ACCELERATING PRIVATE SECTOR ENGAGEMENT IN ADAPTATION IN ASIA AND THE PACIFIC

Xianfu Lu

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Accelerating Private Sector Engagement in Adaptation in Asia and the Pacific

Xianfu Lu

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Xianfu Lu has worked on the science, policy and practices of adaptation and climate resilience for over 20 years, with a focus on integrating physical climate risk into development financing operations. She serves as a climate change adaptation consultant on Private Sector Finance to ADB.

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This report was prepared by the Climate Change and Disaster Risk Management Division, Sustainable Development and Climate Change Department (SDCC) of the Asian Development Bank (ADB), with the support from TA 6627-REG: Building Institutional Capacity: Delivering Climate Solutions under Operational Priority 3 of Strategy 2030.

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ABBREVIATIONS

ADB	Asian Development Bank
CCRI	Coalition for Climate Resilience Investment
CPS	Country Partnership Strategy
DMC	developing member country
EBRD	European Bank for Reconstruction and Development
GCF	Green Climate Fund
NbS	natural-based solutions
OPPP	Office of Public–Private Partnership
PPP	public–private partnership
PRC	People's Republic of China
PSOD	Private Sector Operations Department
SDCC	Sustainable Development and Climate Change Department
SMEs	small and medium-sized enterprises
TA	technical assistance
TCFD	Task Force on Climate-related Financial Disclosures
UNFCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

Private sector engagement is essential to bridge the adaptation gap.

The sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC), calls for urgent and bold mitigation and adaptation actions to seize the narrow but rapidly disappearing window of opportunities—to secure a livable future for all. This report was based on even more compelling scientific evidence referred to as "code red." Despite more adaptation that is occurring, these are highly uneven and adaptation gap is expected to widen in some of the most vulnerable countries. Adaptation has, so far, been supported predominantly by the public sector. To effectively address the adaptation gap, particularly during the post-COVID-19 era when public finance is under more severe strain, private sector engagement is essential.

There are three main modes of private sector engagement in adaptation.

To survive and thrive in a changing climate, businesses in the private sector need to become "adaptors." In addressing the wide range of physical climate risks to communities, economies, and the environment, the private sector is relied upon to be the "solution providers"—to supply the technologies, the services, and the products for building climate resilience. As "financiers," the private sector can help fill in the considerable gap in financing programs for adaptation. To date, all three forms of private sector engagement are taking place, to varying extents and degrees of participation.

The private sector faces considerable technical, institutional, and financial barriers to engaging in adaptation.

Even with the widely recognized need, private sector engagement in adaptation remains nascent and must overcome a number of profound challenges. These challenges include the following: (i) many private sector entities often have limited understanding of climate exposure and risks and their own businesses' vulnerability and those of the wider society, thus, their inability to pinpoint where the needs are, and employ adaptation measures currently available; (ii) in many developing countries, enabling policy and other institutional conditions are not yet in place to facilitate private sector engagement in adaptation; and finally, (iii) the challenges in creating a viable value stream and financial incentives make it difficult for many private sector entities to build a compelling business case for taking adaptation action or investing in adaptation products and services.

However, opportunities for the private sector are emerging so businesses could step up their engagement in adaptation.

The adoption of the Paris Agreement on climate change, the ensuing climate policy development, and the compelling scientific evidence have provided the imperative for businesses in the private sector to adapt. Building climate resilience is becoming an integral part of business risk management, and an area of business growth and/or investment. Prominent examples include the growing support to the recommendations of the Task Force on Climate-Related Financial Disclosures—to report climate-related risks and opportunities. With targeted support from the public sector, a climate resilience entrepreneurial ecosystem is emerging, developing, and growing businesses that provide resilience solutions. Progress has also been made in developing more risk-tolerant financing instruments and tools to facilitate private sector engagement.

Development finance institutions (DFIs), including ADB, could accelerate all three modes of private sector engagement in adaptation—using the full spectrum of their operational modalities.

Developing countries in Asia and the Pacific are among the most vulnerable to the impacts of climate change. Development finance institutions (DFIs) working in the region are well placed to help accelerate private sector investments for adaptation. Some of the examples are technical assistance, policy and institutional development, risk analytics, and adaptation investment planning. DFIs can also help by improving the risk-adjusted return on investment profile through their deployment of risk-tolerant financing instruments and tools. As small and medium-sized enterprises (SMEs) are the backbone of developing economies, DFIs in these countries could immensely support and stimulate SMEs to engage in adaptation as these enterprises have the knowledge of the local markets and can operate in local currencies. Since they often lack the capacity and resources, SMEs could benefit and robustly thrive with the support of multilateral and bilateral DFIs.

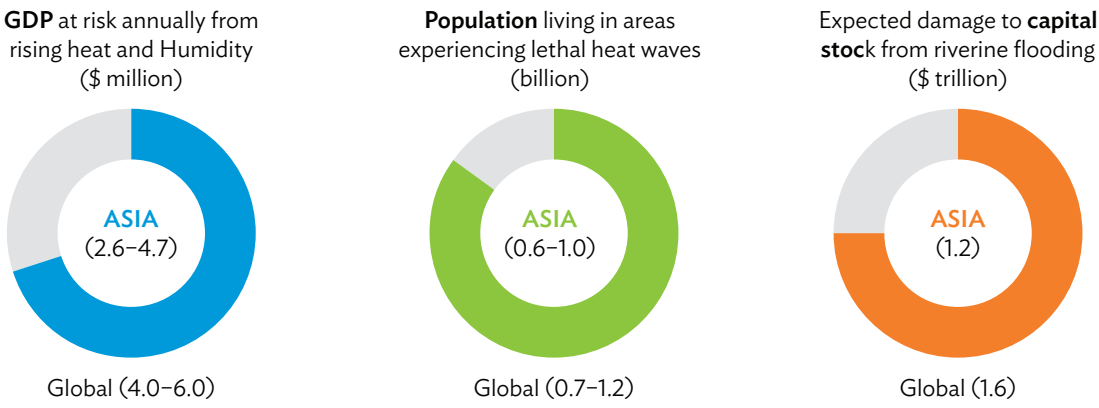
Building on its financing support for adaptation at project level, primarily through sovereign operations, the Asian Development Bank (ADB) and other DFIs could scale up their support to developing countries in Asia and the Pacific in building climate resilience—by accelerating the engagement of the private sector. DFIs could mobilize all function teams and work through their full operational cycle to (i) strengthen upstream engagement through policy dialogues and country programming processes, (ii) accelerate the development and piloting of new financing products and tools, (iii) deploy technical assistance strategically, (iv) leverage partnerships, and (v) further enhance internal policy and operational processes so that these become conducive to engaging private sector entities in adaptation.

I. INTRODUCTION

1. Context

The Asia and Pacific region is characterized by considerable development opportunities but also faces a high level of vulnerability to climate change. As highlighted by the latest assessment report of the Intergovernmental Panel on Climate Change (IPCC), some 3.3 billion–3.6 billion people live in areas that are highly vulnerable to climate change, with global hot spots of high human vulnerability found particularly in South Asia and in small island developing states, among others (IPCC 2022). Asia has six of the top 10 countries globally that are worst affected by climate-related disasters during the past 20 years (Germanwatch 2021). In the decades ahead, a wide range of climate change impacts are expected for the region, such as (i) rising temperature increases the likelihood of heat wave threats across Asia; (ii) droughts in arid and semiarid areas of West Asia, Central Asia, and South Asia; (iii) floods in monsoon regions in South Asia, Southeast Asia, and East Asia; and (iv) glacier melting in the Hindu Kush–Himalayan region; and (v) rapidly increasing flooding events in the small islands in the Pacific as a result of projected changes in the wave climate superimposed on sea-level rise (IPCC 2022). As shown in Figure 1, Asia is to bear the brunt of the physical climate risks to people, critical infrastructure, and the economy. While action to mitigate climate change is more urgent than ever—to seize the rapidly disappearing window of opportunity to keep the global warming below 2°C—actions to adapt to the inevitable climate change are needed immediately. Such adaptation actions should also be at a larger scale to protect lives, livelihoods, businesses, supply chains, and economies.

Figure 1: Disproportionate Adverse Impacts of Climate Change in Asia by 2050



GDP = gross domestic product.
Source: Adapted from Mckinsey Global Institute (2020).

Globally, more adaptation is taking place, but there are increasing gaps between adaptation action taken and what is needed. These gaps are largest among lower-income populations and are expected to grow (IPCC 2022). The annual adaptation finance flow is estimated to be $46 billion during 2019–2020 (CPI 2021). While this represents an increase of 53% from the $30 billion during 2017–2018, it falls far short of what is needed. The annual adaptation cost in developing countries alone is expected to reach $155 billion–$330 billion in 2030 (UNEP 2021). Governments and

the public sector, in general, have so far been leading the adaptation efforts. Of the annual adaptation financial flow during 2019–2020, 98% was from the public sector. Public sector adaptation finance (82%) was delivered primarily by development finance institutions (DFIs), including multilateral, bilateral, and national DFIs. However, the public sector alone will not be able to fill in the considerable gap, particularly with public finance being severely strained by the coronavirus disease (COVID-19) pandemic. Therefore, private sector engagement is ever more important to bridge the adaptation gap.

In its Strategy 2030, the Asian Development Bank (ADB) committed to a series of ambitious climate and private sector engagement targets. These include (i) ensuring at least 75% of its total operations support climate action, (ii) its own climate finance resources to reach at least a cumulative amount of $80 billion by 2030, and (iii) its private sector operations to reach one-third of ADB operations in number by 2024 (ADB 2018). Recognizing the need of its developing member countries (DMCs), in 2021, ADB raised its climate finance ambition from $80 billion to $100 billion by 2030 from its own resources, including $12 billion in cumulative private sector climate finance, and the anticipated crowding in of an additional $18 billion–$30 billion of private sector finance.[1] ADB also committed to fully align its sovereign operations with the goals of the Paris Agreement by 1 July 2023, while aligning 85% and 100% of its nonsovereign operations by 1 July 2023 and 1 July 2025, respectively. To reaffirm its commitments, ADB supported the recommendations of the Task Force on Climate-related Financial Disclosure (TCFD)[2] on assessing and reporting climate-related financial risks and opportunities,[3] to build a resilient and transparent financial system, and to safeguard against risks from climate change through enhanced disclosure.

This report aims to provide an action framework for ADB to accelerate private sector engagement in adaptation—based on the understanding of the key factors that limit private sector engagement in adaptation and the emerging opportunities to address them. Other DFIs, particularly multilateral development banks (MDBs), may find the framework or elements of it applicable for them to support their private sector engagement in adaptation in their client countries.

2. Scope and Target Audience

This report aims to identify potential levers that could help scale up private sector engagement in adaptation—through an action framework where an integrated, whole-of-economy, and multidisciplinary approach is central. This is done by building on the existing literature on private sector engagement and experiences of ADB in adaptation, and those from its operations to date. This report is intended for those working in the sphere of operations, policy, knowledge, and risk management functions—which are important in creating the enabling conditions or in directly engaging with the private sector on adaptation, particularly in developing countries.

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1 ADB. 2021. ADB Raises 2019–2030 Climate Finance Ambition to $100 Billion. News release. 13 October. https://www.adb.org/news/adb-raises-2019-2030-climate-finance-ambition-100-billion.

2 ADB. 2021. ADB Announces Support for Task Force on Climate-Related Financial Disclosures. News release. 26 November. https://www.adb.org/news/adb-announces-support-task-force-climate-related-financial-disclosures

3 Launched in June 2017, the TCFD recommendations on climate-related financial disclosures are widely adoptable and applicable to organizations across sectors and jurisdictions. These are designed to solicit decision-useful, forward-looking information that can be included in mainstream financial filings. These are also structured around four thematic areas that represent core elements of how organizations operate: governance, strategy, risk management, and metrics and targets. Disclosures have been made mandatory in some countries and for some sectors. The TCFD has over 3,000 supporters. ADB became a supporter of the TCFD in November 2021 and committed to implementing TCFD recommendations to raise awareness of climate-related risks across its portfolio of operations in its DMCs, resulting in better risk management and more informed strategic planning.

Even with the focus on ADB, the issues discussed—including some of the internal challenges and opportunities for supporting private sector engagement in adaptation in developing countries—the general action framework presented in this report would also be applicable to other multilateral, bilateral, and national DFIs.

3. Approach and Structure

This report is based on the review of published literature, reports, and institutional documents of ADB and other DFIs, and from informed observations and insights from practitioners working in both operational and supporting functions. The observations and insights were gathered through a series of interviews and bilateral discussions.

