO) and Sanlam InfraWorks, an infrastructure-focused investment company (Climate Fund Managers, n.d.[31]). CI2 follows its predecessor Climate Investor One (CI1) which seeks to encourage private sector investment in renewable energy projects (FMO, n.d.[32]). CI2 has the mandate to facilitate infrastructure investments and mobilise private sector investment in developing countries for sectors related to water, sanitation, and oceans. Importantly, in these sectors, CI2 seeks to contribute to both climate adaptation and mitigation benefits, thereby harnessing spill-over effects (Green Climate Fund, 2022[33]). In the water sector, CI2 aims to improve the sourcing, transportation, and treatment of water to improve water supply and distribution. Infrastructure to improve waste and wastewater treatment is the

focus in the sanitation sector, while investments in (fuel-efficient) ports, ships and harbours form the basis for CI2's activities in the ocean sector. Importantly, as part of its activities in the ocean sector, CI2 will also pursue investments in ecosystems and nature-based solutions to foster ecosystem-based adaptation. In total, CI2 intends to construct infrastructure worth USD 2.96 billion with considerable developmental impacts (providing approximately 11.18 million people with water access, strengthening about 1.7 million Ha in ecosystems and avoiding about 4.96 million tCO2e annually) (Green Climate Fund, 2022[33]). After its initial close in November 2021, CI2 had secured USD 675 million in commitments, a sum which increased to USD 855 million following investments from Swedfund (USD 35 million) and the GCF (USD 145 million) during its recently closed second round (Climate Fund Managers, 2022[34]).

Similarly to CI1, CI2 offers a "whole-of-life" financing approach through three different funds, each of which provides financing at different points in the lifecycle of the respective infrastructure projects (Nordic Development Fund, 2022[35]). The first fund is the *Development Fund*, which offers development loans and technical assistance to project companies, in order to expedite the development process of the infrastructure projects, and to reduce the time to financial close, thereby increasing project bankability (Green Climate Fund, 2022[33]). The Development fund has a size of USD 90 million and can fund up to 50% of project's planning and development (Climate Fund Managers, 2022[36]). The *Construction Equity Fund* provides financing after the development phase. The fund provides 100% of the equity required: by funding projects exclusively through equity, CI2 seeks to reduce complexity and costs, construction time and removes certain debt-specific costs. Further, it repays the development loan with a premium to the Development Fund (Green Climate Fund, 2022[33]). The *refinancing fund*, which is not set up yet, will provide long-term senior debt to projects once these are fully operational (Climate Fund Managers, 2022[37]).

Development (and public sector) partners

There are numerous public sector partners involved in CI2. Development finance partners are primarily involved as providers – for instance, to fund the capital needed for the *Development Fund* as well as the riskier junior equity for the *Construction Equity Fund.* Public actors include FMO, the Dutch Fund for Climate and Development (DCDF), a fund financed by the Dutch Ministry of Foreign Affairs. Further public actors include the European Commission, the Nordic Development Fund and BNG Bank (which is half-owned by the state of the Netherlands and half-owned by other public actors like municipalities and provincial authorities). Most recently, the Swedish DFI Swedfund as well as the GCF also committed financial resources to CI2 (Climate Fund Managers, 2022[34]).

Private sector partners

Private investors in CI2 include the Norwegian pension fund KLP, the Swedish IMAS Foundation, South African financial services group Sanlam, and Dutch asset management firm Aegon (Climate Fund Managers, 2022[34]). The mobilisation of capital from such private actors is imperative to close the financing gap in the typically underinvested water sectors – and CI2 therefore represents an important vehicle that has the potential to increase financial resources for climate adaptation. Further, the involvement of institutional investors such as Aegon and KLP creates an evidence base for the commercial viability of water-based infrastructure investments in developing countries.

