SCALING FINANCE AND INVESTMENT FOR CLIMATE ADAPTATION

Input paper for the G20 Sustainable Finance Working Group

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Global average temperatures temporarily breached the threshold of 1.5°C above pre-industrial levels in 2024, and economic losses from extreme weather-related events are increasing faster than GDP, with profound environmental, social and economic consequences. Around 1.2 billion people are at high risk from climate-related trend changes and extreme events, such as heatwaves, floods and drought (World Bank, 2024[1]). These risks will disproportionately affect vulnerable communities, with up to 132 million people at risk of falling into extreme poverty because of evolving weather patterns by 2030 (Jafino et al., 2020[2]).

Accelerating public and private investment in adaptation is a critical element of the broader efforts needed to increase resilience. There is a compelling economic case for doing so, with average benefit cost ratios more than ten dollars for every dollar invested for measures across a range of sectors (Brandon et al., 2025[3]). However, the benefits of climate resilience are not translating into finance flows at the required scale and have lagged investment flows for climate mitigation. In 2022, OECD analysis found that USD 32.4 billion of climate finance was provided and mobilised for adaptation in developing countries (OECD, 2024[4]). Looking more broadly, USD 76 billion of climate finance for adaptation was identified in 2022 compared to USD 1.3 trillion for mitigation (CPI, 2024[5]).

Addressing the adaptation investment gap will require increased efforts to mobilise and align finance flows from all sources to support climate-resilient development. The New Collective Quantified Goal on Climate Finance, agreed at COP29, reflects the need to "dramatically" scale-up adaptation finance and stresses the need for a balance between adaptation and mitigation in climate finance. It "[c]alls on all actors to work together to enable the scaling up of financing to developing country Parties for climate action from all public and private sources to at least USD 1.3 trillion per year by 2035", and sets a goal with developed country parties taking the lead of mobilising at least USD 300 billion per year by 2035 for climate action in developing country Parties.

Finance flows for adaptation are hindered by the following, interconnected barriers and constraints. A key underlying challenge is that the costs of investment are immediate, while the benefits can accrue beyond the time horizons considered by the public or private sectors. This challenge interacts with the other barriers outlined below, which are particularly challenging for developing countries:

- macroeconomic challenges, including limited fiscal space, high cost of capital and existing debt levels
- lack of suitable data and capacity to assess, understand and manage physical climate risks
- lack of access to, and availability of, suitable risk management tools that encourage investment in climate risk reduction, such as insurance and reinsurance
- insufficient co-ordination and gaps in institutional frameworks at the domestic level that hinder public and private finance flows
- challenges faced by developing countries in accessing international concessional finance, including institutional barriers and lack of co-ordination

- many adaptation investments do not generate direct cash flows.

A strategic, collective response will be required to address these challenges, with involvement from the public and private sectors. For example, approaches such as blended finance can unlock investment when combined with a supportive enabling environment. This report examines the actions that can be taken across all countries, with a particular focus on the diverse needs of emerging and developing economies (EMDEs), to strengthen investment in adaptation. It identifies the following options and opportunities based on existing examples of good practice.

Table 1. Summary of options and good practices for scaling up finance and investment in adaptation

Theme	Action area	Options and good practices
Capacity and data	Strengthening access to high-quality climate data and tools	• Increase funding to support the development of weather observation systems • Invest in "last mile" solutions to expand access to climate data, such as online platforms • Encourage open data on climate risks
	Improving transparency about climate resilience	• Strengthen interoperability of climate-related taxonomies • Integrate climate adaptation into transition plans and other forms of disclosure • Encourage ratings and labels to identify climate resilient investments
Domestic policies	Strengthening the domestic enabling environment	• Undertake adaptation investment planning to identify priority needs in line with national adaptation objectives • Assess alignment of domestic policies with climate resilience objectives
	Scaling up domestic resource mobilisation	• Integrate adaptation into government processes (e.g. budgeting, procurement and project appraisal) • Ensure clear allocation of climate-related risks within Public Private Partnerships (PPPs) • Explore targeted support mechanisms for private investment (e.g. tax incentives)
	Enhancing the contribution of insurance markets to encouraging adaptation	• Explore initiatives to expand access to insurance and reinsurance (e.g. InsuResilience Partnership) • Ensure that insurance encourages investment in risk reduction and efforts to "build back better" following a loss
International support to mobilise investment	Improving the quantity and accessibility of international concessional finance for adaptation	• Set internal targets for international providers of adaptation finance, where appropriate • Encourage use of programmatic approaches • Expand use of policy-based lending to improve enabling environment for investment
	Standardising and streamlining processes for accessing climate finance	• Adopt common application and reporting frameworks • Support direct access to facilitate finance to local communities
	Mobilising private investment through blended finance and project preparation facilities	• Use development finance more catalytically to mobilise private finance towards adaptation, including through the use of blended finance • Integrate climate adaptation into project preparations facilities • Enhance co-ordination mechanisms (such as country platforms) linked to national priorities
	Enabling innovative finance mechanisms	• Explore potential of innovative instruments such as debt for climate conversions and resilience bonds

1 Introduction

Scope and framing for this report

This report has a global geographic scope, recognising that all countries face the challenge of mobilising greater investment to enhance resilience to rising temperatures and rapidly intensifying extreme weather events. However, it places particular emphasis on how the G20 can support the diverse needs of Emerging Market and Developing Economies (EMDEs), and Africa in particular, given their disproportionate vulnerability to climate impacts and specific development needs.

Defining adaptation investment

A broad definition of adaptation investments is used in this report, encompassing all investments[1] that help to build resilience to rising temperatures and extreme weather events regardless of how they are labelled or the sources used to finance them. This does not prejudge the outcomes of international discussions in relation to climate finance or other topics.

Table 2 illustrates potential investments for adaptation. Unlike mitigation, where it is usually possible to identify mitigation measures based on the type of approach (e.g., solar energy or household), whether something contributes to adaptation will be context specific. In addition, the adaptation component of an intervention may be an integral element of an investment made for other reasons, such as a new school that is resistant to flood risk.

Approaches that are commonly used to identify whether an investment contributes to adaptation tend to include the following three elements (Mullan and Ranger, 2022[6]):

- Resilience benefits: the investment should increase resilience to extreme weather events, by directly reducing physical climate risks or by supporting adaptation by others.
- Do No Significant Harm: the investment does not negatively affect the resilience of other people or ecosystems, for example by increasing the risks faced by neighbouring communities.
- Compatible with adaptation plans: the investment should be compatible with national or local strategies, such as National Adaptation Plans, Nationally Determined Contributions or National Disaster Reduction Strategies.

These criteria aim to ensure that the investments have a positive impact on adaptation and reduce the risk that the measure is ineffective or counterproductive (i.e. the risk of maladaptation). A further distinction can be made between “adapted” and “enabling” activities. Adapted activities are those where the resilience benefits result from reduced risk to the project itself, while enabling activities are those that support adaptation by others (e.g. provision of climate projections).

Table 2. Illustrations of investments for adaptation

Sector	Climate-related hazards	Examples of potential investments
Data and capacity	All	Climate analytics and forecasting
	All	Early-warning Systems
	All	Capacity building and training
Agriculture, food and fisheries	Storms, floods, drought	New crop varieties
	Heatwaves	Cooling for livestock
	Drought	Drip irrigation
Buildings	Drought, floods, heatwaves	Natural water retention solutions (e.g. wetland restoration)
	Heatwaves	Retrofitting for thermal comfort
	Sea-level rise, wildfires	Relocation of exposed assets
Business and industry	Floods	Property-level flood barriers
	Heatwaves	Energy efficient cooling
	All	Drones and in-field sensors, smart supply chains
Infrastructure (energy, transport, communications)	Storms, heatwaves	Distributed energy generation
	Heatwaves	Installing heat-tolerant surfaces
	All	Retrofitting, smart monitoring
Natural environment and ecosystems	Ocean acidification, increased ocean temperature	Coral reef restoration
	Sea-level rise, storms	Mangrove restoration
	All	Corridors to increase ecosystem connectivity
Water and flood management	Drought, floods	Construction of new reservoirs
	Floods, sea-level rise	Flood defences (including Nature-Based Solutions)
	Drought	Replacing pipes to reduce leaks

Source: OECD (2024[7]) Climate Adaptation Investment Framework, https://doi.org/10.1787/8686fc27-en; adapted from BII & FMO (2024[8]), Climate Investment Playbook, https://assets.bii.co.uk/wp-content/uploads/2024/06/28115333/Climate-Investment-Playbook-1.pdf.

Importance of scaling up finance flows for adaptation

Extreme weather events are projected to become increasingly frequent and severe. In 2024, global average temperatures were the warmest on record and had temporarily breached the threshold of 1.5°C above pre-industrial levels (1850-1900). Extreme weather led to damages of almost USD 300 billion in 2024, with losses rising faster than GDP growth (Munich Re, 2025[9]). Around 1.2 billion people are at high risk from weather-related hazards such as heatwaves, floods and drought (World Bank, 2024[1]). These risks will disproportionately affect vulnerable communities, with up to 132 million people at risk of falling into extreme poverty because of extreme events by 2030 (Jafino et al., 2020[2]).

Accelerating investment in adaptation is a critical element of the broader efforts needed to reduce the impacts of extreme weather events. Proactive, targeted investments – ranging from protective infrastructure to the provision of early warning systems – are already helping to protect lives, avoid economic losses and create new opportunities. There is a compelling economic case for doing so, with estimated benefit cost ratios of more than ten dollars for every dollar invested for measures across a range of sectors (Brandon et al., 2025[3]).

However, the benefits of resilience are not translating into finance flows at the required scale and have lagged investment flows for climate mitigation. The most recent OECD analysis found that USD 32.4 billion of climate finance was provided and mobilised for adaptation in developing countries in 2022 (OECD, 2024[4]). Looking more broadly USD 76 billion of climate finance for adaptation was identified in 2022 compared to USD 1.3 trillion for mitigation (CPI, 2024[5]). It is challenging to track flows of private sector investment for adaptation, particularly as such investment may be embedded in investments made for other reasons. Recent analysis found that private sector investment remains limited with average annual flows between 2019 and 2022 recorded at just USD 4.7 billion (CPI, 2024[5]). Meanwhile, global estimated

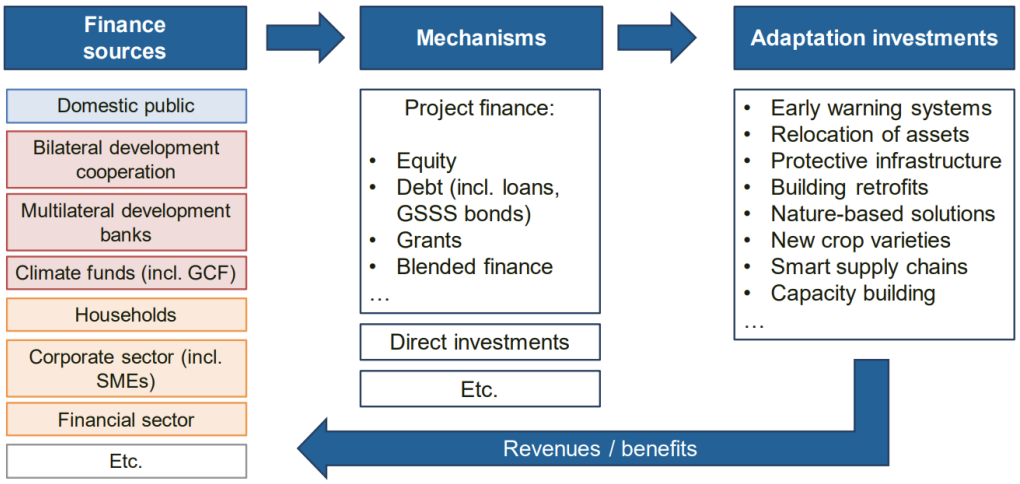
needs are in the hundreds of billions of dollars per year. The UNEP Adaptation Gap 2024 report modelled adaptation needs of at least USD 215 billion per year for developing countries, with the main needs arising from flood protection, coastal protection and infrastructure, as well as significant needs for agriculture and social protection (UNEP, 2024[10]).