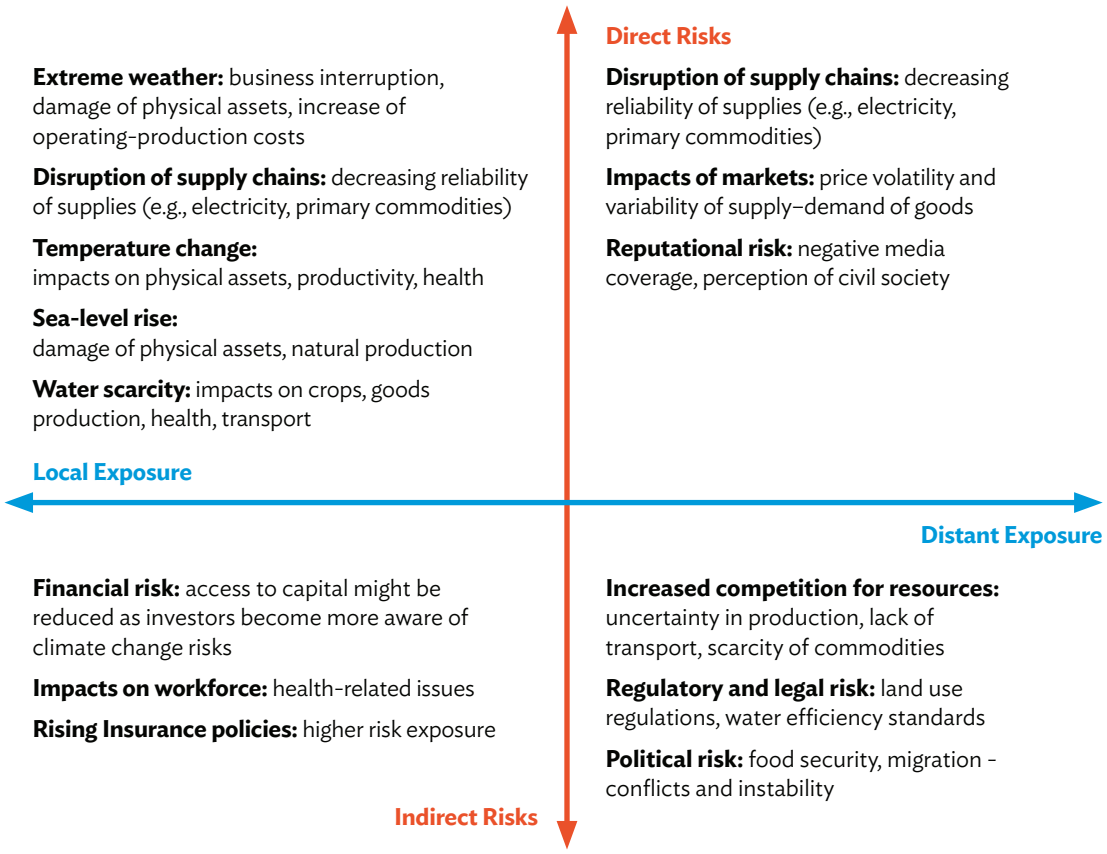
II. CURRENT PRACTICES OF PRIVATE SECTOR ENGAGEMENT IN ADAPTATION

1. Modes of Private Sector Engagement in Adaptation

The private sector is essential to addressing the considerable gap in adaptation finance, particularly in the wake of the COVID-19 pandemic, which put severe strain on public finance. While financing arguably brings the highest and most measurable level of private sector engagement, the mobilization of private sector engagement in adaptation is a means to an end, not an end in itself. The main aim of engaging private sector in adaptation should be to adapt society as a whole in an efficient manner, including the most vulnerable groups and people. To deliver on societal climate resilience, it is important to look at the private sector's engagement in adaptation beyond being **"financiers"** and fully leverage its technological know-how and ingenuity. There are other ways that the private sector can contribute to build society's climate resilience, including in their roles as **"adaptors"** and/or as climate resilience **"solution providers."**

As in the rest of the world, private sector is the backbone of the economy in developing countries in Asia and the Pacific. A climate-resilient private sector is, therefore, an absolute essential for a climate-resilient economy. As shown in Figure 1, climate change can affect businesses—directly, through disruptions to business operations and markets; and indirectly, through availability and price of insurance cover, and competitions for increasingly scarcer resources. Thus, it is vital that the private sector—from small and medium-sized enterprises (SME), multinational corporates, to financial services—takes proactive action to assess and manage material physical climate risks so that goods and services are available in times of climate disruptions. In this context, private sector entities need to become **"adaptors."**

Figure 2. Direct and Indirect Physical Climate Risks to Businesses



Source: Adapted from Tall et al. (2021).

On the other hand, building society's resilience to climate change impacts also presents business opportunities for the private sector. Prospects in developing new and innovative technologies, products, and services exist for some businesses and sectors, which enable others to adapt and build climate resilience. These opportunities bring not only economic benefits in the form of growth and jobs, but also reduce vulnerability and risk within their markets. In other words, the private sector can become climate resilience **"solution providers."**[4]

Table 1 provides a summary of the key features of the three modes for private sector engagement in adaptation: adaptor, solution provider, and financier.

[4] Although the provision of financing is technically included in resilience solutions (finance services), "financier" as a separate mode of engagement is maintained in this report as this has been much more widely discussed, particularly in ADB operations (and to some degree, among DFIs) as climate finance has been a key aspect of private sector engagement in adaptation.

Table 1: Key Features of Private Sector Engagement in Adaptation

Engagement Mode	Objective	Driver(s)		Example
		Internal	External	
Adaptor	To ensure that major assets, business operations, and supply chains are resilient to climate change impacts.	• Business continuity and profitability • Reputation or brand value • TCFD recommendations • Shareholder activism	• Regulatory requirement for service delivery standards • Investor demand	• A hotel chain developing a local food sourcing program that is supporting smallholder farmers. This ensures supply security and reduces costs for their hotels, alongside providing livelihood opportunities to smallholders in the area. • An agribusiness investing in R&D on climate-resilient farming practices and providing advances to its contract farmers to encourage them to apply these practices. • A power utility company investing in climate-resilient infrastructure to ensure service delivery during damaging wildfire and flood events.

Continued on next page

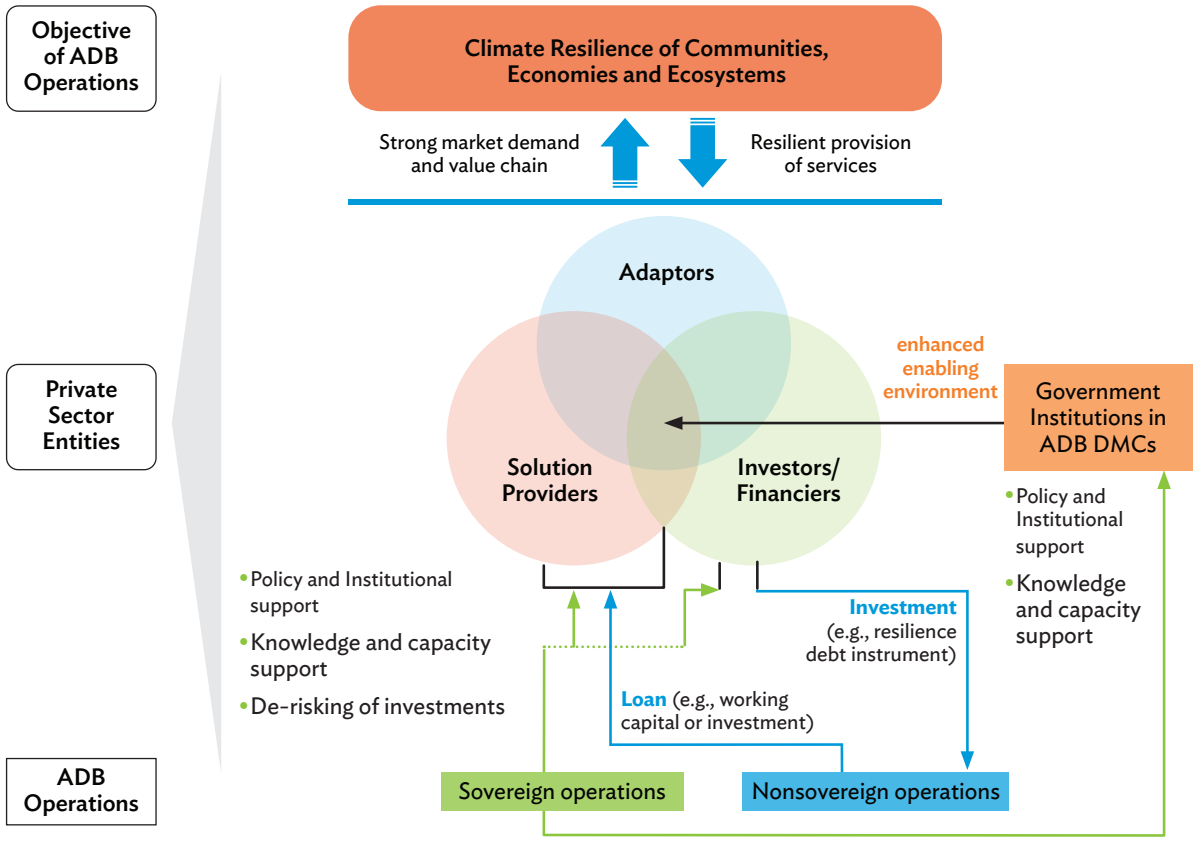
Table 1 continued

Engagement Mode	Objective	Driver(s)		Example
		Internal	External	
Solution Provider	To provide goods or services for the implementation or facilitation of adaptation and climate resilience projects, by developing and distributing new products and services, or by developing new or expanding existing markets for products and services.	• New revenue streams • Risk reduction through portfolio diversification • Increased market share • Long-term viability or success of business		• Precision agri-tech business providing weather forecast and water information to help farmers increase production while minimizing inputs. This enables farmers to adapt to changing climatic conditions due to climate change. • Providing extension services for climate-resilient farming practices (e.g., soil conservation, efficient water use, etc.). • Businesses providing AI-driven smart water management products and services for developing markets; helping water utilities optimize their operations, thus, reducing water loss, reducing power consumption, and improving service levels. • Microfinance service providers making advanced payments to farmers to enable them to take proactive action toward becoming climate-resilient (e.g., by establishing agroforestry systems). • Micro-insurance companies providing cover for weather-related losses and damages to support proactive climate-resilient practices and/or support the recovery.
Financier	To finance the implementation and adaptation of climate resilience projects, and to develop and roll out new climate resilience solutions.	• Return on investment • Positive (social and/or environmental) impacts • TCFD recommendations • Shareholder activism		• Commercial banks investing in utility companies that practice climate-resilient operations and management. • Philanthropists providing funds for coral conservation. • Businesses providing equity investments in projects that develop and disseminate new technologies (e.g., sensor technology to enable precision agriculture or effective climate-risk informed infrastructure management) or in climate resilience solutions (e.g., water recycling or reuse systems).

AI = artificial intelligence, R&D = research and development, TCFD = Task Force on Climate-related Financial Disclosures.
Source: Author.

DFIs have the potential to scale up all three modes of private sector engagement in adaptation. Figure 3 illustrates how a DFI, using ADB as an example—through a combination of sovereign and nonsovereign operation interventions and different financing instruments—can support the upsurge of private sector investments on adaptation in developing countries.

Figure 3. Support for Private Sector Engagement in Adaptation by Development Finance Institutions: ADB as an Example

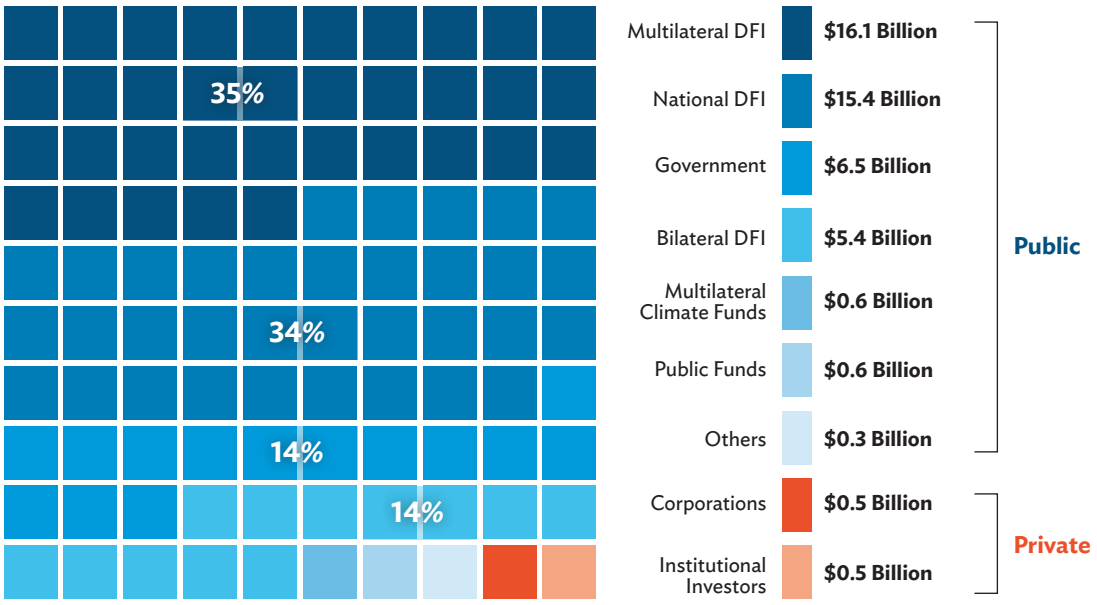


ADB = Asian Development Bank, DMCs = developing member countries,
Source: Author.

2. Current Trends in Private Sector Engagement in Adaptation

Among the three modes of private sector engagement in adaptation, the **"financier"** mode has been the most extensively discussed in the literature—due to the fact that lack of finance has been widely recognized as a major contributor to the current adaptation gap (UNEP 2021). As shown in Figure 4, the current level of reported financial contribution from the private sector to adaptation is very low—just 2% of the annual average total of $46 billion during 2019–2020—although data on adaptation finance from the private sector is largely missing (Climate Policy Initiative 2021).

Figure 4. Sources of Adaptation Finance (Annual average, 2019–2020)



DFI = development finance institution.
Source: Climate Policy Initiative (2021).

In addition to the investment volume, Binet et al. (2021) looked at the total portfolio of 74 adaptation projects supported by the Green Climate Fund (GCF). Of this portfolio, only two were developed by "private" sector entities (Box 1). This low level of private sector engagement was explained through market-related factors, including (i) fewer investable opportunities and predictable return flows, (ii) fewer reactive business models, (iii) lack of predictability, and (iv) the up-front costs of adaptation projects (Binet et al. 2021).

Box 1: Productive Investment Initiative for Adaptation to Climate Change: CAMBio II

The CAMBio II is one of the two Green Climate Fund (GCF) projects that was fully developed by a private entity within a portfolio of 74 adaptation projects, and this was included in the analysis of Binet et al. (2021).

The project, approved by the GCF Board in 2018, was developed and is being implemented by the Central American Bank for Economic Integration (CABEI), a private sector entity. It aims to provide access to finance to small and medium-sized enterprises (SME) in the agriculture, livestock, and forestry sectors in seven Central American countries (Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama). These SMEs dominate the agriculture, livestock, and forestry sectors, which are the core of the region's economy, but are particularly vulnerable to climate change-related natural hazards and, thus, urgently need investments to be able to adapt to these risks. For these SMEs, access to finance has been hindered by conservative banking practices and perceived high risks associated with these sectors.