Challenge and solution

As CI2 improves the availability of clean water and sanitation through its infrastructure investments, it is closely related to Sustainable Development Goal (SDG) 6. Research shows that to meet targets 6.1 (universal access to drinking water) and 6.2 (access to sanitation and hygiene) alone, annual investments of USD 114 billion are required (Hutton and Varughese, 2016[38]). Financing needs for water infrastructure, in general, are a lot higher and estimated at USD 6.7 and USD 22.6 trillion by 2030 and 2050, respectively

(OECD, 2018[39]). Devoting resources to the water, sanitary and ocean sectors is also imperative for purposes of climate adaptation. Resilient water and sanitation infrastructure may be critical in the face of climate change induced water scarcity as well as to deal with extreme weather events such as droughts and floods. Given the immense financial resources needed, the mobilisation of private capital is imperative. In this regard, CI2 makes two main contributions:

1. **Mobilising additional financial resources.** CI2 is a blended finance structure and provides tailored risk-return options for different investor types through the three-tier equity structure of the *Construction Equity Fund* (CEF). The CEF includes junior (tier 1), ordinary (tier 2) and senior (tier 3) equity tranches. Development finance actors such as GCF provide funding for the riskiest junior equity tranche and thereby absorb part of the infrastructure project risks (Green Climate Fund, 2022[33]). In the case of losses, the claims of tier 3 and 2 equity investors are met first. Tier 2 is expected to attract impact investors and DFIs, while tier 3 is reserved for institutional and private investors. Through its blended structure, CI2 expects a mobilisation ratio of 1:4 at the fund level: for every USD invested in tier 1 equity, an investment of 4 USD in the senior tranches is expected (Green Climate Fund, 2022[33]).
2. **Increasing the evidence base for commercial viability of infrastructure projects.** Beyond the private capital directly mobilised, CI2 also contributes to a paradigm shift in perceptions of private investors. It seeks to prove the validity of its financing approach to create commercially viable and bankable projects in infrastructure dedicated to climate mitigation and adaptation purposes in the water, ocean, and sanitary sectors (Green Climate Fund, 2022[33]). Through its "whole-of-life" only equity financing arrangement, it also provides a case study that, if successful, may be replicated by other development financiers. Over time, it therefore contributes to market building efforts.

Case Study 5: EBRD 'climate resilience bond'

The growing investor appetite for sustainable finance products is associated with a significant rise in the issuance of green, social, sustainability and sustainability-linked bond instruments (OECD, 2022[40]). For investors, the attractiveness of green, social or sustainability (GSS) bonds in particular lies in the fact that bond proceeds are earmarked towards sustainable projects or assets. According to projections by Amundi and the International Finance Corporation (IFC), annual green bond issuances in emerging markets will total USD 150 billion annually from 2023 (Amundi and IFC, 2022[41]). The increased appetite for GSS bonds offers an important new channel to increase financial flows devoted to climate adaptation. This is critical not only to make economies resilient, but it is also important as the large majority of climate finance thus far has been directed towards climate mitigation rather than adaptation (CPI, 2022[42]).

In 2019, EBRD issued the world's first dedicated climate resilience bond (CRB) and raised over USD 700 million through the issuance with demand from 40 investors from various countries (EBRD, 2019[43]). Investor appetite for such a product is exemplified by the fact that the bond was oversubscribed by USD 200 million (Smith, 2019[44]). The CRB has reached a total volume of USD 1.15 billion since then (EBRD, 2022[45]). The CRB is part of EBRD's larger green bond framework, which also includes the Environmental Sustainability Bond and the Green Transition Bond.

The proceeds of the CRB are used to finance climate-resilient projects within EBRD's Climate Resilience Portfolio, which as of November 2022 included EUR 1.4 billion in operating assets (EBRD, 2022[46]). The portfolio is composed of projects which aim to increase the climate resilience of financed assets or improve the climate resilience of the systems to which these assets belong. Expected climate resilience goals among others include increased availability of water and energy and decreased weather damage and disruption. Climate resilience is typically supported by providing financing in three areas: (i) financing for infrastructure such as in water, energy, transport, communications, and urban infrastructure; (ii) financing for business and commercial operations, which may encompass investments for water efficiency or

investments to reduce the vulnerability of firm value chains to extreme weather events and (iii) financing for agricultural and ecological systems such as water-efficient irrigation systems, forest management or activities to prevent soil erosion (EBRD, 2022[46]).

Selected projects are reviewed by the Environmental and Sustainability Department to ensure the consistency of selected projects with Climate Resilience Principles (EBRD, n.d.[47]). These have been devised by an expert group including development finance professionals from the EBRD and financial sector experts. The Climate Resilience Principles include an assessment of the physical climate risk to which assets or activities are subjected to, using top-down risk assessment and climate models. Issuers must also prove that risks are mitigated, and that the asset's climate resilience is improved. They must also conduct a trade-off between resilience and mitigation efforts and continuously monitor and evaluate the assets and activities to ensure that they continue to meet their adaptation purposes (Climate Bonds Initiative, n.d.[48]).