Addressing the adaptation investment gap will require increased efforts to mobilise finance flows from all sources – public and private, domestic and international. The New Collective Quantified Goal on Climate Finance, agreed at COP29, reflects the need to "dramatically" scale-up adaptation finance. It "[c]alls on all actors to work together to enable the scaling up of financing to developing country Parties for climate action from all public and private sources to at least USD 1.3 trillion per year by 2035" (UNFCCC, 2024[11]). This agreement also notes the need to achieve a balance between adaptation and mitigation.

Drivers of private, public and international adaptation finance flows

The underlying driver of investment in adaptation is the need to reduce the negative effects of climate-related risks and realise potential opportunities. For example, farmers may invest in irrigation to maintain production considering extreme weather events, or they may shift to a different crop that is more drought tolerant. In that respect, key underlying drivers for investment are awareness of climate risks, clear understanding of responsibility for managing those risks and access to technical and financial resources to make the investment to do so. In addition to social and environmental benefits, adaptation can help to optimise investment performance in light of shifting weather patterns.

Figure 1. Linking finance sources, mechanisms and adaptation investments



Note: Finance is defined in this report in the broad sense of providing capital for investment, consistent with the meaning commonly adopted for climate finance. This definition encompasses financial resources that are provided without the expectation of repayment (sometimes referred to as funding), as well as those that will have to be repaid (such as bank loans).
Source: Adapted from OECD (2023[12]), *Scaling Up Adaptation Finance in Developing Countries: Challenges and Opportunities for International Providers*, https://doi.org/10.1787/b0878862-en.

However, one of the key requirements for investment to take place is that the characteristics of the project or activity match the requirements of the entity or entities providing finance (Figure 1). The two main mechanisms linking finance sources and investments are project finance and direct investment. Project finance is suitable for investments where there is cashflow from the project itself to repay investors (Steffen, 2018[13]). Building resilience into the project design improves the prospects of securing refinancing once the project is operational by reducing climate-related risks. Meanwhile, direct investments are drawn from

the resources of the financing entity, and are justified by a wider variety of benefits including reduced risk to future profits or new market opportunities. In some cases, direct investments do not necessarily require a direct revenue stream. For example, a manufacturer replacing machinery using retained earnings to reduce water consumption would be an adaptation investment but would not generate a direct revenue stream.

All finance sources will expect a return on their investment, but the type of return will vary by actor. Generally, commercial investors will only consider the direct returns to themselves, while the public sector may consider wider benefits to society. Policy-driven finance providers, including domestic public sector and public climate funds, are essential for adaptation given that many of the interventions do not provide a financial return, particularly for the provision of public goods or interventions undertaken for equity reasons. Private sector actors (including households, corporate sector and financial/insurance sector) will require market-rate risk-adjusted returns. These investments will tend to be projects where adaptation is provided as a co-benefit, or the provision of solutions to help others adapt. Between these two extremes, finance providers with a dual mandate (such as impact investors or development finance institutions) require their investments to generate a financial return but can be below market rate if the investment furthers policy objectives. Table 3 illustrates potential finance sources for different types of activities.

Blended finance provides a key instrument for broadening the pool of capital available for investment in adaptation. The OECD defines blended finance as "the strategic use of development finance for the mobilisation of additional finance towards sustainable development", including from commercial finance providers, such as banks or institutional investors (OECD, 2018[14]). Blended finance approaches include the use of concessional finance to reduce the risk and/or increase the returns from an intervention, for example by providing risk guarantees or subsidised loans. It is a particularly relevant for adaptation projects that generate multiple benefits.

Table 3. Illustrative finance sources by type of returns

	Potential finance sources	Examples
No direct financial (or private) returns – expected social return and possible indirect economic / financial benefits	• Domestic public finance • Bilateral and multilateral development co-operation • Multilateral climate funds • Philanthropy • Households (e.g. installing air conditioning)	• Developing social safety net programmes • Provision of climate data
Some financial returns, but below market rate	• Development finance institutions • National development banks • Impact investors	• Nature-based Solutions • Development of innovative technologies for adaptation
Market-rate returns	• Financial sector (banks, institutional investors) • Corporate sector • Households (e.g. flood resilience measures)	• Climate resilient infrastructure (e.g. toll roads) • Water efficiency measures (e.g. drip irrigation)

Source: Adapted from OECD (2023[12]), *Scaling Up Adaptation Finance in Developing Countries: Challenges and Opportunities for International Providers*, https://doi.org/10.1787/b0878862-en.

2 Barriers to scaling up adaptation finance

Investments in adaptation are hindered by an interconnected set of market, financial, institutional, policy and capacity constraints. This section outlines the critical barriers that will need to be addressed to enable public and private investments at the required pace and scale. Potential good practices and options for addressing these barriers are provided in section 4.

Cross-cutting challenges

Macroeconomic factors, including limited fiscal space, high cost of capital and existing debt levels

Weak macroeconomic conditions – high levels of public debt, high inflation, and low near-term prospects for economic growth – are putting pressure on public finances and pushing up the cost of capital (OECD, 2024[7]). Global macroeconomic shocks in recent years have exacerbated long-standing vulnerabilities in developing countries. Over half of low-income countries are assessed as facing a high risk of debt distress or are already in debt distress (World Bank, 2024[15]). In 2024, OECD countries issued USD 15.7 trillion of sovereign debt and EMDEs issued USD 2.8 trillion (OECD, 2025[16]). Borrowing costs for African countries are, on average, four times those of the United States (UNCTAD, 2024[17]).

These pressures are exacerbated by escalating natural hazards. The increasing burden of climate-related losses can directly put pressure on public finances, particularly in EMDEs. Potential impacts include the costs of post-disaster recovery following extreme events and reduction in tax revenues. Moreover, the extreme weather events could also negatively affect a country's overall macroeconomic stability, reflected in lower credit ratings and therefore increased interest rates (Klusak, 2023[18]). This could further limit countries' ability to source finance for adaptation. There is evidence that countries with high vulnerability to weather-related hazards risk bear an incremental cost on government-issued debt, above those attributable to macroeconomic and fiscal fundamentals (Buhr, 2018[19]). This incremental debt yield is carried over into higher costs of private debt, making it challenging to mobilise private finance for investment in adaptation, as well as wider climate action and sustainable development priorities.

Meanwhile, the rising impacts of extreme weather events bring with them the need for increased public adaptation investments that are necessary to reduce and avert economic losses. Constrained public spending, however, limits many developing countries' capacity to invest in the activities required to avert climate-induced losses in the future without putting their debt sustainability at risk in the present. The result can be a negative cycle, where lack of resources to invest in adaptation leads to higher losses, which further constrain the fiscal space available for investment.

Lack of suitable data and capacity to assess and manage physical and transitional climate risks

Lack of climate-related data remains a significant barrier to investment in adaptation, particularly in least developed countries (LDCs) and Small Island Developing States (SIDS). Despite the efforts that have been made to improve provision, there remain significant gaps in the availability of hazard maps, local climate scenarios and high-resolution weather data (World Bank, 2024[1]). These gaps make it difficult to identify and prioritise adaptation needs and build the case for investment, because it is challenging to demonstrate the baseline climate risk and the effectiveness of adaptation measures in reducing those risks. This is an issue for the development of adaptation-specific project proposals and can also hinder the mainstreaming of adaptation into projects that are undertaken for other reasons.

Adaptation-related interventions have the further challenge of currently lacking commonly accepted metrics for demonstrating the benefits of an intervention. Indicators to track global progress on adaptation are currently being developed under the UNFCCC and are due to be agreed at COP30 (Lamhauge and Duluk, 2025[20]). In contrast to mitigation, where benefits can be expressed as tonnes of greenhouse gasses avoided, the benefits of adaptation interventions will be context specific. Currently, there are no standardised approaches for estimating the benefits of a particular adaptation-related intervention, meaning that these must be estimated for each intervention. Despite welcome attempts at harmonisation by Development Finance Institutions (including Multilateral Development Banks) and climate funds, different funders may require reporting on different metrics, thereby adding transaction costs for projects with multiple funders.

Overall, these factors increase the capacity required to develop viable projects; this is a major constraint within many developing countries, particularly LDCs and SIDSs (OECD, 2023[12]). Countries often lack the capacity to undertake climate risk assessments, translate those into adaptation priorities and turn those into viable proposals. In the private sector, lack of capacity can also hinder mainstreaming of adaptation into investment decisions, due to the need for specialised expertise to demonstrate the business case for action. This is particularly a challenge in EMDEs, given the key role of small and micro enterprises in these economies.

Governments, MDBs, private sector actors and global climate partnerships have often highlighted persistent challenges in mobilising adaptation finance due to gaps in data, capacity and co-ordination. Key barriers include the lack of bankable and investment-ready projects, limited guidance on structuring proposals, fragmented donor support, and low success rates in accessing specific funds. Stakeholders also stress the need to avoid duplication and call for more structured co-financing models. Initiatives such as the recently launched *G7 Adaptation Accelerator Hub* seek to address such constraints by supporting co-ordination, pipeline development and better alignment between funding and needs (see Box 10).

Lack of access to suitable risk management tools, such as insurance and reinsurance

Insurance, reinsurance and other risk transfer tools such as catastrophe bonds, are critical in providing a source of funding to support recovery and reconstruction and can also play a vital role in making climate risk visible and thereby providing an incentive for investment in risk reduction. However, limited availability, affordability and take-up of insurance coverage – and constraints in access to affordable reinsurance – in many countries and for many types of perils (or hazards), limits the role of insurance markets in providing financial protection and incentivising risk reduction. Losses from extreme events have been rising faster than GDP, albeit with annual variations. Last year, global recorded losses from climate- and weather-related extreme events were estimated to be USD 298 billion, of which less than half were covered by insurance (Munich Re, 2025[9]). Developing countries face a particularly large insurance protection gap, with less than 10% of economic losses from weather-related events being covered by insurance in those countries (2000-23).[2] Access to affordable insurance coverage is hindered by a number of factors including

the increase in climate-related losses, challenges in quantifying potential losses, limited access to affordable reinsurance and underdeveloped insurance markets while low insurance literacy, a lack of awareness among households, businesses and governments of their exposure to climate risks and the potential benefits of acquiring insurance or other forms of financial protection limit take-up of insurance coverage.[3]

In addition to insufficient coverage of climate-related losses, insurance markets are making only a limited contribution to encouraging investment in adaptation (OECD, 2023[21]). Insurance companies are often unable or unwilling to provide significant risk signals through premium pricing and reductions in premiums for policyholder investments in risk adaptation reduction, whether due to regulatory constraints, limited capacity to assess climate risk or market dynamics. In addition, insurers currently have few incentives to support resilient reinstatement after a climate event, thereby missing a cost-effective opportunity to support resilient reconstruction, such as by funding property-level flood resilience measures.

Limited co-ordination and institutional frameworks at the domestic level

It is essential to have a well-coordinated and efficient response to address climate-related risk. The complexity of climate impacts means that single events can have multiple, cascading effects, the management and responsibility of which can be spread over multiple government departments and agencies. It is therefore essential to have a clear, coherent policy framework to support investment in adaptation as part of the broader enabling environment, but this is not common practice (OECD, 2024[7]). Critical barriers that hinder such a response include lack of capacity in relevant ministries, unclear institutional responsibilities and the need for stronger co-ordination mechanisms to help develop whole-of-government responses (OECD, 2024[7]).

In addition to horizontal co-ordination between parts of national governments, there is the further challenge of vertical co-ordination between different levels of government, which is critical given the role of local authorities in implementing adaptation (OECD, 2023[22]). The locally specific nature of adaptation means that local authorities have a key role in supporting investment. However, local authorities often face capacity and financial constraints and may also face co-ordination challenges in addressing risks that cross administrative boundaries. This can result in a lack of clarity about responsibility for managing climate-related risks, insufficient resources to address those risks and policy misalignments that can deter investments.

Planning processes for adaptation are not yet suited to supporting the mobilisation of the necessary financial resources for adaptation. The development of National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs) have the potential to drive investment by supporting co-ordination, ensuring clarity about risk ownership and communicating needs to the private sector. There has been considerable progress in planning, with 60 developing countries having submitted NAPs to the UNFCCC and a further 89 being in the process of development (NAP Central, n.d.[23]). All OECD countries have developed at least one adaptation plan, strategy or framework (OECD, 2025[24]) . However, these documents tend to have limited analysis of how priority measures will be funded or timelines for implementation (OECD, 2023[12]). This makes it challenging to translate priority adaptation needs into a pipeline of financially viable projects.