The CAMBio II project in partnership with the local financial institutions will provide loans to micro, small and medium-sized enterprises (MSMEs) to promote the best available adaptation measures and help adapt production systems to climate change. It will also reduce the obstacles by providing concessional loans, technical assistance, and an incentive scheme. The latter will benefit businesses and financial institutions—for the successful implementation of adaptation activities.

During the 15 years of its life span—from 2024 to 2039—the project is expected to support over 5,000 MSMEs and enhance the climate resilience of over 69,000 people in the region. The GCF provided $15.5 million ($3 million in grant and $12.5 million as loans), with a CABEI cofinancing of $12.5 million.

Source: Binet et al. (2021).

At ADB, a total of $8.6 billion climate-tagged nonsovereign operations were recorded during 2011–2020. Support for adaptation was limited to $111 million during 2011–2020, or 1.3% of the total climate finance under nonsovereign operations. These consisted mainly of agriculture and natural resources value chain projects at the regional level, and urban projects in the People's Republic of China (PRC), which were all approved after 2016 (ADB 2021a).

In terms of private sector engagement as an **"adaptor"**—partially driven by the already mounting damages caused by extreme weather events—businesses and financiers are starting to realize the imperative and the opportunities of engaging in adaptation.[5] The most relevant information that reflects the level of engagement would be the physical climate- related financial risk disclosure of (large) corporations and financial services companies.[6] According to the latest global climate risk disclosure

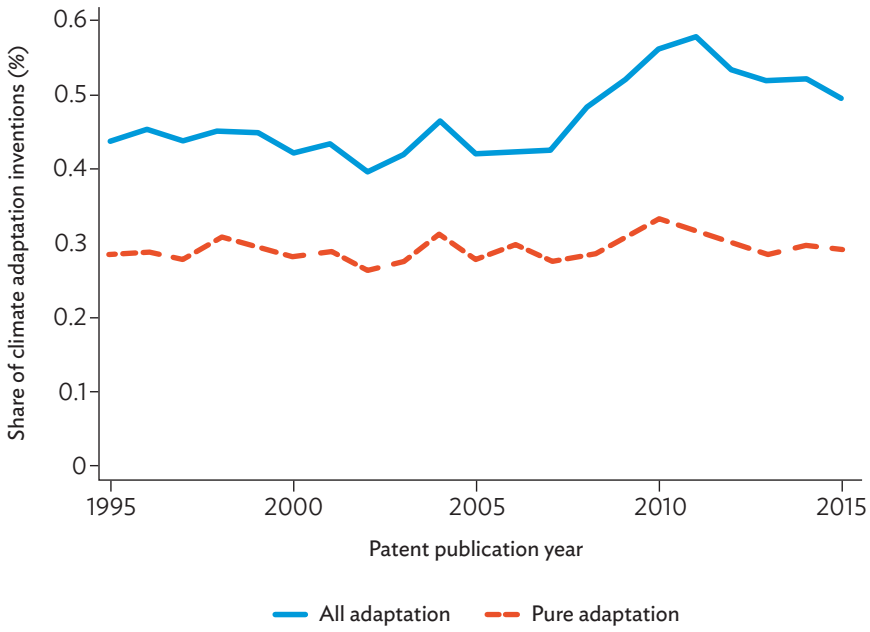
[5] For example, the article on "Climate resilience: Overlooking no more" (Economist, 24 July 2021, under the magazine's "Finance and Economics" section) highlighted the opportunities for banks to provide loans to businesses and homeowners for building resilience to hurricanes, and contrasted these with financial outcomes between businesses taking proactive adaptation actions and those ignoring climate risks.

[6] Although disclosure of risks does not necessarily mean risks are effectively managed, one could argue that identifying the risks is an important prerequisite to manage them, as author Peter Drucker once said, "what gets measured, gets managed."

barometer provided by EY, only 41% of the 1,100 or so companies from 42 countries—whose climate risk disclosures were analyzed in line with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations—are conducting scenario analysis to provide forward-looking risk assessments, and only 15% feature climate change in their financial statements, and are mostly in Europe (EY 2021, TCFD 2021). Due to the challenges of sourcing granular, asset-level data required for assessing physical climate risks, analysis, and disclosure for physical climate risks and resilience-investment opportunities are less common than transition risks (TCFD 2021). It is worth noting that reporting in line with the TCFD recommendations have so far been voluntary and is limited to large organizations. For micro, small and medium-sized enterprises (MSMEs) in developing countries, operating in geographies and sectors (e.g., agriculture) that are vulnerable to climate change, it becomes essential to ensure the climate resilience of their businesses, including supply chains and labor productivity. However, within their business environment, they often face major barriers to adapting to the impacts of climate change, including a lack of access to business finance, inappropriate incentive structures, and limited access to markets and technologies (Gannon et al. 2020).

A **"solution provider"** can fulfill two roles in supporting climate adaptation. First, it could be an entity providing technologies, products, and services that strengthen users' ability to understand and respond to physical climate risks and related impacts and/or capture related opportunities. Examples include (i) weather and climate analytics, (ii) flood or fire forecast and warning system, (iii) microfinance solutions, and (iv)weather parametric insurance. Second, a solution provider could contribute to preventing or reducing physical climate risk and the adverse associated impacts on assets, economic activities, people, or nature. For example, the private sector could develop and deploy (i) water-efficient irrigation systems, (ii) water harvesting and storage, (iii) a cover crop for improving soil quality, (iv) high-precision laser land levelling to reduce runoff, and (v) geosynthetic products to control erosion or stabilize river slope. Prompted by growing awareness of climate-related financial risks, there has been a steady growth in climate analytics (Fiedler et al. 2021). Other climate resilience products and services may have already been available but not necessarily labelled as such (e.g., water harvesting and storage systems). To increase awareness on such solutions, an adaptation SME taxonomy was developed (Trabacchi et al. 2020). Adaptation solutions have also been included in international innovation and patent registers. Dechezlepretre et al. (2020) examined the trend in adaptation innovation, measured by the number of registered patents, during a 20-year period covering 1995–2015. As shown in Figure 5, the rate of innovation activity in pure climate change adaptation technologies since 1995 has been constant. The growing relevance of climate adaptation technologies has seemingly not led to an increase in the proportion of global innovation efforts to develop patented technologies in this field. Innovation in adaptation technologies has been highly concentrated in a small number of countries. The United States (US) is by far the world's leader, with nearly one-quarter of all high-value adaptation inventions developed between 2010 and 2015. However, the rapid growth of innovation in the PRC and the Republic of Korea is notable. Together, these two countries produced less than 4% of all adaptation inventions in 1995 and increased their shares to 8.9% and 7.8%, respectively, in 2015 (Dechezlepretre et al. 2020).

Figure 5. Innovation for Climate Change Adaptation, as a Share of Total Innovation, 1995–2015



Note: "Pure adaptation" refers to technologies for climate change adaptation that are not simultaneously classified as mitigation technologies.

Source: Dechezlepretre et al. (2020) using data from the World Patent Statistical Database (PATSTAT), European Patent Office.

III. KEY CHALLENGES AND BARRIERS

1. General Barriers

Recognizing the importance of unlocking the potential of private sector investment in adaptation, considerable efforts were made to identify the factors that have been limiting the scale of private sector engagement.[7] As summarized in Table 2, the key barriers can be categorized into three clusters: (i) data and information, (ii) institutional arrangements, and (iii) business case and financial incentives. These barriers are generic to private sector engagement in adaptation and are applicable to all DFIs.

It can be noted that the barriers are often interacting and/or reinforcing each other. For example, lack of access to useful risk information leads to a lack of reinforcement of regulatory requirements, such as (i) building away from flood-prone areas, (ii) farming close to rivers or slopes leading to land degradation and increase in vulnerability, or (iii) business cases and/or financial incentives as physical climate risks are not priced in project capital expenditures economic analysis.

[7] For examples, see PCIR (2012), PwC (2013), Antwi-Agyei et al. (2013), Biagini and Miller (2013), Islam et al. (2014), Vivid Economics (2015), Trabacchi and Mazza (2015), Hallmeyer and Tonkonogy (2018), Ahenkan et al. (2018), Bisaro and Hinkel (2018), Tall et al. (2021), Pawu et al. (2021), and Stoll et al. (2021).

Table 2: Summary of Key Barriers to Scaling Up Private Sector Engagement in Adaptation

Barrier Category	Subcategory	Barrier	Description
Data and Information	Investment decision, relevant data and information on physical climate risks, adaptation options, and resilience-investment opportunities	Insufficient availability, access and communication of decision relevant data and information.[a]	Lack of usable data, information, and tools to make informed adaptation and investment decisions.
	Representation and characterization of uncertainties associated with physical climate risks and resilience investment opportunities	The cascade of uncertainties (from global emissions, temperature, and other climate indicators to biophysical and socioeconomic impacts) are often not sufficiently quantified or characterized.	Lack of clarity over uncertainties putting off investment decisions.
Institutional Arrangements	Needs-driven, coherent adaptation, and climate- resilience investment strategy	Lack of robust adaptation planning through NDCs, NAPs, or planning strategies.	Absence of a coherent national or sectoral investment strategy with clear targets, pathways, finance needs, and guidance on where private participation will be critical (i.e., who is best placed to do what and when).
	Institutional capacity	Lack of institutional capacity for planning, financing, and execution adaptation.	Lack of government coordination, fiduciary and technical capacity, and financial management competence (e.g., to set up aggregation platforms) to encourage or facilitate private sector action.
	Policies, standards, and regulatory instruments	Absence of policies, standards, and regulatory tools.	Weak or nonexistent legal and/or regulatory instruments (e.g., design standards, certification) for the private sector to address climate risks and/or invest in climate resilience.
	Policy effectiveness	Low policy effectiveness.	Inadequate transparent monitoring and compliance mechanisms from government institutions.

Continued on next page

Table 2 continued

Barrier Category	Subcategory	Barrier	Description
Business Case and Financial Incentives	Value stream and business case	"Positive externalities"	Much of the adaptation benefits are considered as public goods (e.g., investing in coastal erosion control by a hotel would benefit the local communities) and difficult to monetize; also, adaptation is highly context- specific and the market for climate- resilience solutions often struggles to scale up (e.g., water-harvesting solutions designed for a specific location with its unique terrain and land use, and the land cover features may not work for another market).
		"Tragedy of the horizon"[b]	Short-term time horizons of investors (linked to capital investment and/or loan timeline) as the basis for making investment decisions is incompatible with the often long time frame within which physical climate risks manifest (e.g., construction businesses heavily reliant on outdoor labor in South Asian cities becoming unviable due to extreme heat-related sharp decline in labor productivity) or return on investment materializes (e.g., new heat-resilient cash crops taking long time to develop and deliver profits)
		Incorrect pricing of climate risks and valuation of climate resilience.	Current economic and financial modeling of investments do not reflect the cost of physical climate risks nor account the benefits of enhanced climate resilience (e.g., through longer service life, lower O&M costs, or reduction or prevention of service disruptions).
	Financial (dis)incentives	Lack of conducive incentives.	Businesses could be encouraged to invest in adaptation with conducive financial incentives, such as access to concessional finance (e.g., results-based concessional loan or grants for conducting market analyses), and permission to charge services delivered through investing in climate resilience (e.g., toll collected from vehicle users of all-weather tunnel in a flood-prone area made resilient by a highway maintenance company).
		Perverse incentives.	The provision of certain financial incentives can lead to maladaptation or simply discourage development that is resilient to climate change. Financial disincentives can take the form of subsidies and tax breaks, such as subsidized flood insurance, which may lead to disincentives to invest in building flood resilience, including avoiding development in a flood-prone area.

NAPs = national adaptation plans, NDCs = nationally determined contributions, O&M = operation and maintenance.

[a] Presentation and communication of information on climate risks and opportunities need to be made relevant to a business audience. Technical terms such as "adaptation," "precipitation change," "extreme climate events," and others are unfamiliar to the private sector. Instead, use "enterprise risk and resilience," "service disruption," "operational cost," and others, which can be measured and valued in specific operations of a company, are more recognizable.

[b] In his pivotal speech to the financial services sector ahead of the Paris Climate Change Conference in 2015, the then governor of the Bank of England and the chair of the Financial Stability Board, Mark Carney, described climate change challenge as "tragedy of the horizon," referring to the short-term interest of the financial sector against the long-term perspective needed to take action on climate change.

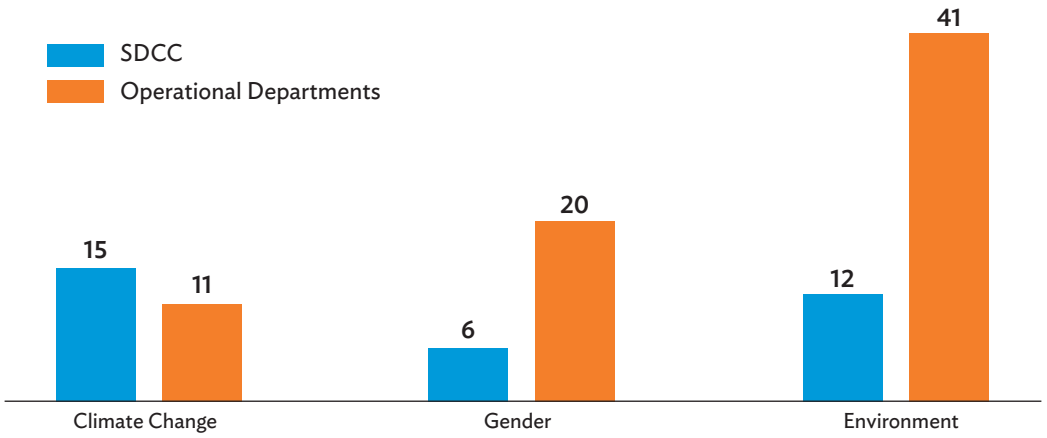
Source: Adapted from Table 4 of Tall et al. (2021).