Development finance (and public sector) partners

The most obvious development finance partner of the CRB is the EBRD itself. The CRB can also be situated within a larger ecosystem of public or publicly funded actors. Together with the Climate Bonds Initiative and the Global Center on Adaptation, EBRD has published guidelines for those interested in issuing bonds for purposes of climate resilience and adaptation as well as reports on the market potential for climate resilience bonds (EBRD, 2021[49]; Climate Bonds Initiative, Global Center on Adaptation, EBRD, 2021[50]). The public sector can also be represented as loan recipients (funded by the bond proceeds), for instance if the recipient is a state-owned enterprise. An example includes a EUR 200 million loan to the state-owned Société Nador West Med, which will finance a port in Morocco with equipment designed to withstand extreme temperatures and weather events (EBRD, 2022[46]). EBRD has most recently extended another loan to Société Nador West Med and expects significant foreign direct investment and private sector involvement in the climate-resilient port project (EBRD, 2022[51]).

Private sector partners

Acting as bookrunners to the issuance of the first CRB were private banks BNP Paribas, Goldman Sachs, and Skandinaviska Enskilda Banken AB (EBRD, 2019[43]). However, beyond the mechanics of raising the capital, there is a more important entry point for the private sector: the CRB is, in itself, a channel for private investment into climate adaptation and resilience. Indeed, 32% of investors of the original USD 700 million bond were asset managers, 28% were banks and 9% were insurance firms and pension funds. The remaining 31% were central banks and other official institutions. In terms of geographic distribution, 58% of investors came from Europe, 28% from North America and 14% from Asia (EBRD, 2019[52]).

Challenge and solution

The main challenge lies in scaling financing for adaptation purposes. As mentioned above, climate finance flows have been heavily focused on mitigation rather than adaptation. Estimates of annual financing needs for adaptation purposes are quite high. UNEP estimates adaptation needs to be between USD 160 – 340 billion until 2030, and estimates are higher at USD 315 – 565 billion by 2050 (UN Environment Programme, 2022[53]) (UNEP 2022). Two main contributions of the CRB can be identified:

1. **Mobilising private finance.** Given these large financing needs, attracting private finance is critical to close the "adaptation gap". The EBRD's CRB makes an important contribution to this by attracting significant private sector finance for a bond instrument dedicated to financing projects with purposes of adaptation and resilience. It is particularly noteworthy that the investor base of the CRB was mostly composed of large institutional investors (EBRD, 2020[54]), who are critical to achieving the necessary scale but often complicated to mobilise due to potential constraints caused

by investor's mandates which may prevent them from investing in emerging markets. Investing in a bond by a triple-A-rated institution, which then uses the proceeds to finance projects or assets in emerging markets, may potentially address this issue.

2. **Broadening the evidence base for adaptation bonds by pioneering the use of such instruments.** The EBRD's CRB can provide a blueprint for other MDBs – and issuers more broadly – who may be interested in contributing to closing the adaptation gap by emulating the approach and following the guidance produced by EBRD to issue their own climate resilience bond. For this purpose, the EBRD's Climate Resilience Bond Framework and 'Frequently Asked Questions' document can also be useful reference points for potential issuers or investors.

Case Study 6: Development Bank of Japan business continuity management (BCM) Rated Loan Program

"Going concern" is a key principle often referred to in business studies and accounting. It implies that businesses will continue to operate indefinitely if they have the resources to do so. Some of the immediate effects of climate change – such as unpredictable weather patterns or more frequent natural disasters – can severely disrupt businesses, for instance by damaging infrastructure and production facilities, supply chains and access to markets. In worst-case scenarios, businesses can instantly be rendered unprofitable, forcing them to exit the market and threatening "going concern". Adaptation to moderate the potential harm of climatic stimuli is becoming of increasing importance for firms to ensure business continuity (IPCC, 2007[55]). In this context, business continuity management (BCM) – a process aimed at building resilience by identifying risks and the potential effect these can have on business processes – is becoming increasingly important (Sapapthai et al., 2020[56]). According to the 2022 Horizon Scan Report of the Business Continuity Institute, which surveyed 424 business professionals in functional areas such as business continuity and risk management, 33.9% of survey respondents note that they will increase investment for business continuity and more than 50% are engaged in the process of BCM (BCI, 2022[57]).