Barriers to domestic public investment in adaptation

Domestic public finance is a critical source of investment in adaptation, but – as highlighted above – many countries are faced with severe fiscal pressures, institutional fragmentation and competing demands for public resources. Against this background, weaknesses in systems for public financial management are hindering public investment in adaptation. In particular (OECD, 2024[7]):

- **Budget allocations and planning**: very few countries currently have a comprehensive view of the impact of rising temperatures and extreme events on their budgetary needs and allocations. There remains a need to integrate climate considerations into budgetary processes and tools (OECD, 2022[25]).
- **Project appraisal**: the benefits of investment in adaptation often have non-market characteristics (such as benefits for ecosystems or health impacts) that may not be captured in the application of tools used by governments such as cost-benefit analysis. Given uncertainties in climate outcomes, approaches that value robustness to different scenarios may need to be introduced.
- **Procurement, including PPPs**: the specification and evaluation criteria used for procurement processes can deter investment in adaptation if they preclude the use of alternative solutions (such as Nature-based Solutions). Procurement processes that focus on upfront costs, rather than lifecycle costs can discourage resilient solutions.
- **Tracking and monitoring**: monitoring government spending relevant to adaptation contributes to transparency and learning. However, there is currently limited transparency about flows of domestic public finance for adaptation.

The relationship between layers of government is also a critical issue for enabling financing for adaptation. Subnational governments oversaw just under 40% of public investment in 2020 (OECD, 2022[26]), and have a particularly critical role in the provision of local infrastructure and response to climate events. Despite having this key role, subnational authorities can be faced with significant financial and capacity constraints that hinder investment in adaptation and resilience (OECD, 2024[27]) such as:

- fiscal frameworks that limit the ability of subnational governments to raise revenue or borrow to finance economically worthwhile projects
- lower capacity to manage their exposure to climate related risks, due to geographic concentration and less diversified revenues
- systems for allocating funding to local governments that do not account for climate risks.

Barriers to private investment

The private sector can contribute to adaptation by (1) investing in its own resilience; (2) providing finance for adaptation investments that generate a market-rate return; and (3) developing adaptation solutions (e.g. drought-resistant crops). While there are clear economic and financial reasons to invest in adaptation, private investment is constrained by the perception that there are low returns to investment in adaptation (Tall et al., 2021[28]). The disconnect between high social returns to investment and low market returns is driven by a set of underlying barriers (OECD, 2024[7]):

- **Externalities and policy misalignments:** Many adaptation investments, such as green roofs or sustainable water management systems, create broader societal benefits that the private sector struggles to capture. As a result, private investors are less inclined to fund projects that offer widespread benefits without clear financial returns. Conversely, some adaptation measures may unintentionally create negative externalities. For example, the widespread adoption of air conditioning may increase the urban heat island effect. Private investors may not internalise this negative societal impact when deciding on how to keep their property cool. These market distortions can lead to a misalignment between private returns and social benefits, hindering private investment.
- **Perceived risks and timing of returns:** Climate adaptation investments are inherently tied to future climate risks, which can be highly uncertain and difficult for investors to accurately predict. Adaptation measures, such as flood defences or heat-resistant infrastructure, may take years or decades to prove their value in terms of reducing losses during extreme events. Moreover, climate

risks can have cascading effects across sectors (e.g. a drought may simultaneously impact agriculture, water and energy systems), leading to a compound risk scenario that could have unpredictable financial outcomes. This complexity and misalignment in investment timeframes can create challenges for private investors to assess the returns on adaptation investments.

- **Access to credit and financial instruments:** A major challenge to scaling up private investment in adaptation is limited access to affordable financing mechanisms. This is particularly a challenge in EMDEs with lower levels of financial sector development. Financial institutions may be reluctant to lend due to high perceived risk or inability of adaptation projects to generate immediate returns. These factors are exacerbated in countries that face high climate risks and high costs of capital. In addition, the financial instruments available for adaptation investment remain relatively underdeveloped. While innovative instruments like resilience bonds or debt-for-climate swaps are emerging, they are often too complex or expensive for smaller-scale adaptation projects, particularly in EMDEs.
- **Regulatory stability and investor confidence:** A lack of clear, credible and stable policies surrounding climate adaptation[4] creates uncertainty for investors around the future direction of government policies and investment needs. Unclear adaptation priorities can make it difficult for the private sector to plan. Particularly in the rapidly evolving context of climate adaptation, private investors require transparent, predictable and non-discriminatory enforcement of the rule of law, to be confident that their capital will be protected over time, including when regulations must be modified according to the evolving situation.

Access to international concessional finance

Accessing international finance for adaptation can be complex and challenging for developing countries. The landscape of providers is diverse, and eligibility criteria and application requirements are varied (OECD, 2023[12]). These challenges apply to development finance generally but are more pronounced in the context of adaptation finance, in part due to the small scale and context-specificity of adaptation projects.

International public finance is critical for supporting adaptation finance in developing countries. The OECD tracked USD 28.7 billion of public (bilateral and multilateral) climate finance for adaptation in developing countries in 2022. This is both critical for directly addressing adaptation needs, and filling capacity gaps – with the majority of national adaptation plans having been developed with external support (OECD, 2023[12]). However, aspects of the international architecture are hindering the flow of resources to where they are needed (OECD, 2023[12]):

- Fragmentation of the funding landscape, with 81 climate funds currently in operation (Le Houérou, 2023[29]). Despite welcome efforts at harmonisation, fragmentation makes it challenging to identify suitable funds for project support and raises transaction costs, as different funds have different processes and requirements for applicants to meet.
- Barriers to access for LDCs and SIDS, as these countries face capacity and institutional constraints that hinder their ability to develop proposals for accessing international funding.
- Challenges in accessing international funding by local and national institutions, due to challenges in meeting accreditation requirements, language barriers and capacity needs (including human resources) for project development.
- Lengthy timescales for reviewing and approving funding proposals, particularly as there are few common metrics or standards for demonstrating the benefits of initiatives. This results in the risk that the project becomes obsolete by the time that approval is achieved.

Adaptation projects tend to be smaller than those targeting climate mitigation, which can lead to proportionately higher transaction costs to meet these requirements. Despite some progress in harmonising requirements and processes, there remains scope to streamline access to finance while ensuring the effective use of public funding.

3 Deep dive in key areas in need of investment

All parts of the economy are at risk of being affected by extreme weather events and trend changes. This section identifies the bottlenecks and opportunities in key areas and sectors that will be critical for adaptation:

- early warning systems
- agriculture
- infrastructure
- energy
- water.

Early warning systems

Climate-related early warning systems (EWS) consists of a broad ecosystem of public and private sector players that aim to provide timely and effective warnings to those at risk of hazardous and extreme weather events. They are crucial for effective emergency responses.

The Global Commission on Adaptation (GCA) reported that investing in EWS yields the highest average return among adaptation measures, with an estimate benefit-cost ratio of 9:1 (GCA, 2019[30]). This analysis also highlights that investment of USD 800 million in such systems in developing countries could prevent annual losses ranging from USD 3 billion to USD 16 billion, underscoring the significant economic value of investing in EWS. Despite these considerable potential benefits, there is a large gap in coverage of EWS, currently in place in only half of all countries globally (UNDRR-WMO, 2022[31]).

Bottlenecks

Finance for climate EWS is constrained by barriers common to adaptation investments in general, related to risk, timing and monetisation of benefits, but also by more specific factors that limit the pipeline of bankable opportunities and reduce investor confidence. In particular, technical, institutional and market-related bottlenecks hinder both public and private investment flows into EWS:

- Limited investment-ready opportunities: EWS are often viewed as public goods, with limited prospects for revenue generation or direct cost recovery. This reduces incentives for private investment and makes it more difficult to structure blended finance approaches. In many contexts, the lack of clear investment models or pathways for private sector participation means there is simply no viable market for EWS-related investment.
- Technical capacity gaps: Deploying and operating EWS requires advanced infrastructure, including weather monitoring stations, satellite systems, and data processing centres, which may be absent or outdated in many developing countries. The lack of technical capacity increases project risk and raises the cost of implementation, making it harder to attract finance. These gaps often persist

because national budgets are constrained, and development finance has not sufficiently prioritised technical systems as a foundational layer for broader adaptation outcomes.

- High maintenance and operation costs: Harsh environments and weak institutional capacity can drive up the long-term costs of maintaining EWS infrastructure. Even when initial funding is secured from development partners, there is often no clear financial plan for sustaining operations, deterring further investment and limiting system durability.
- Connectivity and digital infrastructure deficits: In remote and underserved areas, limited internet access and outdated communication infrastructure weaken the last-mile delivery of warnings. These systemic barriers not only reduce the effectiveness of EWS but also make it difficult to justify or secure ongoing investment, especially where benefits are hard to quantify or attribute.
- Human capital constraints: effective EWS operations require specialised knowledge in fields like meteorology, climatology, hydrology, and data science. However, these skills are often scarce in regions most vulnerable to climate impacts, limiting system functionality and responsiveness. Investors are often reluctant to finance systems that may not be able to function at full capacity due to staffing shortages or training gaps, which introduces further uncertainty into the investment case.

These challenges highlight that financing early warning systems is not only a question of capital availability, but also of developing robust enabling environments, including institutional mandates, human capacity, and digital infrastructure. In the case of Africa, the Climate Information for Development (ClimDev) initiative was established by the African Union, the AfDB, and United Nations Economic Commission for Africa (UNECA) to address these challenges (see Box 1).

Opportunities

Although EWS are developed through collaboration among diverse partners, they are often viewed primarily as government-led efforts. Although governments should remain the authoritative source for issuing warnings, the private sector has significant potential to add value across other components of EWS. These opportunities include improving the accuracy and accessibility of climate risk data, by developing advanced analytics, modelling tools, and integrating diverse data sources. The private sector also plays a crucial role in developing “last mile” platforms and solutions to ensure rapid dissemination of alerts to vulnerable populations, or create customised solutions that help clients anticipate and respond to climate-related risks. However, such roles are not widely recognised beyond the small group of specialist firms already engaged in EWS. Expanding and deepening private sector involvement could help accelerate progress in closing the global EWS coverage gap (WEF-WMO, 2025[32]).

PPPs offer an opportunity to expand private sector participation in EWS, by providing a range of models to support their financing, development, and scaling up. These partnerships can take several forms depending on the respective roles of public and private actors.

Box 1. Case studies: Early warning systems

Leveraging PPPs for EWS

Varied PPP structures unlock new financing channels by combining public oversight with private sector innovation and efficiency:

- **Technical collaborations**, such as the one between Weather Impact and Mozambique's meteorological agency, involve private firms supplying forecasting tools and expertise, while public agencies handle operations and outreach.
- **Data-sharing and service co-design models**, such as PlantVillage Nuru in Kenya, enable private tech providers to work alongside government departments to deliver tailored warnings, especially to sectors like agriculture.
- **Platform partnerships**, such as the RIMES system in Southeast Asia, make use of telecoms and ICT companies to support the wide dissemination of alerts and integration of multi-hazard warnings across regions.
- **Analytics-as-a-service** arrangements, such as SatSure's work with Indian state governments, allow authorities to outsource sophisticated geospatial analysis and predictive modelling.
- **Insurance-linked PPPs**, such as Africa RiskView under the African Risk Capacity initiative, integrate EWS data into sovereign risk finance tools, triggering early payouts and enhancing disaster preparedness. Insurers can also provide early warning systems to help policyholders reduce losses.

Ethiopia - Weather Forecasts Build Resilience

The technical collaboration between ClimDev and the National Meteorological Agency has led to the installation of 18 additional automatic weather stations and development of user-tailored climate advisory services for agriculture, water, and health sectors in the country. This helped to increase the delivery of climate services in 33 new districts and improved the capacity of government agencies such as the Ministry of Agricultural Extension, Ministry of Water, Irrigation and Energy in mainstreaming climate information in their respective sectoral policies and planning. Agriculture extension workers were also trained at the National Meteorological Agency on the use of climate services and products, while farmers' groups were trained to analyze historical climate information and use participatory tools to develop and select crops, livestock and livelihood options best suited to individual farmers' circumstances. This has contributed to improving farmers' capacity to respond to extreme weather and climate events, which in turn is expected to reduce crop loss by at least 25% and loss of livestock due to drought over pastoral areas of the country from 27% to less than 10% by 2025.