2. Internal Challenges within Development Finance Institutions

A number of challenges related to **internal business model, process, and systems** of DFIs also limit the scope of their operations to further strengthen their private sector engagement in adaptation within the developing countries they support.

First, despite the growing importance of the issue, adaptation and climate resilience remain a nascent area in the financing operations at ADB and may well be the case in other MDBs.[8] For a start, some of the ADB staff interviewed for this study find the adaptation concept "fuzzy"—it has been challenging to develop the narrative and even more so to derive quantitative indicators. As a result, there has been an acute shortage of in-house staff with the required specialist knowledge and operational experience, particularly in operational departments (Figure 6).

Figure 6: ADB Staff Knowledge and Operational Experience



ADB = Asian Development Bank, SDCC = Sustainable Development and Climate Change Department.
Source: Author.

Second, one key quantitative indicator for the delivery on climate action has been climate finance—project finance that is associated with activities contributing to mitigation or adaptation. In contrast to the relatively well-understood concept and more straightforward methodology for qualifying and estimating associated finance for mitigation, and its generally larger finance volume, estimating adaptation finance has been characterized as time-consuming, technically challenging, and "low yielding."[9] This has worked as a distraction and disincentive for project teams to pursue adaptation, including adaptation by the private sector.

[8] The shortage of staff specialized in adaptation has been highlighted as a limiting factor for scaling up support for adaptation by the independent evaluation of European Investment Bank's (EIB) support for climate change adaptation, 2015–2020 (EIB 2021); and the independent evaluation of ADB support for action on climate change, 2011–2020 (ADB 2021a).

[9] The joint MDB methodology for tracking climate adaptation finance follows a granular, conservative, and context-specific approach. Project activities need to meet three criteria to be qualified as adaptation activity: (i) a clear vulnerability context, (ii) explicit statement of intent to reduce the vulnerability, and (iii) direct and clear linkage between project activities and the vulnerability identified (for details on the methodology, see Annex B of the joint MDB report on climate finance 2019).

And third, the current business model and process for private sector operations is not conducive for mainstreaming adaptation and climate resilience, for ADB, and maybe for other DFIs as well. Although ADB fully recognizes the importance of private sector engagement and has set ambitious private sector finance target, there has been limited operational guidance to help achieve the goal. For nonsovereign operations, ADB has mostly been a "project taker." When ADB engages with a client, the project design is often already completed or, in some cases, the infrastructure has already been built and the project is underway, leaving very limited scope, if at all, to incorporate adaptation measures. This has not been helped by the fact that nonsovereign operations teams are not routinely involved in ADB country engagements. In terms of financing tools, private sector operations teams have had challenges in mobilizing blended finance, which is essential in supporting adaptation projects. Also, for private sector operations, the focus of risk management on business risk could undermine working with national or local enterprises on projects with less robust business cases or financial standing. Due to its limited linkage to resilience-related indicators, the design and monitoring framework (DMF) or results framework of ADB projects—as it currently stands—is not suited for engaging private sector in adaptation operations.

Compounded by the limited knowledge and awareness on adaptation in general, these internal business model and systems-related limitations have impeded the efforts of the private sector operations to be more proactive and to broaden the engagement of the private sector in ADB's DMCs.

IV. OPPORTUNITIES

In spite of these challenges, which are general and specific to ADB, there are opportunities in light of recent developments in public policy, financial market, policy, and processes within ADB. This section discusses some of these opportunities that ADB, and other DFIs with similar operations, could explore to strengthen its support for private sector engagement in adaptation.

1. Global policy direction has been set to increase private sector engagement in adaptation.

The private sector has been increasingly engaged in public discourse around adaptation and climate resilience, with the policy guidance of the United Nations Framework Convention on Climate Change (UNFCCC) and the ever clearer scientific evidence from the Intergovernmental Panel on Climate Change (IPCC) calling for urgent action. A growing number of climate-related laws and national policies have come into force, with many requiring the corporate and financial services industry to assess and manage climate-related financial risks in line with the recommendations of the TCFD (see https://climate-laws.org/#map-section).

As disclosures are provided by organizations, private sector companies are likely to face more pressure from investors to better assess and manage physical climate risks (Goldstein et al. 2018). As climate-related financial disclosures become a common practice, it is expected that awareness and demand for climate resilience would also grow in both the public and private sectors. In fact, the Bank of America projects a doubling of the climate adaptation market to $2 trillion per year by 2025 (Bank of America Merrill Lynch 2020).

There has been a significant development around the definition of green or sustainable finance, to effectively channel capital toward green, resilient, and inclusive investments. Notably, the European Union's (EU) Sustainable Finance Taxonomy had set out a framework for screening individual economic activities against a set of six environmental objectives, including climate change adaptation. The accompanying legislation—EU Taxonomy Climate Delegated Act—provides further guidance on the criteria for economic activities that make significant contributions to climate change mitigation and adaptation.[10] The act's implementation is expected to increase the financial flow for low-carbon and climate-resilient investments in developing countries, including those in Asia and the Pacific (European Union 2021). The European Commission has proposed spending 30% of the total EU budget on climate action during the 2021–2027 budget cycle.[11]

2. A climate resilience entrepreneurial ecosystem is emerging.

With the gradual increase in public awareness on adaptation, companies and investors are beginning to see climate change adaptation as an opportunity rather than simply a cost, as climate impacts are generating demand for climate resilience solutions. Such demand represents opportunities to develop new or repurpose existing technologies, products, and services. Examples of these are listed under "solution provider" in Table 1. However, companies rarely use climate terminology when describing their business offerings. Thus, there is a need to help them identify themselves as solution providers. Initiatives, such as the Adaptation Solutions Taxonomy under the Adaptation SME Accelerator Project (ASAP),[12] intend to identify solutions from private companies that support climate adaptation and resilience (Trabacchi et al. 2020). With the help of taxonomy, it is expected that enterprises will be recognized by investors and clients to help further develop or grow their resilience business, and eventually deploy their solutions to build the climate resilience of communities and economies.

Despite being a more nascent creation, an ecosystem of climate resilience enterprises are emerging. This is in part helped by venture capital funds, such as the ASAP and ADB Ventures, which identify and support small businesses in developing countries that are providing adaptation and climate resilience solutions. The ASAP has identified over 300 such enterprises and have their profiles in a directory (Figure 7). Supported by these initiatives, it is reasonable to expect that a more dynamic and vibrant climate-resilient market system would emerge, with more private sector **"solution providers"** (the enterprises), **"financiers"** (investors in the enterprises), and **"adaptors"** (clients and customers of the enterprises). National initiative, such as the Climate Incubation Center in Bhutan, has been supporting climate start-ups through mentoring and networking programs. As a result of this and the growing number of other such incubator and accelerator programs, it is expected that the number of investible climate resilience companies will increase in the years to come.

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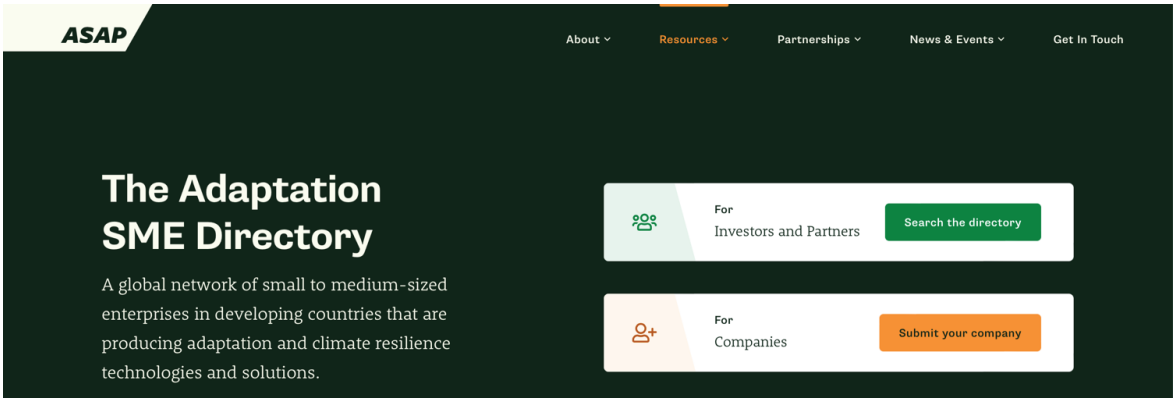
[10] The EU Taxonomy Climate Delegated Act, which outlines sustainable activities for climate change mitigation and adaptation objectives, was published in December 2021 and has been in force since January 2022. However, activities related to nuclear and specific gas projects are not included in this act but are subjects of the EU Taxonomy Complementary Climate Delegated Act, which is being scrutinized by co-legislators.

[11] European Commission. *2021–2027 Long-Term EU Budget & NextGenerationEU.* https://ec.europa.eu/info/strategy/eu-budget/long-term-eu-budget/2021-2027_en.

[12] Adaptation SME Accelerator Project (ASAP). http://climateasap.org.

Figure 7: The Adaptation SME Accelerator Project Directory



Source: Adaptation SME Accelerator Project (ASAP). https://climateasap.org/the-adaptation-sme-directory.

3. Progress is being made toward a more conducive global finance architecture.

As highlighted earlier, (p.11) adaptation presents inherent challenges for the private sector. Hence, concerted efforts by both the public and private sectors were initiated to develop and test new financing tools that are more conducive to the private sector. These include (i) result-based bonds, such as climate resilience bonds to mobilize private finance to support adaptation projects, and (ii) public–private partnerships (PPPs) to promote and facilitate private sector action on adaptation.

As a subset of green bonds, climate resilience bonds aim to raise capital for adaptation projects and unlock development benefits for vulnerable communities.[13] Due to a lack of common definitions and taxonomies for adaptation, climate resilience bond came in much later than mitigation in green bonds space. However, in 2019, the Climate Bonds Initiative (CBI) launched the Resilience Bond Principles, highlighting an opportunity for the creation of a new resilience bond market (Climate Bonds Initiative 2019). On the same year, the European Bank for Reconstruction and Development (EBRD) launched the first ever dedicated resilience bond which received an AAA rating and raised $700 million from commercial banks, central banks, and insurance companies with oversubscription.[14] One of the projects supported by the proceeds is the Tajikistan's Qairokkum hydropower plant (QHPP), with $196 million financing package. It aimed to complete the climate-resilient rehabilitation and modernization of QHPP, thus enabled the plant to cope with the expected impacts of climate change and improved the country's electricity supply. Although the EBRD experience is the first of its kind, others are taking note. To account for the fact that climate resilience is highly context-specific and adaptation being an iterative process, the Climate Resilience Principles emphasize a process of ongoing assessment in climate risk management, resilience benefits, and mitigation trade-offs. This has also made the

[13] Such projects could include investments in enterprises with a climate-resilient value proposition, which is assessed in terms of its economic value alongside its environmental, social, and governance benefits in the context of a changing climate.
[14] https://www.ebrd.com/news/2019/worlds-first-dedicated-climate-resilience-bond-for-us-700m-is-issued-by-ebrd-.html.

application of the Climate Resilience Principles more complex. Long-term success would require a greater awareness and application of climate principles in financing projects. More research would also be needed to better understand if and how progress is being achieved in leveraging the thriving bond market for building climate resilience.

PPPs have been considered as a key entry point to procuring climate-resilient projects, particularly, infrastructure projects. As highlighted by Verkooijen (2021), the incentive structure of a PPP helps establish project requirements for resilient assets or services. The need for a robust revenue model also ensures that adaptation and resilience options are linked to clear financial benefits for the private operators and public sponsors. PPPs also enable the allocation of risks between public and private partners in a way that most efficiently manages uncertain climatic conditions and achieves resilience results. In addition, the focus on measurable outputs and performance stimulates innovation, such as resilient design standards and nature-based solutions (NbS), which can reduce costs over the infrastructure's service life. New Clark City, a green, smart, and disaster-resilient development in the Philippines, has been regarded as a model PPP program that leverages the use of NbS for flood management and green city development (Box 2).

Box 2: Public–Private Partnerships to Leverage Private Sector Action on Adaptation

New Clark City: A Green, Smart, and Disaster-Resilient Development

New Clark City, about 100 kilometers north of Manila, the Philippines' capital, is one of the most important large-scale infrastructure projects in the country's recent history. It aims to set a new benchmark for livable, environmentally sustainable, and resilient cities in Asia and the Pacific.

Located on the site of a former military base, the $14 billion project will span nearly 10,000 hectares with space for up to 1.2 million residents, a new national government administrative center, internationally certified sports facilities, and sites for businesses, including those involved in agriculture, light manufacturing, and high-technology research. The Phase 1 of the new city, focused in the northeast area covering the civic and downtown districts, is scheduled for completion in 2022. Its design integrates a range of climate-resilient features, including nature-based solutions (NbS) for flood control and urban wastewater management. When built, the city will help to decongest Manila and show how meticulous planning and investment in high-quality infrastructure can transform the urban experience.

The New Clark City master plan. ADB's OPPP team helped structure, model, negotiate, document and tender the first infrastructure package of the new future city in the Philippines (photo by ADB).

However, the project would not have happened without the private sector's participation. They joined in and invested because the project was commercially viable, with infrastructure packages structured as public–private partnerships (PPPs) involving the Bases Conversion and Development Authority (BCDA) of the Philippines, which is developing the site, and other private sector partners.

Specialists from the Office of Public–Private Partnership of the Asian Development Bank (ADB) provided transaction advice and support for technical, financial, legal, and documentation work—from contract templates to water supply tariff plans—needed to structure and tender the nearly $2 billion infrastructure packages. ADB's Urban Climate Change Resilience Trust Fund and Environment Thematic Group provided support in climate- and NbS-based solutions for the New Clark City. ADB also provided crucial advisory services on water, power, road transport, and information technology infrastructure.

Source: ADB. 2019. How Can PPP Advisory Service Narrow Asia's Infrastructure Gap? News and Events. https://www.adb.org/news/features/how-ppp-advisory-services-can-narrow-asia-s-infrastructure-gap.

4. Ongoing adjustments to internal policy and processes in ADB have the potential to strengthen support for private sector engagement in adaptation.