Business continuity and resilience are important for the firm itself, but also for the creditors. As BCM helps firms anticipate and successfully deal with potential disruptions, it can provide creditors with a higher degree of confidence in the long-term viability of their debtors (and their loan repayments). The Development Bank of Japan (DBJ) is an example of a creditor which proactively assesses BCM efforts and provides preferential interest rates to firms with high BCM ratings, thus signalling that BCM expenses result in a significant value rather than solely representing a cost (DBJ, 2022[58]).

Development (and public sector) partners

The DBJ BCM Rated Loan Program is the world's first loan program which rates firms based on their disaster prevention, business continuity and crisis management measures. A key player is the Development Bank of Japan (100% owned by the Government of Japan) for which sustainable development is a central part of its mission (DBJ, n.d.[59]). The DBJ BCM Rated Loan Program has its roots in the Enterprise Disaster Resilience Rated Loan Program which was established in 2006 and focused on companies' disaster prevention efforts. After the Great East Japan Earthquake in 2011, DBJ revised the evaluation items to place more emphasis on BCM. In 2016, evaluation items were updated to improve effectiveness and allow for comprehensive evaluations of management strategies and response capabilities (DBJ, 2022[60]). In fiscal year 2021, DBJ has executed 25 deals within the BCM Rated Loan Program. The loans extended through the scheme total JPY 536 billion (USD 3.92 billion) (DBJ, 2022[61]). Beyond providing the loans DBJ also operates the "The BCM Rating Club" which includes DBJ clients with a BCM rating (including disaster prevention ratings) as well as members of DBJ's network of crisis management organizations (DBJ, 2022[62]).

Private sector partners

The principal private sector partners in the BCM Rated Loan Program are the borrowers benefitting from the rating scheme. Examples include Suzuyo & Co., Ltd. a logistics company which provides port and global distribution services. Suzuyo's activities also include cargo handling and transport activities for providing emergency relief supplies during disasters. For its disaster solutions as well as its measures for business continuity, DBJ provided financing under the BCM Rated Loan Program (DBJ, 2022[61]). Another example is Shiraken Kamaboko, a marine product processing company selling fish cake products. After three of the firm's plants were severely damaged during the 2011 earthquake, it still managed to resume production a month after its plants were shut down. Shiraken Kamaboko's BCM ranking and the corresponding access to preferable interest rates are based on the strength of the company's BCM system in an emergency, measures taken to enhance the effectiveness of the business continuity strategy, and the reduction of supply chain risk via information sharing arrangements (DBJ, 2020[63]).

Challenge and solution

Companies that qualify for the BCM loan program receive access to preferential interest rates which are determined by the level of achievement within the BCM rating methodology. The underlying assessment scheme focuses on disaster prevention measures (e.g., firefighting and disaster prevention plans, prevention training programs) and business continuity measures (e.g., understanding of business continuity risks, risk assessment and risk strategies, business impact analysis). DBJ employs a three-tier rating which classifies firms as having excellent, advanced, or sufficient business continuity planning and disaster measures in place. Ratings are constructed using a questionnaire, and the questions can be attributed to the two pillars of disaster risk reduction and prevention and BCM as well as different sub-categories (DBJ, 2022[60]). The BCM Rated Loan Program contributes to adaptation in three ways:

1. **Scaling financing available for adapted activities**. By exclusively lending to corporates that have proved mechanisms and processes in place to deal with the impact of climate change, the programme serves to select and scale sustainable and profitable business models, thereby contributing to aggregate resilience of economy.
2. **Mobilising finance for resilience and adaptation.** While the appetite for "green" or "sustainable" finance seems to be large, private investment devoted towards adaptation remains limited. DBJ has issued sustainability bonds each year since 2015, and the proceeds are used for DBJ's sustainable lending activities, which include the BCM Rated Loan Program as well as others like the Environmentally Rated Loan Program (DBJ, 2022[61]). DBJ thus channels private capital raised via its sustainable bond program into loan programs dedicated to firms which have robust BCM processes and are thus characterized by higher resilience and adaptive capabilities.
3. **Incentivising private sector firms to improve adaptive capabilities and BCM**. Both investors and firms tend to evaluate investment decisions by assessing the return on investment (ROI), and quantifying this is easier for some activities than for others. Improving resilience through efforts of adaptation, for instance by setting up BCM, will not generate immediate cash flows but rather will reduce future costs. This cost-reducing benefit accrues most obviously when there is a disruptive event for which respective firms are then better prepared. By "rewarding" firms with better disaster risk reduction capabilities and better BCM processes through access to preferential interest rates, the BCM Rated Loan Program sets an important financial incentive for the private sector to improve its adaptive capabilities. This is an incentive that the private sector may otherwise not have as the cash flow potential of BCM and resilience efforts are not readily apparent and difficult to quantify.