Source: ClimDev Fund (2024[33]), *Climate Information for Development (ClimDev)*, https://www.climdev-africa.org.

Agriculture

Agriculture today confronts a complex set of challenges, including rising food demand, stagnating crop yields, and the depletion of natural resources and biodiversity. Shifting weather patterns add a further layer of risk, as increasing global temperatures could reduce crop yields by over 25%, while more frequent and intense extreme weather events threaten farmers' livelihoods, damaging land and crops alike. Climate change can affect agricultural production systems in a number of ways (Cobourn, 2023[34]):

- Crop and livestock production: yield variability and productivity losses resulting from extreme temperatures, altered rainfall patterns and growing seasons, reduced forage quality, and increased pests, diseases and invasive species.
- Food safety and security: disruptions to the stability of food supply chains that threaten the availability, quality and access to food. Agricultural disruptions can in turn exacerbate migration, conflict, and political instability.
- Natural resources: effects on the resources that support agricultural production, including water quantity and quality, pollinator populations, arable land availability, and soil fertility.
- Economic effects: effects on employment, relative prices and costs of production, international trade, and farmer income or welfare.

Given these challenges, the urgency to implement adaptation measures that anticipate and reduce the exposure to weather-related risks continues to grow. This requires policymakers to reform agricultural policies to align them with adaptation and resilience needs, which can in turn help identify priorities for investment.

Sectoral bottlenecks

Despite growing recognition of the urgent need to adapt agriculture to evolving weather patterns, significant barriers continue to hinder investment in resilient agricultural systems:

- High perceived risks and uncertainty: Agriculture is inherently risky due to weather variability, pest outbreaks, and market fluctuations. Climate-related risks compound this unpredictability, making it harder for financiers to model and price risk. Innovative technologies or practices (e.g., drought-tolerant seeds, regenerative methods) are often new to the market, lacking proven track records or historical data, or an enabling regulatory environment.
- Misaligned agricultural policies and regulatory gaps: Agricultural support policies often reinforce existing production structures through market-distorting subsidies and commodity-specific payments, reducing incentives for innovation and adaptation. Moreover, lack of enforcement, unclear land tenure rights, or inconsistent climate policies can deter long-term investments to improve resilience of the sector.
- Access to finance for smallholder farmers: The majority of farmers in developing countries are smallholders with limited collateral, formal credit history, or financial literacy. In some countries, agricultural practices are grounded in traditional knowledge of indigenous communities and do not rely on modern technologies. Banks and microfinance institutions may consider them too risky or expensive to serve. Even where funding exists (e.g. from development banks), farmers and agribusinesses may lack the technical capacity or support to design and present proposals that meet investor requirements.
- Environmental and trade policy conflicts: Trade and environmental policies can sometimes create conflicting signals for investment in climate-resilient agriculture. For example, input subsidies or export restrictions introduced in response to crises may discourage sustainable practices and exacerbate global food insecurity. Similarly, easing of environmental requirements to boost short-term productivity can undermine long-term resilience goals. In addition, global trade dynamics may disincentivise investment in locally appropriate, climate-resilient crops when international markets favour the continued dominance of less resilient, high-volume commodities. More broadly, a lack of coherence between trade, agricultural, and environmental policies can hinder the creation of an enabling environment that supports investment in transformative adaptation measures.

Sectoral opportunities

- Develop innovative financial products: Creating and scaling financial instruments tailored to the needs of smallholder farmers can expand access to capital for climate-smart investments while managing risks specific to the agricultural sector. Examples include weather-index insurance products, pay-as-you-go models for equipment, and digital microcredit. Resilience-linked bonds for agriculture can similarly raise capital from institutional investors for projects like regenerative farming, reforestation, or sustainable water management. Performance-linked financing mechanisms also reward improved environmental or resilience metrics.
- Provide financial incentives for resilience-building activities: offering financial incentives to farmers and landowners for adopting long-term conservation practices on their agricultural land can help restore nature-based infrastructure, and enhance the resilience of agricultural systems to extreme weather events. Examples include payments for verified improvements in resilience, such as yield stability or soil health (e.g. payments for ecosystems services), providing direct financial incentives to farmers or agribusinesses.
- Embed resilience in public agricultural spending: Redirecting agricultural support from input subsidies to climate-smart practices (e.g. cover cropping, agroforestry, drip irrigation) can create market signals and catalyse private investment in resilient solutions.
- Leverage digital platforms and climate information services: mobile technologies and digital platforms can help improve access to information, finance, and markets, reducing transaction costs and enhancing the bankability of smallholder farmers. Examples include digital agro-advisory tools, forecast-based warnings, and bundled services to smallholders.

Box 2. Case studies: Agriculture

Technologies for African Agricultural Transformation (TAAT) programme

The TAAT program, launched in 2018, is an integral part of the African Development Bank's (AfDB) Feed Africa Strategy 2016–25 and consistent with the new AfDB Ten-Year Strategy (2024-33). Its overall objective is to harness proven technologies to raise agricultural productivity in Africa, as well as mitigate risks and promote diversification and processing in 18 agricultural value chains within eight priority intervention areas. Overall, TAAT will produce 100 million metric tonnes of additional food to feed 200 million people.

In Ethiopia, TAAT is providing tens of thousands of smallholder farmers with heat-tolerant wheat varieties that produce more profitable harvests compared to traditional crops like vegetables. In Ethiopia's lowlands like Adama District, about 100 km southeast of capital Addis Ababa, wheat farming is relatively new. The Ethiopian government programme approached farmers and provided training on growing the heat-tolerant grains where daytime temperatures can reach 35°C Farmers receive loans from the government to cover 80% of costs for land preparation, seeds, fertiliser and mechanised equipment for harvesting. The loans are paid back at harvest.

Following the nationwide deployment of heat-tolerant wheat varieties, the irrigated-wheat area expanded from less than 5,000 hectares in the 2018-19 farming season to 650 000 hectares in the 2021-22 season. Wheat yields doubled and Ethiopia's wheat production increased by an additional 1.6 million metric tonnes in 2022. The country says it achieved wheat production self-sufficiency in 2023 and that it is poised to export wheat for the first time.

Source: AfDB (2024[35]), *Technologies for African Agricultural Transformation,* https://taat-africa.org/.

Infrastructure

Infrastructure is critical for sustained economic development and environmental outcomes[5]. Efforts to improve the quality and quantity of investment in infrastructure will be critical for enhancing resilience to changing weather patterns, given the close relationships between infrastructure and extreme weather events.

- Extreme weather events pose risks to infrastructure service provision, as roads melt, reservoirs run dry and tunnels flood.
- Infrastructure can exacerbate weather-related risks – for example, dams collapsing following heavy rains, or wildfires ignited by electricity transmission lines.
- Escalating weather hazards will also create new demands for protective infrastructure – for example, reinforcement of flood defences.

Getting things right at the outset is critical given that infrastructure investments are long-lived, illiquid and capital intensive. Infrastructure assets built today may still be in operation at the end of the century. This section explores infrastructure in general, with the subsequent sections exploring the specific issues in relation to energy and water.

Sectoral bottlenecks

- Uncertainties: the long-lived nature of infrastructure assets means that they could face widely varying climate scenarios over their lifetime. These uncertainties can increase the costs of provision, by requiring additional redundancy and flexibility, and make it more complex to apportion risk between parties.
- Capacity constraints: it is technically complex to understand the impacts of rising temperatures and extreme weather events on an infrastructure asset and this may not be part of the professional education of the engineers and planners responsible for the asset. This increases project development costs and can hinder scaling up. This is a particular challenge when considering the use of Nature-based Solutions, as these tend to require a different skillset than the construction of conventional (“grey”) infrastructure.
- Interdependencies between and within infrastructure networks: the weather-related hazards can propagate across and between infrastructure networks. For example, telecommunications services are reliant upon a reliable supply of electricity. However, ownership and policy responsibilities are often split, leading to co-ordination challenges and missed opportunities to invest in strengthening resilience across sectors.
- Unsuitable procurement policies and regulation: procurement policies and regulatory approaches that fail to capture the value of resilience can encourage a focus on the upfront costs of the asset, rather than supporting investment to maximise economic efficiency over the lifespan of the asset.
- Infrastructure financing gap: developing countries face an urgent need to improve access to core infrastructure services, while facing competing priorities. Targeted interventions to make infrastructure resilient to extreme weather only add an average of 3% to project costs, but the integration of climate resilience can be seen as an additional burden rather than an opportunity to ensure good performance throughout the asset’s lifespan.

Sectoral opportunities

- Adopt a systems approach to planning resilient infrastructure: new modelling approaches enable the analysis of infrastructure at the level of networks, and even the interdependencies between

networks. This helps to identify priority areas for investment and provides baseline information that can help to support the mainstreaming of resilience at the project level.

- Integration into project preparation facilities: provision of technical support at the project development phase can support the translation of concepts into financially viable projects. Targeted technical support, such as through the Global Infrastructure Facility, can enable the mainstreaming of climate resilience at the outset and aid financing.
- Increasing private sector engagement, including through PPPs: well-designed PPP arrangements, including suitable performance indicators, can play a critical role in unlocking investment, supporting the use of innovative approaches and providing incentives to manage risks. Frameworks and guidance for PPP design are increasingly being used to support climate resilient infrastructure.
- Development of comprehensive funding strategies covering operations and maintenance: infrastructure services are traditionally funded through user charges and, in some cases, government subsidies. Exploring additional funding sources, such as land-value capture, ancillary revenues (such as property income) can help projects achieve financial viability and reduce pressures on public finances.

Box 3. Infrastructure case studies

Ghana - Roadmap for Resilient Infrastructure: A systems-modelling approach was applied to understand the impact of climate risks across infrastructure systems in Ghana. This enabled the identification of priority adaptation measures, including the use of Nature-based Solutions. This analysis generated a pipeline of 35 priority interventions to strengthen infrastructure resilience. It was undertaken by the Government of Ghana, with support from the Global Centre on Adaptation, UNOPS and UNEP.

Private Infrastructure Advisory Facility (PPIAF): This Facility provides the governments of developing countries with support to strengthen their enabling environment to attract private infrastructure investment. PPIAF, in collaboration with the Global Infrastructure Facility and the IFC, developed a toolkit to help systematically integrate climate resilience throughout the PPP lifecycle.

Canada - Infrastructure PPP: The Government of the Northwest Territories and the Tłı̨chǫ Government are working in partnership to develop the Tłı̨chǫ All-Season Road project as a PPP. The 97-kilometre all-season highway is intended to provide uninterrupted access between remote northern communities with the Northwest Territories, even in the face of extreme weather events. The project is jointly funded by the Government of Canada (25%) and the Government of the Northwest Territories (75%). It includes a bespoke risk-sharing mechanism that uses modelling of climate risks to effectively price long-term risk exposure for the operations and maintenance of a road constructed above permafrost. The risk-sharing mechanism was developed through the Request for Proposal (RFP) period, which enabled all proponents to effectively price climate risk from the outset.

Source: Thacker et al. (2022[36]), Ghana: Roadmap for Resilient Infrastructure in a Changing Climate Acknowledgements; OECD (2024[7]), Climate Adaptation Investment Framework, Green Finance and Investment, https://doi.org/10.1787/8686fc27-en; Buck (2017[37]), https://doi.org/10.1680/jcien.17.00005.

Energy

Secure energy access is a fundamental component of economic and social wellbeing and development, articulated in SDG 7 – ensuring access to affordable, reliable, sustainable and modern energy for all. While many developing countries are grappling with the challenge of broadening reliable and affordable access to energy for their populations in the immediate term, weather-related risks pose significant threats to both existing and future energy systems. In Africa, more than 600 million people lack access to clean and sustainable energy (IEA, 2022[38]). Expanding energy access is critical to building adaptive capacity on the continent. The primary objective of adaptation for energy is simply therefore "guaranteeing the supply of sustainable energy, and balancing production and consumption throughout time and space" (Ebinger and Vergara, 2011[39]).