The list of ADB corporate climate commitments has expanded, with the latest addition of the Paris Alignment and the support for TCFD recommendations. To deliver its ambitious targets and commitments, and in response to the recommendations from an independent evaluation (ADB 2021a), adjustments in the internal business processes and operational practices have been initiated to make them more fit for their purposes.

First, within the private sector operations, staff performance is no longer measured against the financing volume but instead on the number of projects. Given the usually small size of adaptation projects, this adjustment should help remove the disincentive associated with the volume-centric system. There has also been a recruitment drive within ADB's nonsovereign operations department to increase adaptation expertise, along with an increase in financial resource allocation, including resources for technical assistance (TA). Efforts are also being made for nonsovereign operations to engage in upstream country engagement and strategy development processes, including country investment programming. This would help private sector operations teams to be more effective in identifying strategic opportunities to engage private sector in adaptation investments.[15]

Second, there has been concerted efforts to implement the "One ADB" approach. The One ADB approach calls for close collaboration and integration of the following four areas: (i) sovereign and nonsovereign operations, (ii) inter- and intra-department teams, (iii) knowledge and operations functions, and (iv) staff mobility and recognition (ADB 2018). To address the challenges earlier identified (p.11) and scale up private sector engagement in adaptation in ADB's DMCs, the full implementation of the "One ADB" approach is ever more important. As pointed out earlier, all the key barriers require both sovereign and nonsovereign interventions and these need to be resolved in a coherent and highly coordinated fashion. Similarly, each transaction needs technical inputs from a wide range of specialists (e.g., sector specialists, engineers, economists, risk analysts, and environmental and social specialists). Finally, close collaboration and integration between the support functions (such as climate change policy and knowledge management) and the operations functions are essential for each to be more effective. All these dimensions of the "One ADB" approach would be critical in order to switch gears and meaningfully engage the private sector in adaptation in DMCs. It is encouraging to note that progress has been made in this sphere and there are early successes, as illustrated in the conception and structuring of a recent ADB project (Box 3).

[15] Some of the interviewees from ADB's Private Sector Operations Department (PSOD) highlighted the fact that projects often originate from national development strategy or planning documents. Without being involved in some of the key in-country policy engagements, PSOD teams do not feel they have the essential understanding of the wider policy context to be able to effectively identify investment opportunities.

Box 3: An Example of How "One ADB" Approach Works in Practice (People's Republic of China: Climate-Resilient and Smart Urban Water Infrastructure Project)

Artificial reservoir near Shenzhen City in the PRC. The project, conceived and structured via a strong "One ADB" approach, is the first nonsovereign operation undertaken jointly by ADB's East Asia and Private Sector Operations departments in the PRC (photo by Shenzhen Water Group)

In August 2020, the Asian Development Bank (ADB) approved the first nonsovereign operation in the People's Republic of China (PRC) conceived and structured via a strong "One ADB" approach. This was jointly undertaken by ADB's East Asia Department (EARD) and the Private Sector Operations Department (PSOD), and with technical inputs from the Sustainable Development and Climate Change Department (SDCC). The project is signed with the Shenzhen Water (Group) Co. Ltd. (SZWG). With a $200 million ADB commitment from its ordinary capital resources, the project supported SZWG's investment in various water supply and wastewater treatment facilities with smart water technologies and climate- and disaster-resilient urban water infrastructure in Shenzhen and in third- and fourth-tier cities in the PRC. The project was designed to provide cost-effective financing for subprojects to be identified during project implementation (2020–2023). ADB was to finance the individual subprojects.

Established in 2001, SZWG is a water utility that provides comprehensive water solutions and services, including urban water system management, wastewater treatment, and network maintenance. Its majority owner is the Shenzhen municipal government (55%); the rest of the shares are held by Veolia Environnement SA (25%), and by Beijing Capital Co., Ltd. (20%). Shenzhen Water and Environment Investment Group Co., Ltd. is SZWG's co-borrower—an investment platform established in 2005 to develop, invest in, and implement subprojects outside Shenzhen. It is owned by SZWG (70%) and by the Shenzhen Capital Group Co., Ltd. (30%), which is the investment arm of the Shenzhen municipal government.

Discussions to initiate the project started with an EARD knowledge workshop on Sponge City. Representatives from SZWG approached EARD team to express interest in working with ADB. Given the private sector nature of the SZWG, PSOD was brought in to lead the development of

Continued on next page

Box 3 continued

the project. The project is structured in a way that, while PSOD leads the project, EARD would provide substantive support on the gender action plan to ensure that climate and disaster resilience of women is strengthened through the project. In addition, the Water Sector Group team within SDCC has been supporting the technical design and screening of the subprojects by, among others, developing climate resilience subproject criteria and options. These are to strengthen climate resilience within the water supply and wastewater management system.

Through this project, ADB aims to mobilize private sector resources through various cofinancing arrangements during project implementation. In addition to championing the integration of climate resilience into the urban water infrastructure through innovative adaptation measures, including nature-based solutions, ADB's support also includes developing and disseminating knowledge on the climate resilience of infrastructure, and those of vulnerable social groups, such as women, within the water supply and wastewater management sector—within Shenzhen, PRC and beyond.

Sources: ADB (2021b), and from discussions with the project team in ADB's PSOD.

Third, a series of knowledge outputs from TA projects have the potential to propel a major uptick in private sector engagement in adaptation. These knowledge products can help address information gaps on region- or sector-specific resilience investment opportunities. ADB's private sector operations have also added a new function that focus on incubating bold technology start-ups, including those with climate resilience solutions. Within its current portfolio, a growing number of companies are providing climate resilience solutions in infrastructure, agriculture, water resources, and early warning platform (Box 4). It is reasonable to assume that once these enterprises become investment ready, ADB would be able to work with and support them through capital investment.

Box 4: An Example of ADB Ventures Portfolio Company

Komunidad

The Philippine-based *Komunidad* is a climate and weather data intelligence company. The company integrates real-time environmental data from various sources, including satellites, sensors, and weather stations. It uses this data to provide localized, affordable analytics, and timely alerts.

Location Name	Heat Index	Status
General Emilio Aguinaldo, Cavite	57	Warning
Tanza, Cavite	57	Warning
Lobo, Batangas	57	Warning
San Ildefonso, Bulacan	57	Warning
Los Banos, Laguna	57	Warning
Pila, Laguna	56	
General Tria, Cavite	56	Warning
Marilao, Bulacan	56	Warning
Silang, Cavite	55	Warning
Makati City, Metropolitan Manila	55	Warning
Bocaue, Bulacan	55	Warning
Malvar, Batangas	55	Warning
Waterbody, Laguna	55	Warning
Dasmarinas, Cavite	55	Warning
Batangas City, Batangas	55	Warning
Pakil, Laguna	54	Warning
Cavinti, Laguna	54	Warning
Imus, Cavite	54	Warning
Quezon City, Metropolitan Manila	54	Warning
Liliw, Laguna	54	Warning
Lipa City, Batangas	54	Warning
Muntinlupa, Metropolitan Manila	53	Watch

Among a range of data platforms that Komunidad provides, one is an alert platform, which enables customers to pick parameters and activate hyperlocal alerting via email, SMS, and popular messaging apps, such as Viber, WhatsApp, and more. Here is an example of a city interface where recipients from every sub-location gets an alert based on custom-defined parameter thresholds.

Source: Komunidad . https://komunidad.co/platform/.

Komunidad has built solutions for four types of customers. It offers a multi-hazard tool for municipalities, including a civilian app for citizen safety, disaster visibility, and mosquito surveillance. It also offers a continuity planning tool for business; and a tool that helps the agriculture sector plan seeding, irrigation, and harvesting. Lastly, it has built a specialized dashboard to help electric utilities forecast grid demand, which not only builds utilities' resilience but also mitigates some of their climate impact.

Komunidad has achieved promising commercial traction. Since its inception in 2019, it has partnered with two municipalities, three energy utilities, and 11 commercial customers in the Philippines. *Komunidad* is now expanding across the Asia and Pacific region. It has completed two agricultural pilots in Viet Nam and has entered a joint venture to serve customers in Sri Lanka.

ADB Ventures provided *Komunida*d seed financing to support its regional expansion. The company aspires to help communities across Asia and the Pacific build their resilience to climate-related weather events, and to help the agriculture sector mitigate its climate impact through more efficient use of water and fertilizer.

Source: ADB Ventures. https://ventures.adb.org/komunidad/.

Recognizing that public finance alone is insufficient to meet the needs for adaptation, DFIs could help accelerate private sector engagement in adaptation (Prasad et al. 2022). To address some of the internal challenges, DFIs may take steps similar to those adopted by ADB, as discussed.

V. A FRAMEWORK FOR ACTION

This section outlines an action framework that would help guide DFIs in accelerating private sector engagement in adaptation in developing countries that they support. This framework is based on two overarching principles: "eye on climate resilience results" and "integrated institutional approach."

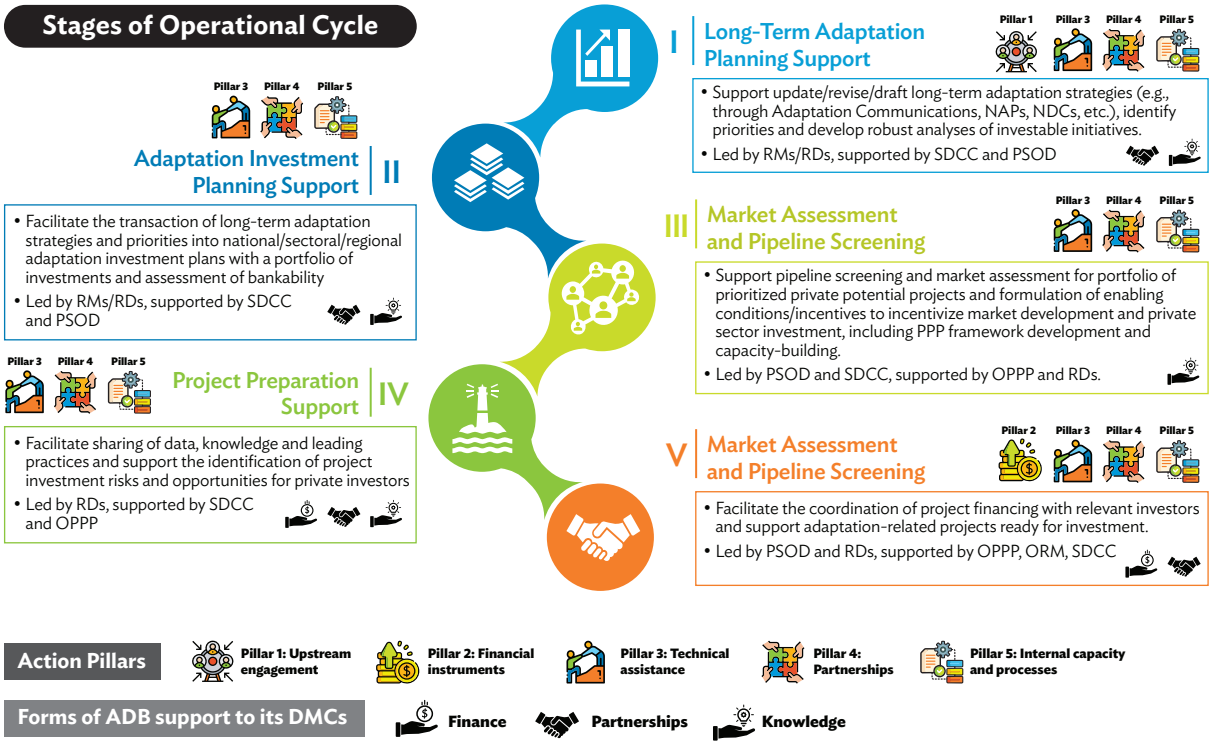
Enhancing the climate resilience of people and economies in developing countries should be the ultimate goal. These principles call for all three modes of private sector engagement in adaptation to be scaled up so that (i) businesses (*as adaptors*) are well adapted to provide all weather services; (ii) abundant and affordable resilience technologies, products, and services (*as solution providers*) are available to help protect people, livelihoods, and businesses; and (iii) private sector finance (*as financiers*) is leveraged to support adaptation projects.

To meaningfully scale up private sector engagement, all functions within a DFI need to work together. Actions are required from all relevant DFI teams to address the key challenges, consider the needs of different private sector entities, and support all stages of the operational cycle. A five-pillar action framework is suggested, as follows:

- Pillar 1: Strengthen upstream engagement through policy dialogue and country programming processes.
- Pillar 2: Accelerate the development and piloting of new financing products and tools.
- Pillar 3: Strategically deploy technical assistance.
- Pillar 4: Leverage partnerships.
- Pillar 5: Further enhance internal policy and operational processes.

These action pillars are mapped into the operational cycle (Figure 8) and are discussed in more detail below. As shown in Figure 3, actions under different pillars can also be linked to specific modes of private sector engagement through all forms of DFI support—as indicated in Figure 8—using the ADB operational cycle as an example.

Figure 8. Action Pillars Mapped into the Stages of a Typical Adaptation Operational Cycle within DFIs: ADB As An example



ADB = Asian Development Bank, DFIs = development finance institutions, DMCs = developing member countries, NAPs = national adaptation plans, NDCs = nationally determined contributions, OPPP = Office of Public-Private Partnership, ORM = Office of Risk Management, PPP = public-private partnership, PSOD = Private Sector Operations Department, RMs = resident missions, RD = regional department, SDCC = Sustainable Development and Climate Change Department.

Source: Author, based on Tall et al. (2021).

Pillar 1—Strengthen upstream engagement and support to create policy and investment conditions.