References

ADB (2021), *ACliff Overview*, https://www.adb.org/sites/default/files/page/631241/acliff-overview.pdf. [15]

ADB (2021), *Climate Change Fund Progress Report*, https://www.adb.org/sites/default/files/institutional-document/848311/ccf-progress-report-2021.pdf. [16]

ADB (2021), *Microinsurance for Climate Change and Disaster Resilience: Capacity Building and Implementation Support*, https://www.adb.org/sites/default/files/project-documents/44934/44934-031-tar-en.pdf. [18]

ADB (2017), *Establishment of Asia-Pacific Climate Finance Fund*, https://www.adb.org/sites/default/files/institutional-document/349981/establishment-acliff.pdf. [13]

ADB (2017), *Meeting Asia's Infrastructure Needs*, https://www.adb.org/sites/default/files/publication/227496/special-report-infrastructure.pdf. [17]

ADB (n.d.), *Asia-Pacific Climate Finance Fund*, https://www.adb.org/what-we-do/funds/asia-pacific-climate-finance-fund. [14]

Alam, A. et al. (2022), "SMEs respond to climate change: Evidence from developing countries", *Technical Forecasting and Social Change*, Vol. 185/122087, https://doi.org/10.1016/j.techfore.2022.122087. [21]

Amundi and IFC (2022), *Emerging Market Green Bonds Report 2021*, https://research-center.amundi.com/article/emerging-market-green-bonds-report-2021. [41]

ASAP (2022), *16 Climate Adaptation Startups from Asia and Africa Selected for ASAP Climate Adaptation Accelerator*, https://climateasap.org/asia_africa_cohort/. [24]

ASAP (2021), *Climate Adaptation Accelerator Partnership with Village Capital*, https://climateasap.org/accelerator-partnership-announcement/. [27]

BCI (2022), *BCI Horizon Scan Report 2022*, https://www.bsigroup.com/globalassets/localfiles/en-th/iso-22301/bci-horizon-scan-report/bci-horizon-scan-report-2022-th.pdf. [57]

Climate Bonds Initiative (n.d.), *Climate Resilience Principles*, https://www.climatebonds.net/climate-resilience-principles. [48]

Climate Bonds Initiative, Global Center on Adaptation, EBRD (2021), *Green Bonds for Climate Resilience: A Guide for Issuers*, https://gca.org/reports/green-bonds-for-climate-resilience-a-guide-for-issuers/. [50]

Climate Fund Managers (2022), *CFM Announces the Second Close of CI2, Its Second Global Climate Fund, at USD 855 Million*, https://climatefundmanagers.com/2022/12/02/cfm-announces-the-second-close-of-ci2-its-second-global-climate-fund-at-usd-855-million/. [34]

Climate Fund Managers (2022), *Funds*, https://climatefundmanagers.com/funds/#FutureFunds. [36]

Climate Fund Managers (2022), *Refinancing Fund*, https://climatefundmanagers.com/rf/. [37]

Climate Fund Managers (n.d.), *Shareholders*, https://climatefundmanagers.com/shareholders/. [31]

CPI (2022), *Global Landscape of Climate Finance: A Decade of Data: 2011-2020*, https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-a-decade-of-data/. [42]

CPI (2018), *Understanding and Increasing Finance for Climate Adaptation in Developing Countries*, https://climatepolicyinitiative.org/wp-content/uploads/2018/12/Understanding-and-Increasing-Finance-for-Climate-Adaptation-in-Developing-Countries-1.pdf. [22]

DBJ (2022), *DBJ BCM Rated Loan Program - Designing a disaster-resilient Japan*, https://www.dbj-sustainability-rating.jp/en/bcm/. [58]

DBJ (2022), *DBJ BCM Rated Loan Program - Overview*, https://www.dbj-sustainability-rating.jp/en/bcm/overview.html. [60]

DBJ (2022), *Integrated Report 2022*, https://www.dbj.jp/en/pdf/CSR_disclo/2022/04.pdf. [61]

DBJ (2022), *The BCM Rating Club*, https://www.dbj-sustainability-rating.jp/en/bcm/club.html. [62]