Climate impacts can affect energy security in a number of ways (IEA, 2020[40]; Ebinger and Vergara, 2011[39]):

- **Generation:** Climate impacts, including more erratic weather patterns and extreme weather events, can reduce the efficiency and alter the availability and generation-potential of both thermal and renewable power plants. Sea level rise poses major risks to energy assets, including nuclear power plants, located in coastal areas. Hydrological changes are also affecting the generation output and reliability of hydro-electric power.
- **Transmission and distribution:** Extreme weather events and wildfires can physically damage transmission and distribution networks, resulting in higher losses and changes in transfer capacity. Rising global temperatures will also diminish the efficiency of transmission and distribution networks.
- **Demand**: High average temperatures and the increased incidence of heatwaves will increase electricity demand for cooling, straining existing capacity.

Investing in climate-resilient energy systems is therefore critical to anticipate, absorb, accommodate, and recover from climate impacts. This requires policymakers to internalise climate resilience as a key component of energy security. This can help identify priorities for investment, including technological adaptation that invests in protective infrastructure to provide physical protection from losses and damages induced by climate-related events (Ebinger and Vergara, 2011[39]). These can include targeted refurbishment of infrastructure to increase robustness and resilience to climate events. Improvements in design standards are also critical to improving the resilience of new infrastructure, for example building standards to improve insulation and reduce electricity demand for cooling during extreme heat events. Technological adaptation should be combined with behavioural adaptation strategies. These include shifting energy production to less disaster-prone areas, and taking proactive steps to better anticipate climate-related shocks through improved meteorological forecasting. The recently launched Mission 300 by the World Bank, AfDB and other partners incorporate these considerations (see Box 4).

Box 4. Mission 300: An ambitious vision for access in Africa

In response to the growing urgency of Africa's energy crisis, the World Bank, the AfDB and other partners have launched Mission 300 to provide access to sustainable energy for 300 million Africans by 2030. It leverages a combination of public investment, private sector engagement, and innovative financing mechanisms. This initiative represents an opportunity to scale up electrification efforts while ensuring that energy access contributes directly to economic transformation, social equity and climate resilience.

Source: AfDB (2025[41]), Mission 300, https://www.afdb.org/en/mission-300-africa-energy-summit.

Sectoral bottlenecks

The complexity of energy systems – characterised by large, complex value chains, often with a mix of public and private ownership and control; geographically distributed infrastructure assets; network effects; and externalities including public goods, among others – means it is often unclear who should deliver and pay for investment in resilience. Though energy asset owners and operators should factor climate impacts into their routine business decision-making, there are a number of factors holding back the mainstreaming of climate resilience into energy infrastructure planning:

- **Time horizons**: The capital cost of investment in resilience is incurred immediately, whilst the benefits may take significantly longer to materialise.
- **Externalities**: The wider social and economic costs of climate damages to energy infrastructure outweigh the costs to energy system operators and generators.
- **Business models and competition**: The energy sector is highly concentrated, and often monopolistic. These market conditions can dampen investment in climate resilience in certain contexts.

Sectoral opportunities

Policy can help address these bottlenecks. A conceptual framework – for example that developed by the Argonne National Laboratory (Argonne, 2010[42])– can help articulate the specific components of resilience, with a view to steering policy development.

Energy security needs to be better integrated into national adaptation plans and strategies, to establish a shared understanding across the sector of projected shifts in weather patterns. National authorities, including energy sector regulators, also have a critical role to play in requiring, or at least encouraging, utilities to integrate climate risk into their construction plans and operational regimes. This can support the mainstreaming of adaptation into energy investments.

Similarly, resilience needs to be integrated into energy planning. More robust climate risk assessment and management can help address knowledge gaps and information asymmetries that lead to under-investment in adaptation and continued investment in mal-adapted infrastructure. This, in turn, can help better apportion responsibility of risk management to various parties, for example power plant operators/utility companies, transmission system operators, or national or local governments.

Investment in clean energy has adaptation, as well as mitigation, benefits. Distributed renewables, for example rooftop solar panels and solar-powered water pumps, can help improve resilience by providing sustained energy and water access during disasters. Improving energy efficiency reduces energy demand, improving energy security and the overall resilience of the system; improving building standards to improve insulation can significantly reduce vulnerability to heat stress in a cost-effective way.

Water

Investment in the water sector will be a critical element of our broader efforts to adapt to rising global temperatures and escalating frequency of extreme weather events. There is already a water finance gap, with 2.2 billion people still lacking access to safely managed drinking water – including 69% of the population of Sub-Saharan Africa (United Nations, n.d.[43]). Significant additional investments will be required to fill these gaps.

Changes in weather patterns will place further pressures on hydrological systems. Water-related risks are becoming increasingly frequent, severe and hard to predict. In particular, extreme weather events will exacerbate the risks of too much water, too little water and water that is too polluted. As an illustration of

the scale of impacts, the cost of a single extreme drought in Paris could reach EUR 2.5 billion by 2100 (OECD, 2025[44]). In addition to the social costs, these risks could have systemic impacts, with many of the costs ultimately falling to governments.

In managing these risks, investment will have to be mobilised across scales, with different implications for how to support investment for adaptation in these areas (OECD, 2019[45]):

- Large-scale infrastructure: the construction of desalination plans, increased water storage capacity and sea walls. Some of these interventions will give rise to revenue streams, particularly multipurpose infrastructure such as hydroelectric dams, which opens up the potential for project finance arrangements, such as PPPs.
- Small-scale infrastructure: interventions at households' level, farm or business will also be essential to manage water-related risks. For example, the use of water-efficient irrigation for agriculture
- Landscape-scale interventions, including Nature-based Solutions: these interventions complement or replace conventional infrastructure by working with nature. For example, protecting watersheds to reduce the need for water treatment or managing flood risk through creating "room for the river" to reduce the need for physical defences. These interventions often require co-ordination between multiple stakeholders and the blending of different revenue streams.

Different interventions will be suitable in different contexts, and these are diverse in terms of the funding models and actors involved. The following barriers and constraints have been identified through the OECD's work on financing water.

Sectoral bottlenecks

- Insufficient revenues for water utilities: in many countries, water revenues are insufficient to maintain existing systems, let alone fund new capital investment to expand access and retrofit systems (WHO, 2022[46]).
- Pricing arrangements: pricing arrangements that fail to reflect the value of water reduce the incentive for water users to invest in small scale infrastructure (such as drip irrigation) to increase efficiency.
- Regulatory and governance challenges: water does not fit neatly within geographical or policy boundaries. The need to coordinate amongst multiple actors can increase transaction costs and delay needed investments. Regulatory arrangements that govern the allocation of water that were set under the basis of a historic climate may lack the flexibility to adjust to changes driven by climate. More generally, the long-lived nature of many assets means that predictable policy frameworks will be essential for encouraging investment.
- Data and capacity: the lack of suitable capacity to model the impact of extreme weather events on hydrological conditions serves as a barrier to the development and planning of investments in water infrastructure.
- Constraints on alternative funding and financing sources: insufficient tariff revenue in many countries (above) means that large-scale and landscape-scale investments are reliant upon public budgets and international concessional finance. Non-market benefits (such as positive impacts on biodiversity) are challenging to translate into revenue streams. Interventions across scales can be hindered by a lack of access to credit, particularly in EMDEs.

Sectoral opportunities

- Enhance water governance: Weak or fragmented governance can create uncertainty for investors and lead to inefficient or competing uses of water. Strengthening co-ordination mechanisms and aligning institutional responsibilities, through clear mandates, data sharing and integrated planning,

can help manage water more effectively at the scale of hydrological systems. For example, basin-level governance bodies can facilitate public–private partnerships for climate-resilient irrigation or flood control by offering a clear framework for risk-sharing and resource allocation.

- Examine use of economic instruments: The OECD Recommendation on Water calls for using economic instruments to facilitate improved water resources management (e.g. water abstraction charges), support for water-efficient technologies or for the use of alternative sources of water (e.g. reclaimed water) (OECD, 2016[47]). Well-designed economic instruments (e.g. tiered pricing systems) can strengthen the incentive to use water efficiently and raise revenues to support needed investment, while ensuring access to water to low-income households.
- Examine regulatory arrangements: Regulatory arrangements may need to be revised to improve co-ordination and adjust allocation regimes. There are also opportunities to enable the use of innovative approaches, such as nature-based solutions, or financing models such as land value capture. Price regulation for water utilities may need to be examined to ensure that there is adequate scope for necessary investments to build climate resilience.
- Realise the potential of blended finance arrangements: blended finance can provide a powerful tool for bringing greater investment into the water sector. This includes the use of "de-risking" instruments and technical assistance to support large-scale and landscape-scale projects. Efforts to standardise and pool water-related investments can help to bring in new sources of finance. Innovation will also be critical to address evolving weather-related risks. Grants and concessional finance, including from philanthropic sources, can have a catalytic role in supporting the development and implementation of innovative technologies.

Box 5. Case studies: Water

Climate Resilient Water Sector (Grenada)

This initiative aimed to help Grenada to address pressures on its water resources, given rising temperatures, changing patterns of rainfall and saltwater intrusion into groundwater sources due to sea-level rise. The Green Climate Fund (GCF) is supporting efforts to improve water efficiency and management in Grenada with a grant of USD 38.7 million. This project, implemented by GIZ (the German development agency), includes an integrated package of measures that aim to improve water security. These measures include the creation of a Water Resources Management Unit (WRMU) as a national regulator, improvements in data collection and revision of water tariffs to encourage efficiency. Technical and financial support will be provided to the agriculture and tourism sectors to help them improve their efficiency of water use, for example through the use of rainwater harvesting.

Delta Programme and Fund (Netherlands)

Water management is a high priority in the Netherlands given that around 26% of the country lies below sea-level and around 60% of the country is susceptible to flooding. The 2012 Delta Act created the current structure for planning to manage flood risks, aiming to support a coherent and adaptive approach in the face of pressures. Planning takes a consensus-based approach bringing together relevant ministries, local authorities and water boards and is led by the Delta Commissioner. Each year, a Delta Programme is published featuring specific investments and suggested policy measures. Implementation of specific investments is largely funded through a Delta Fund (a dedicated element within the national budget), which includes a total budget of EUR 25 billion for measures between 2024-2037.

Source: Reproduced from OECD (2024[7]), *Climate Adaptation Investment Framework*, https://doi.org/10.1787/8686fc27-en.

4 Good practices and options to scale up finance and investment for adaptation

A comprehensive approach is needed to achieve a significant increase in finance for investment, across three themes: capacity and data, domestic policies and international support. Adaptation is context-specific policy area, with needs and priorities varying across countries. The following table summarises a set of options and good practices that could be implemented to overcome bottlenecks to investment in these areas, which are discussed in greater detail in the following sections.