The absence of a well-designed and fully costed adaptation investment plan for most developing countries has been recognized as a major barrier to progress in adaptation, in general, and to private sector adaptation, in particular, which is compounded by the lack of financial support. Between a country's planning for its pledged nationally determined contributions (NDCs) and the private sector's interest lies a key bottleneck—a coherent investment plan with a pipeline of bankable projects (UNEP 2021). Therefore, it is vital that, DFIs, through their policy dialogue and country programming processes, support developing countries in articulating their adaptation needs and investment priorities through the formulation of NDCs or national adaptation plans (NAPs). A common vision for building national and sectoral climate resilience will not only help translate policies into investible programs, but it will also facilitate the coordination and collaboration among domestic and international financiers from both the public and private sectors. With a common vision, investments are more likely to achieve transformational climate resilience. In other words, upstream engagement with countries is essential to achieve a scalable and effective private sector adaptation and DFIs are well positioned to do so. This can be followed up, but not replaced, by deal level engagement.

Once the investment plan is in place, governments need support by creating the enabling conditions for the adoption of resilience solutions provided by the private sector. These conditions may include (i) mandating local banks to provide insurance-linked loan to farmers to take up water efficient irrigation technology, or (ii) to attract private sector investment in climate resilience projects through fiscal decentralization (i. e., to allow utilities to create a funding stream through charging industrial and residential water use. To create the demand for adaptation, it is also important to develop or update design standards, building codes, or planning rules that are climate risk informed. Another important enabling condition to include is transparency for public procurement—to assure enterprises with appropriate solutions to participate in public works contracts.

An adaptation investment plan should also consider the private sector's development to increase its engagement in adaptation. As shown in Table 3, private sector entities have a variety of needs if they were to engage in adaptation.

Table 3: Needs of Private Sector Entities for Engaging in Adaptation

	Direct Operations	Value Chain Cooperation	Development of Climate Resilience Solutions
Small and Medium-sized Enterprises (SME)	• Risk information and capacity building for risk management • Technology transfer (e.g., intermediate crop technologies or mobile data) • Access to affordable credit and risk transfer products • Regulatory frameworks for microfinance and/or insurance	• Awareness building of vulnerable communities and customers • Collaboration platforms • Methods and tools for risk management	• Market information • Business plan support • Investment support and advice • Costs and time required to gain government standards testing certificates for new technologies and products • Access to markets
National companies	• Peer collaboration • Sector development support • Technology transfer (e.g., early warning systems and infrastructure solutions) • Risk information and vulnerability data	• Risk information • Capacity building for risk management • Financial de-risking for lenders • Methods and tools for risk management • Collaboration platforms at sector and government levels • Information sharing and management systems	• Innovation incentives • Legal and intellectual property support for innovation and product development • Investment support and readiness
Multinational corporations	• Risk information • Methods and tools for risk management	• Risk information • Knowledge and collaboration platforms to support good practice and sector knowledge	• Improved market entry conditions • Innovation incentives • Financial de-risking
Private investors	• Detailed risk information	• Awareness and knowledge • Detailed risk information • Business case-related information • Risk assessment methods and tools	• Detailed risk information • De-risking support to lending and investment • Policy structures, consistency, and incentives

Note:
• entries related to information, knowledge, and cooperation
• entries enabling policy and regulation-related
• entries associated with finance

Source: Adapted from PwC (2013).

Pillar 2—Accelerate the development and piloting of new financing products and tools.

Sovereign and nonsovereign **adaptation operations have so far focused on project loans.** However, they may not be suitable or most conducive to engaging the private sector in adaptation. To mitigate the investment risks common in adaptation projects and in many developing countries, more risk-tolerant financing products, instruments, and tools are needed. These include the following:

1) **Guarantee**—to de-risk an investment improves its credit profile; it was noted that guarantees are a valuable but underrepresented part of the tool kit for supporting private sector climate investment, including in adaptation (ATKINS COWI 2021).

2) **Policy-based lending**—to help create important policy conditions for private sector engagement in adaptation.

3) **Results-based incentives**—to provide incentives (and disincentives) to achieve desired outcomes. This may include impact bonds and performance-based contracts that investors can walk away from if outcomes are not reached.

4) **Climate resilience bonds**—to catalyze private capital for investment in resilience projects. DFIs could contribute to the development of taxonomy and/or labelling, policy incentives and guiding frameworks, and disclosure standards and systems (Asseline and Hiller 2021).

5) **Public–private partnerships**—to provide an effective entry point for private sector participation in climate resilience operations. This is particularly helpful in developing bankable projects, including public and private off-take agreements, subsidies, and tax credits (Box 2).

6) **Junior or subordinated capital**—to help bridge a project financing gap where cash flow during the initial revenue ramp-up period is too uncertain for senior lenders or when acceptable collateral is limited.

7) **Contractual mechanism**—to support the development of bankable projects, including public and private off-take agreements.

8) **Parametric insurance**—to facilitate the de-risking of climate resilience investments and the engagement of the insurance industry in providing climate risk management. According to Munich Re, of the total $50 billion natural catastrophe loss in 2021 in Asia and the Pacific region, only $9 billion were insured—which translates into an 83% protection gap (Gallin 2022).

9) **Finance instruments for NbS**—to scale up one of the most important adaptation approaches in order to unlock the social, economic, and environmental dividends afforded by NbS (Box 5).

Given the highly context-specific and generally small-sized nature of adaptation projects, investments in adaptation projects are challenged by high transaction costs and risks (Shakya and Byrnes 2017). This could lead private investors to seek larger-sized investments (typically over $10 million)—but stand-alone adaptation projects of such size are limited in developing countries. Therefore, it is helpful to adopt a portfolio approach and provide a pooling or aggregating platform to bring smaller adaptation projects together and make them more in line with the investors' comfort zone. Aggregated projects can be managed under different arrangements, using, for example, a facility or a pooled fund, managed by a

private equity firm (e.g., the Lightsmith Group,[16] the Climate Investor One,[17] and others). Alternatively, funds could be channeled through local financial institutions, which onlend to clients. Working through local facilities or financial institutions with local knowledge and physical presence also helps overcome the major challenge for international investors of closely monitoring and supporting the investee SMEs.

Box 5: Catalyzing Private Sector Investment in Nature-Based Solutions to Adaptation

The important role of nature-based solutions (NbS) in building climate resilience has been widely recognized, including by the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (IPCC 2022), and yet financing for NbS remains a major challenge.

It was estimated that to meet the global climate change, biodiversity, and land degradation targets, $4.1 trillion is needed to close the financing gap in nature by 2050. The current investments in NbS amount to $133 billion—most of which come from public sources (UNEP 2021b). Efforts have been made to develop a compelling business case for private sector investment in NbS projects. For example, the Natural Capital Finance Facility (NCFF) (2021) developed cash flow patterns over time for different types of conservation and NbS projects, demonstrating the financial value of investing in nature and an analytical framework to quantify it.

To unlock the value of NbS, one needs to consider the specific context, including the level of social and economic development. In lower-income areas, government funding will continue to be critical in supporting NbS. However, in higher-income locations where there are stronger revenue streams, a range of policy instruments can be leveraged to encourage investments in nature-based interventions, such as the establishment of special project vehicles that can issue dedicated bonds to institutional investors. There are also opportunities to better leverage increased property values associated with an improved environment, such as linking floor ratio requirements to investment commitments in NbS.

Other approaches that may be used to catalyze private sector investment in NbS include (i) payment for ecosystem services (e.g., programs to protect and enhance forestry, biodiversity, to reduce water or soil pollution); (ii) biodiversity offsets and/or compensation beyond legal requirements (e.g., compensation pools for on-site and off-site projects); and (iii) pro-biodiversity and adaptation businesses (e.g., sustainable forestry, agriculture, aquaculture, and ecotourism).

Source: Natural Capital Finance Facility. 2021. Investing in Nature: Financing Conservation and Nature-based Solutions. European Investment Bank. https://www.eib.org/attachments/pj/ncff-invest-nature-report-en.pdf

[16] The Lightsmith Group. https://lightsmithgp.com.
[17] Climate Investor One. https://www.climatefinancelab.org/project/fmo-climate-development-finance-facility/.

Figure 9: Illustrative Cash Flow Patterns Over Time for Different Types of Conservation and Nature-Based Solutions Projects

Project Example	Typical Cash Flow Patterns Over Time	Core Financing Need	Example Funding	Desired Outcomes
Sustainable Forestry		Initial capital investment and ongoing operations (e.g., land acquisition maintenance of trees)	**Equity fund** (see the example of the SLM fund, backed by NCFF funding	• Revenue from timber sales (for a newly planted facility, this will be a long cash cycle) • Potential additional revenues (e.g., from sale of verified carbon units (VCUs) or Payment for Ecosystem Services
Sustainable Agriculture		Capital investment to adjust traditional practices (e.g., additional equipment	**Indirect debt** (for example, loan through a local bank)	• Premium prices for environmentally-supportive practices, and/or potential increased yield drive increased revenue • Cost savings from reduced use of artificial inputs (fuel, fertilizers, persticides)
Sustainable Aquaculture		Initial capital investment to establish new farm (infrastructure, equipment, purchase of stocks, etc.	**Equity fund** (with a mandate to invest in marine conservation)	• Revenues from sales of acquaculture products, increasing over time • Enterprise becomes profit-making, allowing for potential "exit" through sale of the enterprise, or shares, to new investor
Ecotourism		Initial capital investement for creation of new lodge (infrastructure, equipment, land leases, etc.)	**Indirect debt** (loan from local financial institution e.g., HBOR, Croatia)	• Revenues from paying tourists increasing over time • Revenues exceed operational costs (staff salaries, supplies, etc.); debt repaid from profits
Carbon Sequestration Payments		Initial capital investment to establish new enterprise and start operations (acquire project land, baseline surveys, etc.	**Equity fund** (e.g., with a mandate to invest in Payments for Ecosystem Services projects)	• Revenue from sale of Verified Carbon Units (VCUs) to voluntary corporate buyers or sale of biodiversity offset payments exceeding operational costs
Green infrastructure		Initial capital for purchase and installation of infrastructure	**Direct debt** on concessional terms (to cover portion of infrastructural investment	• Cost savings from reduced operational costs increase over time to optimum

Source: Natural Capital Finance Facility (2021).

Pillar 3—Strategically deploy technical assistance

Meeting the challenges in knowledge, information, technical and institutional capacity, and other enabling conditions will require interventions from the public sector, and often, through TA support. Therefore, it is essential that limited TA resources are strategically deployed to fill critical knowledge gaps and create the enabling environment.

Some strategic areas that TA support could target include the following:

1) **Policy development support**—to establish private sector development strategies, plans, and policy measures, such as reforms to ease the path for private sector engagement in adaptation.

2) **National and sectoral diagnostics**—to identify vulnerability hot spots, adaptation priorities, investment needs, and opportunities; to facilitate the identification and development of bankable projects (Box 6), including a mapping of adaptation investment needs and associated suitable finance products or mechanisms against the financiers' landscape.

3) **Practical guidance notes**—to recommend practical ways to enable the three modes of private sector engagement in adaptation through sovereign and nonsovereign operations, and in conjunction with the Paris Alignment assessment.

4) **Support for nonsovereign project pipeline development**—to translate the sector investment needs and opportunities into project pipelines, with a focus on investment readiness and scale.

5) **Knowledge management**—to support the provision of (i) climate risk information required for project preparations, (ii) regional knowledge sharing and learning, (iii) capacity building, and (iv) awareness-raising—where target audiences include DFI staff, government officials and staff, nongovernment organization representatives, and private sector stakeholders within the countries that they support.

Box 6: Strategic Deployment of Technical Assistance Resources

Technical assistance deployed strategically could lead to financing opportunities.

For example, a national-level transport sector climate vulnerability and resilience assessment that is supported by technical assistance could help assess the climate risks in existing and planned transport network infrastructure. It could also identify the scale of investment required to ensure the structural integrity, service delivery, and financial performance. If the assessment is presented and communicated in a decision-relevant fashion to the key decision makers, it may persuade rail or port operators to decide to take action and invest or build assets that feature and/or incorporate climate resilience. This has been observed in Poland—where a study looking at the damage and subsequent repair and maintenance costs following extreme weather events led to a major rehabilitation program of the national road network to build climate resilience.

Source: European Investment Bank (2021).

Pillar 4—Leverage partnerships

Given the enormity of the task at hand, much efficiency and development impact could be gained from leveraging expertise, knowledge, and finance from DFIs' partners.

Strategic knowledge partners, such as the Global Center on Adaptation (GCA), World Resource Institute, and the Coalition for Climate Resilience Investment (CCRI) are at the cutting-edge of applied research and could offer valuable expertise and knowledge to strengthen a DFI's tool kit. The GCA has been leading the international efforts in developing decision-relevant adaptation science, with its latest flagship initiative producing the world's first climate resilience infrastructure officer handbook (GCA 2021). If work is coordinated under the CCRI, climate risks in infrastructure project valuations become correctly priced, hence, creating a climate-resilient asset class over time (CCRI 2021). These and other knowledge initiatives can help fill in some of the formidable knowledge gaps and to some degree, address other financial incentive-related challenges.

Similarly, finance partnerships with other DFIs and other financiers, such as the Green Climate Fund (GCF), are critical to demonstrating the business case for innovative but nascent solutions, and for upscaling the participation of the private sector. Partners such as the International Finance Corporation (IFC), which has deeper relations with the private sector, are particularly valuable as ADB expands its private sector operations in the years to come.

Pillar 5—Further enhance internal policy and operational processes

Although specific to ADB, but could be applicable to other DFIs as well, the limited nonsovereign adaptation operations within ADB have arisen on an opportunistic rather than a targeted basis (ADB 2021a). In addition to the ongoing changes in its internal processes (see discussion on p. 25), ADB may need to take further actions in the following:

1) **Ease the process of working with private sector entities**, by keeping the risk assessment framework and due diligence focus proportionate so that relatively small and less-established enterprises could access DFI financing.

2) **Make the upstream policy engagement with countries more inclusive—e.g., through country strategic processes and country investment programming processes**—to include operational staff from nonsovereign operations so that potential private sector opportunities could be earlier identified.

3) **Target private sector organizations for capacity-building and training activities**, through both sovereign and nonsovereign operations, and undertake close coordination and collaboration across the institution.