DBJ (2020), *DBJ BCM Rated Loan for Shiraken Kamaboko | Cases*, https://www.dbj.jp/en/topics/case/html/20200405_9.html. [63]

DBJ (n.d.), *Corporate Philosophy*, https://www.dbj.jp/en/co/info/philosophy.html. [59]

EBRD (2022), *EBRD lends further support to Moroccan Nador West Med port*, https://www.ebrd.com/news/2022/ebrd-lends-further-support-to-moroccan-nador-west-med-port.html. [51]

EBRD (2022), *Focus on Envrironment - November 2022*, https://ebrd.com/focus-on-environment.pdf. [46]

EBRD (2022), *The EBRD Climate Adaptation Action Plan 2023 - 25*, https://www.ebrd.com/climate-adaptation-action-plan.pdf. [45]

EBRD (2021), *Vital role for private sector in financing climate resilience*, https://www.ebrd.com/news/2021/vital-role-for-private-sector-in-financing-climate-resilience.html. [49]

EBRD (2020), *Climate Resilience Bonds: EBRD's experience - IDB Webinar: Building Resilience through Green Bonds*, https://www.greenfinancelac.org/wp-content/uploads/2020/04/2020-04-23-EBRD-climate-resilience-bonds-IDB-webinar.pdf. [54]

EBRD (2019), *Press Release: 1.625% US$700 Million 5-year Climate Resilience Bond due 27 September 2024*, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjFyPLLqYSAAxU6VaQEHSclB3UQFnoECA4QAQ&url=https%3A%2F%2Fwww.ebrd.com%2Fdocuments%2Ftreasury%2F1625-us700-million-5year-climate-resilience-bond-due-27-september-2024.pd. [52]

EBRD (2019), *World's first dedicated climate resilience bond, for US$700m, is issued by EBRD*, https://www.ebrd.com/news/2019/worlds-first-dedicated-climate-resilience-bond-for-us-700m-is-issued-by-ebrd-.html. [43]

EBRD (n.d.), *EBRD's Climate Resilience Bonds - Frequently Asked Questions*, https://www.ebrd.com/documents/treasury/faqebrds-climate-resilient-bonds.pdf. [47]

FMO (n.d.), *Governnace of Climate Investor One / Climate Fund Managers*, https://www.fmo.nl/governance-related-to-cio-and-cfm. [32]

GEF (2019), *Adaptation SME Accelerator Project (ASAP)*, https://publicpartnershipdata.azureedge.net/gef/GEFProjectVersions/ef828c28-2f99-e911-a82d-000d3a365fc2_CEOEndorsement.pdf. [26]

Green Climate Fund (2022), *Consideration of funding proposals - Addendum IV | Funding proposal package for FP190*, https://www.greenclimate.fund/sites/default/files/document/gcf-b33-02-add04_0.pdf. [33]

Guidebook for Just Financing (n.d.), *Adaptation SME Accelerator Program (ASAP)*, https://guidebookforjustfinancing.com/portfolios/adaptation-sme-accelerator-program-asap/. [29]

Hott, C. and T. Tran (2020), *NatCats and Insurance in a Developing Economy - New Theoretical and Empirical Evidence*, Kiel, Hamburg: ZBW - Leibniz Information Centre for Economics, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiQndWxhtn_AhXQTKQEHfaYCp4QFnoECA4QAQ&url=https%3A%2F%2Fwww.econstor.eu%2Fbitstream%2F10419%2F224551%2F1%2Fvfs-2020-pid-39295.pdf&usg=AOvVaw1gE4D7vGTNgamRgdLi3dDm&opi=. [12]

Hutton, G. and M. Varughese (2016), *The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation, and Hygiene*, World Bank, https://www.worldbank.org/en/topic/water/publication/the-costs-of-meeting-the-2030-sustainable-development-goal-targets-on-drinking-water-sanitation-and-hygiene. [38]

IDB (2020), *Developing solutions for climate adaptation and resilience is a business opportunity for SMEs in Latin America and the Caribbean*, https://blogs.iadb.org/sostenibilidad/en/developing-solutions-for-climate-adaptation-and-resilience-is-a-business-opportunity-for-smes-in-latin-america-and-the-caribbean/. [25]

IPCC (2007), *Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability - G. Definitions of Key Terms*. [55]

Kull, D. et al. (2021), *The Value of Surface-based Meteorological Observation Data*, World Bank, https://documents.worldbank.org/en/publication/documents-reports/documentdetail/192461614151036836/the-value-of-surface-based-meteorological-observation-data. [7]