Table 4. Summary of good practices and options for scaling-up finance and investment in adaptation

Non-prescriptive list of measures that can be taken to support investment in climate resilience

Theme	Action area	Options and good practices
Capacity and data	Strengthening access to high-quality climate data and tools	• Increase funding to support the development of weather observation systems • Invest in "last mile" solutions to expand access to climate data, such as online platforms • Encourage open data on climate risks
	Improving transparency about climate resilience	• Strengthen interoperability of climate-related taxonomies • Integrate climate adaptation into transition plans and other forms of disclosure • Encourage ratings and labels to identify climate resilient investments
Domestic policies	Strengthening the domestic enabling environment	• Undertake adaptation investment planning to identify priority needs in line with national adaptation objectives • Assess alignment of domestic policies with climate resilience objectives
	Scaling up domestic resource mobilisation	• Integrate adaptation into government processes (e.g. budgeting, procurement and project appraisal) • Ensure clear allocation of climate-related risks within Public Private Partnerships (PPPs) • Explore targeted support mechanisms for private investment (e.g. tax incentives)
	Enhancing the contribution of insurance markets to encouraging adaptation	• Explore initiatives to expand access to insurance and reinsurance (e.g. InsuResilience Partnership) • Ensure that insurance encourages investment in risk reduction and efforts to "build back better" following a loss
International support to mobilise investment	Improving the quantity and accessibility of international concessional finance for adaptation	• Set internal targets for international providers of adaptation finance, where appropriate • Encourage use of programmatic approaches • Expand use of policy-based lending to improve enabling environment for investment

Theme	Action area	Options and good practices
	Standardising and streamlining processes for accessing climate finance	• Adopt common application and reporting frameworks • Support direct access to facilitate finance to local communities
	Mobilising private investment through blended finance and project preparation facilities	• Use development finance more catalytically to mobilise private finance towards adaptation, including through the use of blended finance • Integrate climate adaptation into project preparations facilities • Enhance co-ordination mechanisms (such as country platforms) linked to national priorities
	Enabling innovative finance mechanisms	• Explore potential of innovative instruments such as debt for climate conversions and resilience bonds

Capacity and data

Improvements in access to data and capacity can underpin efforts to mobilise additional investments for adaptation, as well as facilitating the integration of climate resilience into all investments. This includes integrating traditional and local knowledge, where possible. In terms of the underlying climate data, the main requirements include:

- Sufficient geographical granularity to capture the investment's local climate: Global climate models generate outputs at coarse scale (100-250km grid). Statistical analysis of historical climate trends can be used to downscale these projections to 10km scale, with the quality of this depending upon the availability of historic weather data.
- Covering relevant scope: Need to provide the climate variables that are relevant to the investment and over relevant time horizons.
- Communicating uncertainties to decision makers: presenting the uncertainties inherent in climate projections is essential for planning investments that are robust to a range of future scenarios.

There has been considerable progress in the quality and accessibility of climate data services, particularly in Africa and Asia. For example, the number of countries in Africa providing only basic access to data has fallen from 8 to 3 (WMO, 2024[48]). Key drivers of this improvement in capacity have been regional cooperation, international support (including through stakeholder engagement) and effective collaboration between data providers and data users (WMO, 2024[48]).

Further efforts through partnerships such as ClimDev can support the translation of climate data into decision-relevant information (see Box 1). In particular, providing tools to translate climate projections will influence the performance of a given project or programme: for example, how potential changes in daytime temperatures will influence the efficiency of solar panels, or how investment in adaptation will reduce physical risks to property. This requires modelling and additional data to translate the changes in a climate variable into a relevant impact.

As such, there is scope to improve the overall "information ecosystem", which can include contributions from the public and private sectors, adapted to the context of specific countries. Key areas for action include improving access to climate data and supporting open data approaches, as well as strengthening the translation of that data into decision-relevant information. In parallel to efforts to increase the supply of data and capacity, streamlining processes and supporting standardisation and inter-operability can help to reduce the demands on this capacity. Among the ongoing efforts to strengthen the adaptation information ecosystem, the G7 *Adaptation Accelerator Hub* (AAH) stands out as a promising initiative to help address persistent data and capacity gaps that hinder the development of bankable adaptation projects (Box 10).

Strengthening access to high-quality climate data and tools

Global collaboration has a key role in improving the quality and accessibility of decision-relevant information. The EU's Copernicus programme and the US NOAA's National Centers for Environmental Information provide extensive global datasets relevant to understanding historical climate trends and projecting future impacts. The IPCC provides access to core climate scenarios through its Data Distribution Centre. These initiatives have provided consistency, quality control and accessibility for climate data. International collaboration could build on this success by improving the quality and comprehensiveness of input data for this process.

- support the expansion and maintenance of weather observation networks in developing countries
- support the capture and digitisation of historical weather data.

There is also scope to support the development of climate platforms to provide downscaled data in a usable format for end users. For example, the World Bank's Climate Change Knowledge Portal provides access to comprehensive data at the global, regional and national levels. It brings together datasets covering climate projections, disaster risk and socio-economic trends and provides tailored knowledge products tailored to different end users. The Global Risk Modelling Alliance, established by the Vulnerable 20 (V20) group of countries and the Insurance Development Forum (IDF), provides access to data, tools and expertise to improve understanding of disaster-related risks.

Improve transparency about climate resilience

Improving information flows about exposure to physical climate risks, and the benefits of adaptation in reducing those risks, will be critical for ensuring the efficient use of capital, avoiding the accumulation of systemic risks and helping to identify investment opportunities. Standardised methodologies for assessing exposure to physical climate risk, such as the PCRAM (Physical Climate Risk Assessment Methodology) tool have been developed to support assessment and communication of these risks. There have been considerable efforts to improve transparency in relation to understanding potential exposure to physical climate risks:

- Disclosure: physical climate risks are included within the scope of initiatives to support the disclosure of climate-related risks, including the ISSB's IFRS S2 standard and the European Sustainability Reporting Standards (see Box 6). These efforts could be further supported by supporting the development of standardised metrics for reporting, particularly in relation to potential opportunities from climate change.
- Stress-testing: central banks are taking an active role in analysing the potential impacts of weather-related risks on the stability of the financial system (NGFS, 2024[49]). The current NGFS scenarios for physical risks do not include the impact of tipping points and other non-linearities in the climate system, or the impacts of compound events (NGFS, 2024[50]). Further efforts to develop methodologies for integrating the impacts of climate-related risks into stress testing would enhance transparency in this area.
- Commercial data providers: there are a growing number of private sector providers offering datasets to help understand exposure to climate risks using proprietary approaches.

Exposure to physical risk is a key driver of investment in climate adaptation, but this is only one part of the issue. For example, the consequences of locating an industrial facility in a flood zone depend upon the design of the facility, integration with supply chains, strength of contingency planning. Further efforts to improve the quality of risk analysis are needed to ensure that metrics provide a relevant measure of risk.

Efforts are also underway to broaden the focus from risk exposure to identify the benefits of adaptation. Effective mechanisms to identify investments that are well-adapted to weather-related risks, or contribute

to the adaptation of others, will be a critical step for encouraging investments in resilience through instruments such as green bonds, or policy incentives (discussed below). Key areas for this include:

- Transition plans: although originally designed to communicate the proposed approaches for climate mitigation, these are now being considered to help communicate entities' plans to adapt to climate change. This is explored further in the NGFS input paper to the G20 SFWG.
- Taxonomies: twenty-four adaptation-related taxonomies were published between 2020 and 2024, including voluntary and government-led initiatives (Spacey Martin, Ranger and England, 2024[51]). These have been developed to meet different needs, but tend to share underlying principles and approaches. In particular, they tend to be based on the categorisation in terms of the process being followed (e.g. climate risk assessment) rather than on the basis of sector or technology. Further efforts to ensure interoperability between taxonomies, whether voluntary or mandatory, will support market development and help to reduce transaction costs.
- Resilience ratings and labels: there are a number of relevant initiatives to help identify investments that have integrated climate resilience. The World Bank's Resilience Rating System provides a score from A+ to C on two dimensions (resilience of the investment to climate change, and the project's contribution to resilience of others). Climate resilience is also one of the dimensions included in infrastructure labelling systems, including the Blue Dot Network and FAST-Infra.

Despite this progress, there is scope to further improve transparency about adaptation within financial markets. Key areas for future exploration could include: mapping gaps in the current information ecosystem, identifying options to enhance consistency between the mechanisms listed above and identifying areas of good practice in critical areas such as development of common definitions and approaches to credibly communicate adaptation benefits. Such work could explore the use of Key Performance Indicators (KPIs), potential of new tools such as AI to process heterogenous data and approaches to labelling or rating of investments, building on existing initiatives.

Box 6. Enhancing disclosure of climate-related risks through data and capacity

Disclosure of climate-related risks and opportunities can help to raise the visibility of these issues within organisations, inform capital allocation decisions and contribute to transparency about progress in adapting to climate change. Climate change impacts are included in major international initiatives for reporting included the International Sustainability Standard Board's (ISSB) IFRS S2 standard and the European Sustainability Reporting Standards. A general principle is that reporting entities should aim to identify the financial consequences of climate change impacts under different scenarios, including impacts such as potential loss of revenues, damages to assets or increased operating costs.

Providing quantitative estimates of impacts will require access to localised climate scenarios and access to models that translate climate variables into hazards (e.g. drought frequency and severity). In addition, reporting entities will require the internal capacity and data to understand how climate hazards could specifically affect their business, informed by experience of past extreme events and prospective modelling.

Additional support can help to improve the quality of reporting, particularly for micro, small and medium-sized enterprises that face strong capacity constraints. Areas for intervention include the development of websites that provide access to data and tools, such as Business Development Canada's Climate Action Centre. The development of standards metrics and indicators would also facilitate transparency and reduce transaction costs.

Source: OECD (2024[7]), Climate Adaptation Investment Framework, https://doi.org/10.1787/8686fc27-en; OECD (2024[52]), Implementing Sustainability Reporting Requirements that Work for SMEs, https://g20sfwg.org/wp-content/uploads/2024/06/P3-G20-SFWG-OECD-Implementing-sustainability-reporting-that-works-for-SMEs.pdf .

Domestic measures

Strengthening the domestic enabling environment

Adaptation is a systemic challenge both in terms of the propagation of climate risks and the development of adaptation responses. Experience with climate mitigation has shown that clear and consistent policy frameworks are essential for enabling investment at scale (see Box 7) Articulating strategic priorities and strengthening institutional co-ordination mechanisms is essential to direct finance and investment toward adaptation needs. Addressing any relevant regulatory distortions and providing regulatory incentives can strengthen incentives to invest in adaptation, while discouraging investments that undermine climate resilience.

Clearly defining roles and responsibilities across different levels and sectors of government, as well as between public and private actors ensures policy coherence and institutional co-ordination. Strong co-ordination mechanisms help prevent fragmentation and conflicting objectives, while enabling integrated decision-making on adaptation priorities. Mainstreaming climate adaptation into broader development strategies and fiscal planning ensures that adaptation is not treated in isolation but is embedded across economic, environmental, and social policy domains. Engaging finance and planning ministries is essential for aligning adaptation priorities with national investment strategies and budgetary processes.

Clear objectives, metrics, and targets for adaptation should be embedded within national strategies and action plans. Identifying the economic consequences of extreme weather events and mapping out the financial needs for adaptation investments are critical for mobilising public and private resources. These insights should inform robust financing strategies, including the development of sectoral or national adaptation investment plans. Monitoring and evaluating progress, particularly in terms of investment mobilisation, helps maintain accountability and inform future decision-making.

A stable, transparent, and predictable regulatory framework is vital for directing capital towards resilient investments. Regulations should support adaptation goals rather than hinder them. This could require reforming subsidies that create perverse incentives (e.g. in agriculture or energy) and updating existing technical codes and regulatory standards to reflect current and projected climate risks. Performance-based standards can foster innovation by focusing on desired outcomes instead of prescribing fixed methods, allowing for more flexible and creative solutions.

Regulatory incentives can play a catalytic role, for example by encouraging nature-based solutions, supporting efficient and equitable water allocation, or promoting resilient building practices through updated codes and standards. Infrastructure sectors regulated for economic efficiency (e.g. water, energy, transport) should incorporate adaptation into their pricing and investment frameworks to avoid long-term maladaptation.