4) **Enhance the technical capacity and the number of in-house staff, and deploy them effectively** by forming a cross-institution community of practice, periodic technical training or knowledge-sharing sessions, and placing adaptation specialists within operations teams.[18]

Table 4 provides a summary of the actions that ADB could take to address specific challenges limiting private sector investment in climate adaptation. Other DFIs could similarly map out these actions based on their own organizational structure.

[18] See Appendixes 1–2 for materials that operational staff may find useful, and Appendix 3 for an outline of a general training session.

Table 4: Summary of Potential ADB Actions to Address the Key Barriers and to Scale Up Private Sector Engagement in Adaptation in Asia and the Pacific

Key Areas	Actions	Roles of Different ADB Departments				
		Sovereign Operations (RDs and RMs)	Nonsovereign Operations (PSOD)	SDCC	OPPP	Other Policy and Management Functions (e.g., SPD, ORM, PPFD, BPMSD, Treasury)
Improving the availability, accessibility and use of information and knowledge on climate risks and resilience investment opportunities, in support of efforts to raise awareness of relevant stakeholders in public and private sectors, and supporting climate-resilient investment decisions and development of resilience solutions (see below)	To develop a "business-friendly" information pack on risks and opportunities associated with climate change in key economic sectors.	✓	✓✓	✓✓✓	✓✓	
	To disseminate the information pack developed (as described above) to public and private sector partners in DMCs.	✓✓ (RMs)	✓✓✓	✓	✓✓	
	To develop sector-specific technical guidance on climate risk assessment, appraisal, and economics analysis of adaptation options.	✓	✓✓✓	✓✓✓	✓✓	✓ (ORM)
	To develop sector and/or industry-specific market analyses.	✓	✓✓✓	✓✓	✓	
Driving the demand for climate resilience co-benefits, as a basis for mainstreaming adaptation and creating markets for climate resilience	To help raise awareness on the risks and opportunities associated with the impacts of climate change among all stakeholders.	✓✓✓	✓✓	✓✓✓	✓✓	✓✓

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Table 4 continued

Key Areas	Actions	Roles of Different ADB Departments				
		Sovereign Operations (RDs and RMs)	Nonsovereign Operations (PSOD)	SDCC	OPPP	Other Policy and Management Functions (e.g., SPD, ORM, PPFD, BPMSD, Treasury)
Driving the demand from the private sector for (ADB) finance to support adaptation, accelerating public sector engagement as "adaptor" and "solution provider"	To help governments develop and/or update the standards for all-weather services (e.g., for utilities).	✓✓✓	✓	✓✓	✓	
	To drive the demand for climate resilience solutions (technologies, products, and services) by raising awareness, improving industrial and business standards, and identifying the growth-stage enterprises offering solutions, among others.	✓✓✓	✓	✓✓	✓✓	
	To develop and deploy financing instruments and modalities (e.g., results-based finance, and PPPs), that better target private sector clients to support their resilience practices.	✓✓✓	✓✓	✓	✓✓✓	✓✓
Crowding in private sector investment in adaptation, to enhance the role of the public sector as financier	To help improve the return on investment through domestic policies that allow public sector entities to charge for services as a result of investing in climate resilience, among others.	✓✓✓	✓	✓✓	✓✓	✓✓
	To improve the risk profile (de-risk investment) in climate resilience projects through guarantees, insurance, and other financial instruments and arrangements, among others.	✓✓	✓✓✓	✓✓	✓✓✓	✓✓

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Table 4 continued

Key Areas	Actions	Roles of Different ADB Departments				
		Sovereign Operations (RDs and RMs)	Nonsovereign Operations (PSOD)	SDCC	OPPP	Other Policy and Management Functions (e.g., SPD, ORM, PPFD, BPMSD, Treasury)
Strengthening in-house technical capacity and tool kit to support the full cycle of deal management, in order to leverage opportunities and deliver on ADB's corporate commitment	To recruit staff for PSOD (and OPPP) with relevant technical skills and experience.		✓✓✓	✓✓	✓✓✓	✓ (BPMSD)
	To establish an ADB-wide Community of Practice for private sector operations focusing on adaptation and climate resilience.	✓	✓✓✓	✓✓	✓✓	
	To develop a standard Terms of Reference for adaptation and climate resilience-related analyses (including climate risk and adaptation assessment, adaptation finance tracking, and the Paris Alignment).	✓✓	✓✓	✓✓✓	✓✓	✓ (SPD, ORM, PPFD)
	To provide periodic seminars and/or training sessions that provide policy update (e.g., Paris Alignment), and facilitate the sharing of good practices and learning.	✓	✓✓✓	✓✓✓	✓✓	✓ (SPD, ORM, PPFD)

BPMSD = Budget, Personnel, and Management Systems Department; DMCs = developing member countries; OPPP = Office of Public–Private Partnership; ORM = Office of Risk Management; PPFD = Procurement, Portfolio, and Financial Management Department; PPPs = public-private partnerships; PSOD = Private Sector Operations Department; RMs = resident missions; SDCC = Sustainable Development and Climate Change Department; SPD = Strategy, Policy, and Partnerships Department.

✓✓✓ = Departments taking the lead, ✓✓ = Departments providing substantive inputs, ✓ = Departments contributing as appropriate.

VI. CONCLUSIONS

To meet the ambitious targets in climate and private sector finance, and to support developing countries in Asia and the Pacific in meeting their socioeconomic development aspirations, development finance institutions (DFIs) need to accelerate efforts to increase private sector engagement in adaptation. Progress has been limited, so far, by a range of external and internal factors. However, there are emerging opportunities and DFIs, including ADB as the region's climate bank, have vital roles in exploring these opportunities.

Guided by the principles of having an "eye on climate resilience results" and "integrated institutional approach," a framework for action is proposed—to impel an integrated and holistic approach that strengthens private sector engagement in adaptation. Actions in five areas have been identified: (i) strengthen upstream policy and investment planning support, (ii) accelerate the development and piloting of new financing instruments and modalities, (iii) adjusting further the internal policies and business processes, (iv) strategically deploy TA resources, and (v) leverage knowledge and finance partnerships.

DFIs are well placed to support these actions. Examples are (i) through technical assistance, policy and institutional development, risk analytics, and adaptation investment planning; and (ii) support for improving the risk-adjusted return on investment profile by deploying risk-tolerant financing instruments and tools. As small and medium-sized enterprises (SMEs) are the backbone of developing economies, national DFIs in these countries can greatly support SMEs that will engage in adaptation as these have the knowledge of the local markets and can operate in local currencies. Their drawback is they often lack the capacity and much-needed resources and, therefore, they could substantially benefit from the support of multilateral and bilateral DFIs.

APPENDIXES

APPENDIX 1: CLIMATE CHANGE IMPACTS ON KEY BUSINESS SECTORS

Climate change can affect the private sector—both directly and indirectly. Table A1 provides a summary of how a set of common climate hazards could affect infrastructure systems in several key sectors.

Table A1: Impacts of Climate Change on Infrastructure in Key Sectors

Sector	Potential Impacts by Hazard			
	Temperature Changes	Changing Patterns of Precipitation	Sea-Level Rise	Changing Patterns of Storms
Water	• Need for more water treatment • Higher evaporation loss, mainly on reservoirs • Need for higher storage capacity • Salinization of water supply • Increased water demand	• More risk of overtopping river embankments and flooding • Overwhelming drainage systems • Disruptions to the supply due to water scarcity • Salinization of water supply	• Physical damages to assets, such as water and wastewater treatment plant	• Physical damages to assets, such as water and wastewater treatment plants
Transport	• Buckling of railway lines and melting road surfaces	• Shipping transport disruptions due to lower levels in waterways • Damage to roadbed for unpaved roads • Disruptions due to floods or higher water levels in water ways	• Inundation of coastal infrastructure like ports, roads, and railways	• Physical damages to assets like bridges and coastal transport networks • Disruption of port and airport services
Energy	• Power outages or reduced output from power plants • Impact on transmission lines • Lack of cooling water for thermal plants • Excess pressure and demand on networks from overheating	• Physical damages to assets, like wind farms and distribution networks	• Inundation of coastal infrastructure affecting generation, transmission, and distribution	• Disruptions in the supply of energy • Downed power lines and transmission

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Table A1 continued

Sector	Potential Impacts by Hazard			
	Temperature Changes	Changing Patterns of Precipitation	Sea-Level Rise	Changing Patterns of Storms
Information and Communication Technology	• Higher demand for cooling data centers	• Physical damages to aboveground transmission (e.g., radio masts)	• Inundation of coastal infrastructure, like telephone exchanges	• Physical damages to aboveground transmission (e.g., radio masts, telecom towers)
Urban Development	• Higher demand for cooling (e.g., air conditioning)	• Disruptions in the distribution of basic services due to reduced water availability	• Inundation of urban infrastructure (e.g., schools, hospitals)	• Physical damages to homes and commercial assets (e.g., buildings)
Solid Waste	• Increasing incidence of fires in landfills • Heat damage to infrastructure (e.g., collection) • Flooding of treatment facilities	• Increase in waste arising from flooding • Inundation of critical infrastructure (e.g., waste management plants)	• Erosion of coastal landfills	• Disruption to services (e.g., collection)

Source: Adapted from GCA (2021).

APPENDIX 2: POTENTIAL ADAPTATION MEASURES AND OPPORTUNITY AREAS IN CLIMATE RESILIENCE INVESTMENT

To raise the awareness and understanding on potential adaptation activities, this appendix provides illustrative examples of sector- or theme-specific adaptation measures (Table A2.1), cross-sectoral adaptation measures (Table A2.2), and more general and nonstructural (also called "soft") adaptation activities (Table A2.3). Table A2.4 provides illustrative examples of climate resilience investment opportunities within the key sectors.

Table A2.1: Examples of Adaptation Measures within Key Sectors

Sector/Theme	Adaptation Interventions
Coastal and River Protection	• Hard structures (e.g., dams, dikes, or breakwaters) • Dune restoration or creation; Cliff stabilization • Artificial reefs or seaweed; Restoration or protection of coral reefs • Flood prevention; Flood or stormwater management (e.g., using flood barriers) • Controlling or monitoring (e.g., of flood or hurricane); Forecasting (e.g., risk assessment or mapping)
Water Management (water conservation, efficient water supply, and efficient water use)	• Rainwater harvesting • Water desalination • Reverse osmosis • Water resource assessment and planning • Using grey water, using household water from washbasins or showers • Leakage reduction or detection in water storage or distribution • Water filtration • Controlling water pollution, wastewater treatment • Solar-powered water purification • Solar-powered wastewater sewage treatment (e.g., spray evaporation) • River restoration • Saltwater intrusion barriers • Aquifer recharge • Water-saving techniques at user level

Continued on next page

Table A2.1 continued

Sector/Theme	Adaptation Interventions
Infrastructure (construction, operation and maintenance)	• Extreme weather-resilient electric power supply systems (e.g., strengthening power lines or underground power cables) • Structural elements or technologies for improving thermal insulation • Slab-shaped vacuum insulation using natural or recycled building materials (e.g., straw, wool, clay, or used tires) • Glazing (e.g., vacuum glazing) • Roof garden systems • Roof coverings with high solar reflectance • Relating to heating, ventilation, or air conditioning (HVAC) technologies • Solar heating or cooling using waste energy (e.g., from internal combustion engine in transport, such as on roads, waterways, or railways) • Planning or developing urban green infrastructure
Agriculture and Forestry	• Abiotic stress • Plants tolerant to drought, salinity, and heat • Fertilizers of biological origin (e.g., guano or fertilizers made from animal corpses) • Enzymes to improve soil health • Integrated pest management • Improvement of land use, water use or availability, controlling erosion • Greenhouse technology (e.g., cooling systems especially adapted for farming) • Improving animal health and welfare (high quality feeds, vaccines, probiotics) • Ecological corridors or buffer zones • Agroforestry and multitiered agricultural production systems • Aquaculture: flood protection, water circulation and aeration, and feed management • Off-grid food refrigeration
Health	• Air quality improvement or preservation (e.g., vehicle emission control or emission reduction by using catalytic converters) • Atmospheric particulate matter (e.g., carbon smoke microparticles, smog, aerosol particles, dust) • Protecting against water- and vector-borne diseases exacerbated by climate change (e.g., through disease surveillance, public health measures)
Cross-cutting	• Information and communications technologies (e.g., weather forecasting and climate analytics) • Sensor technology for infrastructure management

Note: Y02A is a patent classification within the European Patent Office's (EPO) World Patent Statistical Database (PATSTAT) for technologies that enable adaptation to climate change. For the full classification, see https://worldwide.espacenet.com/classification?locale=en_EP#!/CPC=Y02A.

Source: Adapted from "Technologies for Adaptation to Climate Change," Cooperative Patent Classification Subclass Y02A, EPO.

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Table A2.2: Examples of Cross-Sector Adaptation Measures

	Transport	Energy	Water	Agri-food	Services and Insurance
Built Environment	• Planning • Retrofit network	• Micro-generation • Retrofit buildings	• Water efficiency • Sustainable drainage	• Natural fiber products • Resilient buildings	• Modeling and risk assessment • Eco-design ICT systems
Transport		• Decarbonized power for electric vehicles	• Retrofit drainage • Flood protection	Biofuels risk management	• Insuring products for supply chain • ICT and logistics
Energy			Resilient water supplies for power generation cooling and hydropower	• Climate-resilient "Chill chain" • Energy-efficient heating/cooling • Biomass crops and residues	• Asset management • ICT systems • Grid balancing services (e.g., dynamic demand in industry and/or business)
Water				• Irrigation • Water supply, reuse, recycling	• Modelling and risk assessment • ICT systems insurance
Agri-food					• Resource planning • Remote sensing and logistics

ICT = information and communication technology.
Source: Adapted from GHK (2010).