Nordic Development Fund (2022), *Climate Investor Two [NDF C132]*, https://www.ndf.int/what-we-finance/projects/project-database/climate-investor-two-ndf-c132.html. [35]

Nordic Development Fund (2022), *Systematic Observations Financing Facility (SOFF) [C139]*, https://www.ndf.int/what-we-finance/projects/project-database/systematic-observations-financing-facility-soff-c139.html. [4]

OECD (2022), *Green, social, sustainability and sustainability-linked bonds in developing countries: How can donors support public sector issuances?*, OECD Publishing, Paris, https://www.oecd.org/dac/green-social-sustainability-and-sustainability-linked-bonds.pdf. [40]

OECD (2019), *Making Blended Finance Work for Water and Sanitation: Unlocking Commercial Finance for SDG 6*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/5efc8950-en. [30]

OECD (2018), *Financing Water Investing in Sustainable Growth - OECD Environment Policy Paper No. 11*, OECD Publishing, Paris, https://www.oecd.org/water/Policy-Paper-Financing-Water-Investing-in-Sustainable-Growth.pdf. [39]

Rudolph, M. (2022), *15th Emerging Risk Survey*, Society of Actuaries, https://www.soa.org/resources/research-reports/2022/15th-survey-emerging-risks/. [9]

Sapapthai, S. et al. (2020), "A Stakeholder Analysis Approach for Area Business Continuity Management: A Systematic Review", *Journal of Disaster Research*, Vol. 15/5, pp. 588 - 598, https://doi.org/10.20965/jdr.2020.p0588. [56]

Smith, E. (2019), *EBRD's first ever climate resilience bond 'paves way'for more green products*, https://www.investmentweek.co.uk/interview/4006300/ebrd-climate-resilience-bond-paves-green-products. [44]

SOFF (2021), *Systematic Observations Financing Facility (SOFF) - Terms of Reference*, https://alliancehydromet.org/wp-content/uploads/2021/10/SOFF-Terms-of-Reference.pdf. [6]

SOFF (2020), *The value of GBON: Exploring the Insurance Sector*, https://library.wmo.int/doc_num.php?explnum_id=10379. [8]

Terpstra, P. and A. Ofstedahl (2013), *Micro, Small, and Medium Enterprises: Key Players in Climate Adaptation*, https://www.wri.org/insights/micro-small-and-medium-enterprises-key-players-climate-adaptation. [20]

Trabacchi, C. et al. (2020), *Adaptation Solutions Taxonomy*, The Lightsmith Group, https://lightsmithgp.com/wp-content/uploads/2020/09/asap-adaptation-solutions-taxonomy_july-28-2020_final.pdf. [23]

Tsan, M. et al. (2019), *The Digitalisation of African Agriculture Report 2018 - 2019*, CTA / Dalberg Advisors, https://cgspace.cgiar.org/handle/10568/101498. [10]

UN Environment Programme (2022), *Adaptation Gap Report 2022: Too Little, Too Slow - Climate adaptation failure puts world at risk*. [53]

Village Capital (2021), *Village Capital Partners with The Lightsmith Group on Adaptation SME Accelerator Project (ASAP)*, https://newsandviews.vilcap.com/press-releases/lightsmith-asap-accelerator. [28]

WMO (2022), *Boosting the provision of essential weather and climate data*, https://public.wmo.int/en/media/press-release/boosting-provision-of-essential-weather-and-climate-data. [3]

WMO (2022), *SOFF Opens Its Doors for Business*, https://public.wmo.int/en/resources/meteoworld/soff-opens-its-doors-business. [5]

WMO (2021), *State of the Climate in Asia 2020*, https://library.wmo.int/index.php?lvl=notice_display&id=21977#.Y6I2fRWZPVp. [11]

WMO (2021), *UN Unveils New Finance Mechanism to Boost Climate Action*. [2]

WMO (2020), *The value of Surface-Based Meteorological Observation Data: Costs and benefits of the Global Basic Observing Network*, https://library.wmo.int/doc_num.php?explnum_id=10376. [1]

World Bank (n.d.), *Small and Medium Enterprises (SMEs) Finance*, https://www.worldbank.org/en/topic/smefinance. [19]

Notes

[1] Public ownership in this context includes ownership by the state and/or respective National Hydrological and Meteorological Services.