Table 5. Examples of potential regulatory reforms in key sectors

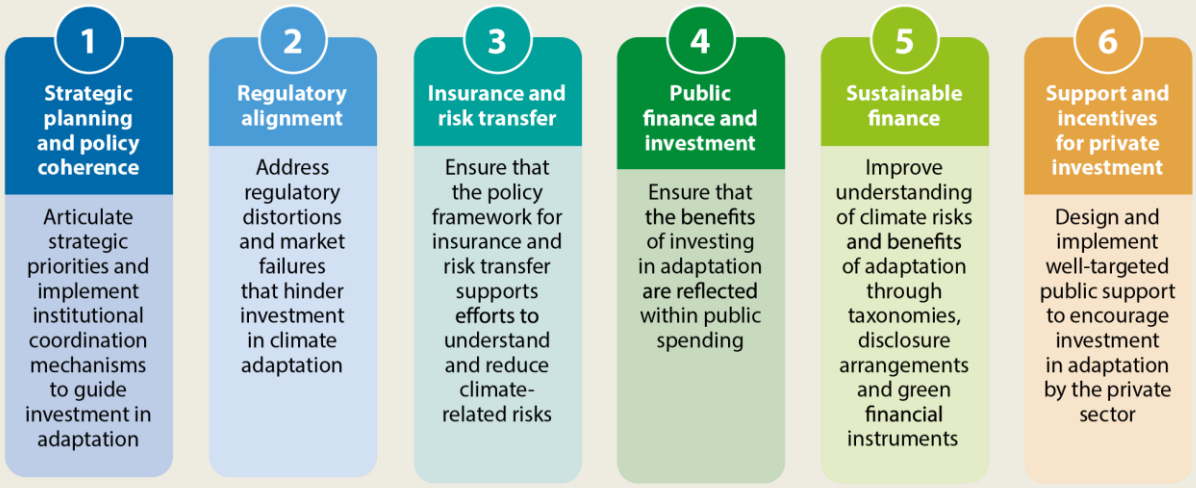
Sector	Examples
Agriculture	Reducing and redirecting commodity-specific agricultural subsidies
Buildings	Retrofitting the existing building stock for greater energy efficiency
Industry	Updating health and safety regulations to account for higher summer temperatures
Infrastructure	Mandating the integration of green roofs into urban development
Natural environments	Mandating the restoration of mangroves and coral reefs
Water	Ensuring that the price of water faced by end users reflects its value

Source: Based on OECD (2024[7]), Climate Adaptation Investment Framework, https://doi.org/10.1787/8686fc27-en.

Box 7. OECD's Climate Adaptation Investment Framework (CAIF)

The OECD's Climate Adaptation Investment Framework provides a comprehensive approach for strengthening the domestic policy framework for investment in climate adaptation. Building on the OECD's Policy Framework for Investment and FDI Qualities Toolkit, it identifies six key policy areas for enabling investment in adaptation. Each building block contains diagnostic questions to identify potential policy gaps, examples of good practice and signposts to further resources.

Figure 2. Components of the CAIF



Source: OECD (2024[71]), *Policy Highlights: Climate Adaptation Investment Framework*, https://www.oecd.org/en/publications/climate-adaptation-investment-framework_8686fc27-en/support-materials.html.

Scaling up domestic resource mobilisation

The public sector is a major source of investment in climate adaptation. The relative priority of areas of public spending may also change as the frequency and severity of extreme events rise. To effectively mobilise domestic resources, governments must integrate climate considerations into public financial management. This involves embedding climate resilience into budgeting processes, appraisals, procurement policies, fiscal policy frameworks and financial risk management strategies:

- *Green budgeting and expenditure tracking* provides a framework that can support the integration of adaptation into budgetary processes. Key instruments include the integration of climate into the design of medium-term expenditure frameworks, requirements specified in the budget preparation phase ("budget circular") and reporting. These efforts can be supported by the development of measurement frameworks to define and track public investment that supports climate adaptation. Setting targets and tracking expenditure relevant to adaptation investment can increase accountability and transparency which can strengthen incentives to mainstream adaptation.
- *Project and programme appraisal tools* may need to be adjusted to account for the role of uncertainty, non-market benefits and discount rates. For example, the benefits of adaptation investments, in terms of saving lives and improving health and wellbeing can be assessed using non-market valuation techniques or multi-criteria analysis for project selection.

- *Public procurement policies* should account for benefits over the lifecycle of investments. This approach encourages the selection of goods and services that, while potentially more expensive upfront, offer lower maintenance costs and greater durability in the face of climate challenges. For instance, investing in infrastructure materials that are more resistant to extreme weather can reduce repair costs and service disruptions over time.
- *Public-private partnerships (PPPs)* should clearly identify and manage climate risks. This involves delineating responsibilities between public and private entities for addressing climate-related damages and ensuring that contracts include provisions for risk mitigation and adaptation measures. Such clarity helps prevent disputes and ensures that infrastructure projects remain functional and safe under changing climate conditions
- *Fiscal policy* should strengthen incentives for investing in adaptation through a policy framework that allows for the implementation of taxes or charges on externalities that hinder investment in adaptation. For example, the city of Philadelphia has introduced a stormwater fee based on impermeable surface area, which provides an incentive to replace paved areas with green spaces. Tax credits and rebates can be used to encourage retrofitting and investment in R&D.
- *Financial risk management* includes establishing reserve funds, securing insurance coverage, and exploring financial instruments like catastrophe bonds to manage risk. By proactively planning for potential fiscal shocks caused by climate events, governments can maintain financial stability and ensure the continuity of essential public services.

Enhancing the contribution of insurance and reinsurance markets

The rising frequency of extreme weather events is expected to exacerbate challenges related to insurance coverage by increasing the frequency and severity of extreme weather events, making potential losses larger and less predictable. Effective insurance and risk transfer arrangements can support investments in adaptation by rewarding risk reduction investments and providing funding to support resilient reconstruction. By reflecting the underlying risk in insurance premiums, these mechanisms encourage policyholders to adopt risk-reducing measures.

The limited availability and take-up of insurance coverage for climate-related risks, particularly in developing countries, is a significant barrier to enhancing the contribution of insurance to encouraging adaptation. Governments could support broader insurance coverage for climate-related risks by:

- leveraging increased access to digital technologies to support the reach of insurance products
- encouraging the development of suitable and affordable insurance coverage products, including microinsurance and parametric insurance
- improving clarity on coverage for climate-related risks (and exclusions) and considering the potential advantages (and disadvantages) of requiring insurers to offer coverage for climate-related risks automatically in property insurance coverage
- supporting sustainable access to affordable reinsurance capacity, including through capital markets
- considering the establishment of Public-Private Insurance Programmes to ensure the availability of affordable insurance coverage for climate-related risks
- supporting insurance literacy and building awareness of the benefits of, and need for, insurance coverage against climate-related risks.

Translating greater insurance coverage of climate-related risks into support for adaptation will require further efforts by the insurance sector to provide risk information and incentives that encourage risk reduction by policyholders. Enhancing access to quality data and modelling tools will help address the challenges in accurately quantifying complex weather-related risks and establishing accurate premiums

for coverage and premium reductions for risk reduction measures implemented by households and businesses. Eliminating the restrictions that some jurisdictions impose on the premium prices[6] that insurers can apply to coverage for weather-related risks can incentivise the use of risk-based pricing and the development of risk assessment tools for underwriting coverage. Insurance supervisors can play an important role in ensuring that premiums are adequate and fair[7] and that insurers provide consumers with pricing incentives for the implementation of effective risk reduction measures.[8]

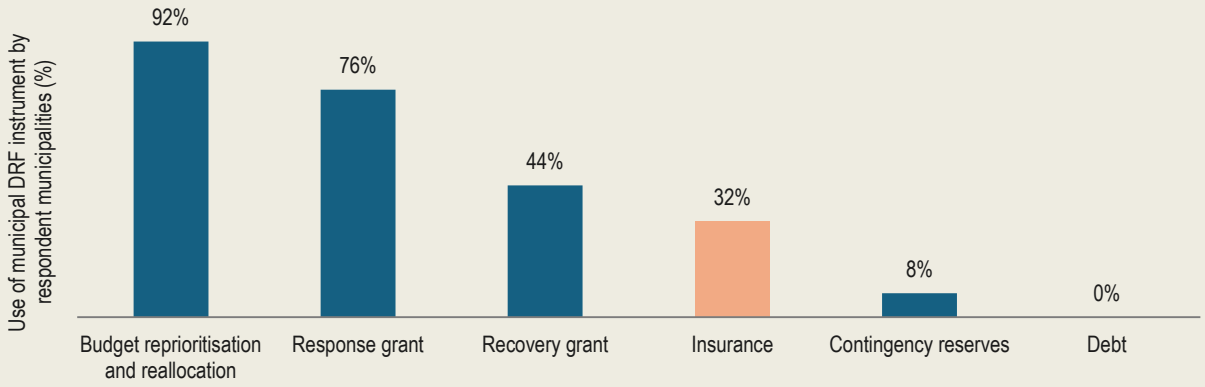
International cooperation is vital in expanding access to insurance mechanisms in developing countries. Initiatives like the G7/V20 Global Shield against Climate Risks, launched in 2023, aim to strengthen financial resilience in vulnerable countries through technical and financial support to implement innovative approaches to providing financial protection. Efforts such as the Global Risk Modelling Alliance support the availability of sophisticated climate risk assessment tools that can be used to underwrite and price insurance coverage.

There are also opportunities for collaboration between the insurance sector and governments to co-finance building back better by directing insurance company claims payments and government recovery and reconstruction assistance towards resilient reinstatement.

Box 8. Case study: Parametric insurance in South Africa

South Africa faces a substantial disaster risk protection gap, with 71% (or USD 6 billion) of disaster-related losses uninsured over the decade ending in 2023. This vulnerability is expected to worsen as the frequency and severity of natural disasters rises (IPCC, 2022[53]). Despite a robust insurance sector with an 11% penetration rate and USD 16 billion in non-life assets, public assets, particularly those managed by municipalities, remain largely underinsured (Swiss Re, 2025[54]).

Figure 3. Overview of the use of DRF instruments by a sample of 26 municipalities



South Africa's 257 municipalities are critical in disaster management, as they are responsible for the provision infrastructure and essential services for the country's largely urban population (68% as of 2024). Municipalities are mandated to use their own resources before seeking national aid for disaster response. However, their capacity is limited by strained budgets and governance issues. A recent study by the National Treasury and World Bank suggests that insurance plays a minor role relative to other disaster risk finance instruments (DRFs) for municipalities (World Bank, 2025[55]). Only a third of sampled municipalities claimed insurance for natural disaster losses (Figure 3), and even then, payouts were slow to process (one to two years). Instead, municipalities rely on their own budgets and contingency reserves, and on national

grants (totaling nearly USD 0.35 billion since 2022 to 54% of municipalities), which are often slow and difficult to deploy effectively.

South Africa's well-developed insurance sector has the potential to play a greater role in municipal disaster risk management, but several challenges contribute to the insurance protection gap.

On the demand side, municipal constraints include:

- Budgetary pressure: Insurance is seen as a cost rather than an investment during procurement.
- Underinsurance: Common practices include unfunded self-insurance, insuring at book value instead of replacement value, and excluding critical infrastructure (roads, bridges, underground assets) to reduce premiums.
- Lack of understanding: Many municipalities are unaware of policy conditions or available options.
- Poor asset management: Incomplete asset registers, aging infrastructure, and inadequate maintenance hinder claims.
- Complex and slow claims: Payouts for large disasters are often delayed.

On the supply side, industry constraints include:

- Limited competition: Only two insurers serve municipalities, with one holding a majority share.
- Unattractive clients: Municipalities are often viewed as high-risk due to financial instability, poor governance, and weak risk management.
- Data gap: Unreliable data on disaster impacts, asset conditions, and values impede accurate risk modelling and pricing, deterring broader insurer participation.
- Reinsurance costs: High reinsurance costs and constraints further limit market options.
- Regulatory barriers: Current insurance legislation does not fully incorporate parametric insurance, hindering innovation.

Recent reports and initiatives highlight several strategies to enhance municipal insurance and reduce the disaster protection gap in South Africa:

- **Partnerships for risk management and data:** Collaboration between municipalities and the insurance industry, supported by national insurance guidelines and capacity-building, can improve data quality and risk management practices. The Prudential Authority is also developing disaster risk indicators to inform policy.
- **Formalising self-Insurance and contingency reserves:** Models like the City of Cape Town's self-insurance, involving internal risk-pooling and external reinsurance, can improve financial responsiveness and reduce reliance on external providers. Formalising such structures (e.g., cell-captive structures) could offer cost savings and faster payouts for well-governed municipalities.
- **Exploring parametric insurance:** National Treasury is investigating parametric products for cities, following successful pilots for drought risk in the agricultural sector. Parametric insurance offers faster, more transparent payouts based on predefined triggers, complementing traditional indemnity insurance in a risk layering approach. The Prudential Authority is exploring its formal integration into the insurance framework.
- **PPPs for uninsurable risks:** For commercially uninsurable risks (e.g., certain natural disasters or social unrest), expanding the mandate of state insurer Sasria to include natural disaster risks for municipalities is proposed. Sasria could also provide disaster risk reduction capacity building and direct response services for less-resourced municipalities.

Source: World Bank (2025[55]), Disaster Risk Financing Approaches: Independent Report on the Experience of South Africa Municipalities, http://documents.worldbank.org/curated/en/099032825104570788.