Technologies that Make Indirect Contribution to Climate Change Adaptation

Table A2.3: Examples of Activities that Enhance Adaptive Capacity

Category	Activities
Policy Development and Long-Term Strategic Planning	• Develop guidelines at the national, state, and sector level (e.g., guidelines for road investments [new and existing] that include climate-smart design considerations). • Integrate climate information into systems planning to assess climate impacts on transport infrastructure. • Upgrade design standards and codes (e.g., using stronger building materials) to be implemented in both new constructions and renovations. • Modify tender selection criteria to allow for climate-resilient project design and/or construction. • Provide flexibility in project management protocols to allow them to be adapted into the changing hazards. • Strengthen disaster planning and response for critical infrastructure and services, such as a flood risk management plan. • Establish and sustain interministerial collaboration, particularly on data sharing. • Promote an integrated, cross-sector approach and community engagement.
Capacity Building, Training, and Outreach	• Raise awareness in all ministries, departments, agencies, local governments, civil society organizations, and the private sector on climate change impacts. • Provide education and training for the general public to effectively respond to emergency events. • Encourage local stakeholder consultations and dialogues to enhance resilience measures.
Emergency Planning	• Develop early warning systems and establish emergency protocols and evacuation procedures to respond to extreme events, such as tropical cyclones. • Integrate disaster risk management criteria into codes, regulations, and zoning laws to increase the resilience of key infrastructure. • Establish or expand a contingency budget reserve or insurance plan to address unexpected disruptions, and fund investments to restore services and facilities.
Data Gathering, Monitoring and Information Systems, Research	• Establish information systems that can collect and monitor information on future climate and disaster risks (including models of hydrology flow, land erosion patterns, tides, and water levels) to understand evolving adaptation needs. • Incorporate geographic information system (GIS), remote sensing, and climate risk assessment technologies to identify disaster risks in project locations and integrate climate considerations into the project design. • Build relevant national and/or regional research programs on the links between climate and key economic sectors and livelihood systems.

Continued on next page

Table A2.3 continued

Category	Activities
Operation and Maintenance and Support	• Account for maintenance activities that ensure preparedness for climate-related risks (frequency and type of maintenance activity). • Prioritize the maintenance of critical infrastructure in terms of climate hazards in transport asset management plans. • Develop budgeting processes that account for additional maintenance costs to address increasing damages from hazards, increase the frequency of asset repair schedules, and implement changes in maintenance protocols. • Develop contingency plans in the event of disruption and install redundant systems that can be relied upon if disruptions occur. • Integrate nature-based solutions. • Partner with local communities to ensure the effective management and maintenance of public sector assets to avoid heavy costs associated with further rehabilitation and reconstruction.
Support to Vulnerable Populations	• Incorporate migration patterns in population projections and composition of vulnerable groups when estimating and assessing the population to be served by critical infrastructure systems. • Provide capacity building that enables women and other vulnerable groups to serve as decision makers and effective agents in community preparedness and emergency response to extreme events. • Improve access to information and communication technologies (ICT) including radio, TV, and mobile devices to increase access to weather forecasts and reduce the impacts of extreme events among the vulnerable populations. • Prioritize and ensure the functioning of critical infrastructure for vulnerable groups who rely on pedestrian infrastructure, such as sidewalks, lighting, and crossings to access social services (e.g., clinics, hospitals, schools), shopping centers, and workplaces. • Incorporate gender-responsive climate programming.

Source: Adapted from Van Steenbergen et al. (2021).

Table A2.4: Examples of Adaptation Business Opportunities in Different Sectors

Sector	Near-Term (<5 years)	Medium-Term (5 years+)
Built Environment	• New commercial and domestic developments are driving innovations in energy, water management, and control technologies. • Increased adaptation awareness by property developers and owners are driving the demand for both innovative retrofit solutions (e.g., insulation, ventilation, flood protection, water saving) and training and support services for building managers.	• Global new build and retrofit markets are likely to grow substantially, requiring technologies and design, engineering, and construction services. • Opportunities for green infrastructure and redesigning and/or reengineering urban areas for climate resilience are to gain importance and prominence. • Eco-towns and/or cities are to provide the potential for demonstration sites.
Water	Opportunities are arising where adaptation and cost-effectiveness measures overlap (e.g., water efficiency, reuse and recycling, flood resilience, including examples such as modeling, risk assessment, and monitoring systems). There are also opportunities in integrated drainage solutions (e.g., with built environment).	• Opportunities are emerging in managing surface water and drainage more effectively, and in upgrading and building new water collection and supply infrastructure, particularly in drought-prone countries. • Greater use of ICT systems is likely to expand for risk management.
Energy	• Opportunities related to factoring adaptation measures into new build of generation capacity, particularly renewables, are expected to increase. • Opportunities in asset management and maintenance are arising from adapting existing infrastructure (e.g., substations, oil and gas storage sites)	Opportunities from integrating smart technology into networks, distributed power systems and energy storage are likely to increase to improve resilience, including those in other developing economies (which may be building assets without instituting adaptation measures).
Transport	Research, planning, risk management, and modeling services are needed for assessing physical climate risks and adaptation needs across existing networks of roads and railway lines, and in other critical transport.	• Opportunities exists in new build and in upgrading network with ICT to aid monitoring and maintenance. • Innovation in durable materials is required to provide long-term climate resilience.
Agri-food chain	• Adaptation in production and processing overlap with investments in resource efficiency with immediate bottom-line benefits, such as water-saving technologies. • Opportunities are arising from the demand for solutions for low-carbon, climate-resilient retail stores.	Resilience measures are expected to deepen throughout the supply chain—development of drought-resistant crops, adoption of more efficient irrigation systems, and systems that provide supply chain transparency vis-à-vis water management will be needed.
Insurance services	• Demand for new products and services (e.g., weather-related derivatives, risk transfer mechanisms) is expected to grow. • The need to provide more information to consumers will arise, particularly on links between premiums and risks, and information on incentives for taking preemptive, adaptive actions.	• Provision of greater incentives for adaptive investments will be required. • Developing forward-looking models and collaborating with partners for developing best practices and innovative products are likely to be needed.

Source: Adapted from GHK (2010).

APPENDIX 3. OUTLINE OF AN INTERNAL ENGAGEMENT MODULE

During discussions with the Asian Development Bank (ADB) teams as part of this study, the need to build the capacity and raise awareness on key conceptual and technical issues among operations teams within ADB, and among public and private sector partners in the developing member countries (DMCs), was highlighted. The ADB teams suggested that a series of engagement modules be developed and delivered to strengthen internal capacity within ADB's Private Sector Operations Department (deal teams), Office of Public–Private Partnership, the regional departments (including public finance divisions), and resident missions.

The following is a proposed outline for an introductory module, which could also be applicable to other development finance institutions (DFIs) that are aiming to enhance their internal institutional capacity on private sector engagement for climate change adaptation. This could be followed by a series of sector-specific modules to dive deep into the opportunities for engaging private sector in adaptation and climate resilience investments and associated financing modalities. The application of the climate risk and vulnerability, the adaptation planning tool kit, and the cost–benefit analysis guidance note could be integrated into the sector modules.[19]

Objective. To raise awareness on the key concepts of private sector engagement in climate change adaptation within relevant DFI operations teams.

Target audience. Operations teams within a DFI's private sector and nonsovereign operations departments, sovereign operations departments, country offices, and sector and thematic groups that lead, support, or contribute to nonsovereign or public–private partnership (PPP) operations.

Duration. 2 hours with 40 minutes presentation of the key concepts that are relevant to operations. The rest of the session is reserved for question-and-answer (Q&A) (e.g., myth busting and misconceptions).

Format. Presentation + open dialogue—to ensure basic level of understanding of the key concepts and operational implications.

Session Outline

A. The Fundamentals

a. Adaptation and climate resilience: Concepts and misconceptions
b. Adaptation and mitigation: Differences and synergies
c. Adaptation in action: Implications for project cycle management

B. Adaptation and the Private Sector

a. Climate change and the private sector
b. Impacts of climate change in Asia and the Pacific, and implications for the private sector
c. Current status of private sector engagement in adaptation in Asia and the Pacific
d. Key challenges for private sector engagement

[19] The guidance note will be developed under the Office of Public–Private Partnership's knowledge support technical assistance "Upscaling Private Sector Investment in Climate Adaptation in Asia and the Pacific."

C. Opportunities to Strengthen Private Sector Engagement in Adaptation

a. The plethora of post-Paris Agreement policy and regulatory developments on climate-related financial risk disclosures and sustainable finance are helping increase awareness and create demand for action.
b. Environmental, social, and governance (ESG) funds are rapidly expanding.
c. The public sector alone is unable to meet the challenge of adaptation and private sector engagement becomes essential in delivering climate-resilient socioeconomic development.
d. The expanding financial tool kit and innovation in digital technology is offering exciting opportunities.

D. Steps Toward Greater Private Sector Engagement in Developing Countries

a. Internal policies—better reflect physical climate risks in overall risk appraisal and resilience benefit in evaluation, greater risk appetite; procedures—include team(s) from nonsovereign operations in upstream engagement with DMCs; and capacity— strengthen technical capacity and training and more effectively deploy staff.
b. In sovereign operations—leverage public sector support to create enabling environment, including the use of policy reforms; private sector development; and provision of services with a public goods nature, among others.
c. Nonsovereign operations—adapt "traditional" operations, explore new clients, develop innovative products and business models that are conducive to investing in new areas such as nature conservation and climate risk transfer mechanisms, and carry out market research.

APPENDIX 4: ADDITIONAL RESOURCES

The following is a list of additional resources to support private sector engagement in adaptation and climate resilience. These are grouped into the following themes: (i) **general** resources on adaptation and private sector engagement in adaptation, (ii) climate-resilient **infrastructure**, (iii) **financial products and tools**, and (iv) **nature-based solutions** for building climate resilience.

A. General

A1: Principles for Integrating Adaptation into Development Projects

- Watkiss, Paul; Robert Wilby; and Charles Andrew Rodgers. 2020. Principles of Climate Risk Management for Climate Proofing Projects.
- Hallegatte, Stephane; Jun Rentschler; and Julie Rozenberg. 2020. Adaptation Principles: A Guide for Designing Strategies for Climate Change Adaptation and Resilience.

A2: Private Sector Engagement in Adaptation

- **A Blueprint for Action**

  Tall, Arame; Sarah Lynagh; Candela Blanco Vecchi; Pepukaye Bardouille; Felipe Montoya Pino; Elham Shabahat; Vladimir Stenek; Fiona Stewart; Samantha Power; Cindy Paladines; Philippe Neves; and Lori Kerr. 2021. Enabling Private Investment in Climate Adaptation and Resilience: Current Status, Barriers to Investment and Blueprint for Action.

- **Principles, Guides, and Taxonomies**
  - Climate Bonds Initiative. 2019. Climate Resilience Principles: A Framework for Assessing Climate Resilience Investments.
  - Trabacchi, Chiara; Jay Koh; Serena Shi; and Tara Guelig. 2020. Adaptation Solutions Taxonomy.
  - Global Center on Adaptation. 2021. Green Bonds for Climate Resilience: A Guide for Issuers.
  - EU Sustainable Finance Taxonomy: Technical Screening Criteria for Adaptation Objectives (see Part B of the Technical Annex to the Taxonomy).
- **Adaptation Solutions**
  - Asian Development Bank. 2014. Technologies To Support Climate Change Adaptation in Developing Asia.
  - UN Climate Technology Center and Network (CTCN). Adaptation Technologies by Sector.
  - Adaptation SME Accelerator Project (ASAP). Adaptation SME Directory.

B. Infrastructure

B1: Guidance

- The Resilience Shift. Climate Resilient Infrastructure Guidance.
- European Commission. 2021. Technical Guidance on How to Climate-Proof Infrastructure Projects for the Period 2021–2027.

B2: Financing Tools

- The Lab. Climate Insurance-Linked Resilient Infrastructure Financing.
- SwissRe Institute. 2020. Closing the Infrastructure Gap: Mobilising Institutional Investment into Sustainable, Quality Infrastructure in Emerging Markets and Developing Economies.

C. Financial Products and Tools

C1: Green and/or Climate Resilience Bonds

- Climate Bonds Initiative. 2019. Climate Resilience Principles.
- Global Center on Adaptation (GCA). 2021. Green Bonds for Climate Resilience: A Guide for Issuers.

C2: Insurance

- Mckinsey & Company. 2021. How Insurance Can Help Combat Climate Change?
- Institute and Faculty for Actuaries. 2019. Practical Guide to Climate Change for General Insurance Practitioners.
- Munich Re. Parametric Solutions.
- MarshMcLennan. Parametric Insurance: A Tool to Increase Climate Resilience.

C3. Public–Private Partnerships (PPPs)

- Global Center on Adaptation (GCA). Knowledge Module on PPPs for Climate- Resilient Infrastructure: Handbook: Self-Paced Online Course.
- World Bank. 2022. Climate Toolkits for Infrastructure PPPs.

D. Nature-based Solutions (NbS)

D1: Standards

- International Union for Conservation of Nature (IUCN). 2020. IUCN Global Standards for NbS.
- IUCN. 2020. Guidance for Using the Global Standards for NbS.
- Financing Conservation and Nature-based Solutions.

D2: Guidance for Investors

- European Investment Bank (EIB). 2020. Investing in Nature: Financing Conservation and Nature-based Solutions.
- EIB. 2020. Invest in Nature: A Step-by-Step Guide (e-learning module)

D3: Case Studies

- World Bank. 2021. A Catalogue of Nature-based Solutions for Urban Resilience.
- Nature4Climate. Nature-based Solutions Case Studies.
- Oxford University. Nature-based Solutions Initiative. Nature-based Solutions Case Studies. (This online database is categorized by themes, such as economic recovery, coast, agriculture, montane, lowland, and urban infrastructure.)

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Accelerating Private Sector Engagement in Adaptation in Asia and the Pacific

This working paper outlines how to scale up the private sector's involvement in climate adaptation and harness its financial clout, technical know-how, and ingenuity to help build climate-resilient economies in the Asia and Pacific region. It looks at the role the private sector currently plays and at the technical, financial, and institutional hurdles it faces. The publication highlights the key resources, instruments, and emerging opportunities, including key levers that could be applied through upstream policy engagement and analytical efforts, as well as downstream practices related to investment structuring and finance instrument deployment. Multilateral development banks such as the Asian Development Bank, can accelerate and guide private sector involvement to help support climate-resilient development in the region.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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