International support to mobilise investment

Notwithstanding the strong economic case for domestic investment in adaptation, many developing countries struggle to dedicate the required resources to finance their needs. These challenges have been exacerbated in recent years by rising levels of public debt and higher interest rates. External finance – from public and private sources alike – is therefore critical.

International assistance, including external finance, needs to be anchored in country-defined and -led national plans. At the same time, recipients need to be given the confidence that their adaptation plans – alongside wider development and climate priorities – will be backed and financed in part by stable, long-term assistance. This underscores the need to move towards programmatic approaches for financing and supporting adaptation, including through country platforms. Examples of country platforms and lessons for scaling up their use in adaptation are explored in Box 9.

Box 9. Country platforms for adaptation

Systematic efforts to co-ordinate beneficiary governments' domestic efforts, donor assistance, and private investment can simultaneously guide domestic policy and reform efforts to reflect investor needs, while providing greater direction for international public and private climate finance on priorities. To this end, country platforms have risen in the agenda in recent years.

The objectives and potential benefits of country platforms include:

- mobilising the needed domestic and international finance to support developing countries' development priorities
- providing longer-term certainty and stability on international support for national priorities, thereby supporting more ambitious national action
- supporting alignment between national needs and priorities, on the one hand, and providers' capacities and mandates, on the other
- strengthening co-operation between the public and private sector at the country level, including by providing a channel of communication and co-ordination on high level national strategies and sector pathways, policy reforms required to stimulate investment, and prospective projects through the co-creation of project pipelines
- reducing transaction costs associated with more fragmented, project-by-project approaches.

Country platforms have been most prominently used to target climate action in the energy sector, including through the *Just Energy Transition Partnerships (JETPs).* There is therefore scope to widen the sectoral and thematic priorities of country platforms, either by mainstreaming adaptation considerations into existing platforms, or by establishing new platforms to target adaptation specifically.

Egypt's Nexus of Water, Food, and Energy (NWFE)

Egypt's *Nexus of Water, Food, and Energy (NWFE)* is one example of this approach. NWFE's goals include "enhancing adaptive capacity and climate resilience and alleviating the associated negative impacts". This includes bolstering adaptation and resilience of the agricultural sector through the adoption of smart agricultural practices, and revitalising Egypt's irrigation and water management systems with a view to addressing future water shortages. NWFE's goals are explicitly linked to the Government of Egypt's 2023-2027 Action Program. By 2023, the NWFE platform had mobilised EGP 110 billion and 86 billion (USD 3.3 and 2.2 billion) for the water and food pillars respectively.

Central to NWFE's delivery is international co-ordination, led and managed by Egypt's Ministry of Planning, Economic Development and International Cooperation. The NWFE platform brings together

a wide range of international partners, including the European Bank for Reconstruction and Development (EBRD), World Bank Group, African Development Bank, various UN agencies, and private sector alliances. The Ministry plays a crucial role in linking international support to domestic priorities, and supporting the establishment of and co-ordinating meaningful working relationships between relevant international and domestic actors, including various line ministries and national bodies across the Egyptian system.

AfDB's Climate Adaptation Country Compacts

The AfDB is prioritising investments for adaptation through the Climate Adaptation Country Compacts, which seeks to increase adaptation investments in Africa. The Compacts are multi-sectoral in nature, with specific programs to mainstream adaptation in key priority sectors identified by the countries and all other key sectors that will be significantly affected by climate change in the short- and medium-term at country level. In addition to facilitating co-ordination between individual African countries and their development partners and private investors to increase adaptation investments, the Compacts outline key investment priorities, financing needs, and finance mobilisation strategies for implementing climate adaptation measures for each country while navigating the available financing opportunities and thus aligning efforts and resources towards common goals. The Compacts, when fully deployed, will provide individual African countries with a solid foundation for decision making, resource allocation, and greater investments in their adaptation projects and programs.

Source: Ministry of International Cooperation of Egypt (2023[56]) AfDB; (2023[57]), Climate Adaptation Country Compacts, https://blogs.afdb.org/climate-change-in-africa/african-development-bank-in-2023-a-comprehensive-journey-in-climate-action.

Improving the quantity and accessibility of international concessional finance

Providers of development finance have a central role in financing and strengthening adaptation in developing countries, many of which – especially least development countries (LDCs) and small island development states (SIDS) – are among those most affected by extreme weather events.

International public climate finance (in the context of the USD 100 billion goal) remains skewed towards mitigation, despite increases in the share of funding going towards adaptation. In 2022, of the USD 115.9 billion provided and mobilised by developed countries towards climate action in developing countries, only USD 32.4 billion targeted adaptation. This compared to USD 69.9 billion targeted mitigation (and USD 13.6 targeting both objectives simultaneously) (OECD, 2024[4]).

As outlined in Section 3, the international landscape for finance for adaptation is complex and challenging for developing countries. Development finance providers can take a number of steps to strengthen development practices and systems, with a view to ensuring more efficient delivery of adaptation finance (OECD, 2023[12]). These include:

- **Setting internal quantitative targets for adaptation finance:** This can help providers allocate resources more effectively to achieve a balanced distribution of climate finance for short-term resource allocation and long-term strategic planning. Internal targets can also incentivise providers to more proactively mainstream adaptation into wider development projects that may not have a primary adaptation (or climate) related objective. These targets could include specific geographic targets for allocation of adaptation finance, to ensure that the poorest and most vulnerable countries are adequately served.
- **Move from project-based to programmatic adaptation approaches:** Programmatic approaches to development assistance embed a set of smaller, often interlinked, projects within multi-year programmes at the regional, country, or sector level. These can be aligned with national strategies and priorities, including NAPs. Programmatic approaches can help secure longer-term, more stable

financing for adaptation priorities, thereby supporting long-term adaptation planning, whilst creating opportunities for synergies across multiple priorities and projects. There is scope to widen the use of country platforms for adaptation, bundling programming support from providers and recipients to co-finance projects (see Box 9). In anchoring individual projects in long-term strategies alongside policy action, country platforms can help make individual investments more attractive to commercial finance.

- **Increase the use of policy-based climate finance for adaptation:** Policy-based finance is development finance provided as unearmarked budget support, disbursement of which is linked to an agreed set of policy reforms. Policy-based finance can be used to complement project-level interventions. Adaptation should also be integrated into policy-based reforms with other primary objectives. Policy-based finance offers recipients more flexibility and ownership over the use of funds, and reduce transactions costs. It is not suitably in all contexts, however, and requires strong public financial management systems. Moreover, given policy-based finance is typically provided as loans, it may not be suitable for highly indebted countries.

Standardising and streamlining processes for accessing climate finance

Upstream efforts to simplify and harmonise access to climate funds would reduce administrative overhead, increase transparency and avoid potential duplication of effort. The OECD report, *Scaling up Finance for Adaptation in Developing Countries* (2023[12]) highlights the following areas for international efforts:

- **Simplify and improve the interoperability of application procedures across different climate finance providers.** Efforts to support this goal include the GCF and GEF Long-Term Vision on Complementarity and Coherence, which aims to support collaborative programming and contains the commitment to undertake the development of shared guidance on measuring project impacts. Further areas to explore could include mutual recognition of accredited entities between multilateral climate funds
- **Streamline the architecture of climate funds** to address fragmentation by avoiding the creation of new funds and encouraging existing funds to strengthen collaboration (G20 Brasil, 2024[58]).
- **Encourage climate funds to provide direct access to resources.** Direct access can support the development of domestic capacity and support the implementation of locally led projects. However, the complexity of the accreditation processes can act as a barrier to the accreditation of local entities. Further efforts to facilitate access and streamline application processes would facilitate direct access.

Supporting the mobilisation of private investment using concessional finance, including through blended finance and project preparation facilities

The private sector has a key role to play in adaptation, both in financing investment directly, and by ensuring economic activities and assets are resilient to climate impacts. This makes it essential to unlock finance from private sources to contribute to scaled-up adaptation financing. Blended finance – the strategic use of development finance for the mobilisation of additional finance towards sustainable development – is one of the main approaches to achieve this objective.

The record of public finance in mobilising private finance for adaptation remains limited. Between 2016 and 2021, developed countries' public finance interventions mobilised in total USD 7.1 billion of private finance for adaptation, or USD 1.2 billion per year on average. This compares to USD 69.5 billion of private finance mobilised for mitigation in the same period (OECD, 2023[12]). This reflects the fact that adaptation has been historically underserved by development assistance in two respects: first, overall development finance flows towards adaptation have been well below those dedicated to mitigation; and second, less relative effort has been placed on private finance mobilisation for adaptation than for mitigation.

There is therefore considerable scope to increase the mobilisation of private finance for adaptation through the catalytic use of development finance, including through blended finance. Three aspects should guide the deployment of development finance to this end (OECD, forthcoming[59]):

- **Blended finance needs to promote integration of adaptation throughout the investment cycle:** Fundamentally, private sector financing of adaptation should be thought of as a means to optimise investment performance and outcomes. For example, climate-resilient agricultural practices serve to protect and/or enhance yield and productivity, thereby maximising earnings. Development actors should therefore ensure their assistance programming, including blended finance, supports the integration of adaptation into business decision-making as a matter of efficiency, robustness, and financial due diligence.
- **Blended finance needs to focus on overall financing constraints in developing countries as the defining challenge for scaled adaptation finance:** Integrating adaptation into investments should improve their projected financial performance and risk profile, and therefore allow them to secure finance more easily. However, these potential gains are often far outweighed by the overall financing constraints in developing countries (see Box 13). The development context is key. Blended finance for adaptation should therefore focus opportunities for catalytic impact through scalability and market creation, and in particular in areas where the economic value of adaptation is not well-reflected in markets or hidden through market failure.
- **Blended finance for adaptation needs to overcome intermediation constraints:** Underdeveloped financial markets struggle to play the crucial role of intermediation for investment – matching the supply of to the demand for finance. One corollary of underdeveloped financial systems is their inability to channel large stocks of international finance towards individual projects and investment in adaptation. Blended finance can help bypass this, by developing solutions to match potential foreign investment to local demand, whilst supporting local financial sector development in the medium-term.

In light of the above, the forthcoming OECD Blended Finance Guidance for Climate Change Adaptation presents four steps for providers of development finance to determine the form and shape of blended finance approaches for adaptation (OECD, forthcoming[59]). These are outlined below:

- Step 1: Select climate-resilient themes and subthemes: Where investment needs for climate adaptation in developing countries are particularly acute.
- Step 2: Determine the adaptation context and implications for investment: Each project needs to reflect the specific conditions and realities that affect its implementation and performance.
- Step 3: Assess practical considerations that determine effective blended finance approaches for adaptation: Three key factors – investment type, finance providers and instruments – together with specific enabling environment factors and investment barriers for adaptation investments are key to determining the scope for and shape of blended finance approaches in a given development context.
- Step 4: Apply adaptation checks to mainstream adaptation considerations: Five adaptation checks support the integration of adaptation considerations in the context of blended finance.

Development assistance, including blended finance, can be used to support developing countries to identify and develop high-quality adaptation projects, with a view to attracting private investment. It can further be used to address some of the data, capacity and financing constraints that hinder investment in innovative adaptation solutions (Box 10). Indeed, the lack of bankable project pipelines for adaptation is a significant barrier to investment, manifesting in a deficiency of funding proposals (OECD, 2023[12]). Development finance should therefore be deployed more strategically with a view to identifying and

defining specific investment proposals that align with national adaptation priorities, and facilitating the preparation of project proposals. This should include:

- leveraging providers' unique competitive strengths and expertise to deliver targeted capacity development
- targeting support for adaptation planning, including support for NAPs, towards identification of projects
- allowing for more flexibility in defining adaptation projects to allow developing countries to more freely determine which investment they consider to be important to their adaptation and resilience efforts
- working with developing countries upstream to identify development projects with a potential for adaptation, including by mainstreaming resilience into projects primarily focused on wider development priorities.

Box 10. Supporting adaptation innovation through accelerators

The African Adaptation Accelerator Programme (AAAP)

The Africa Adaptation Acceleration Program (AAAP) is a flagship initiative of the African Development Bank (AfDB) and the Global Center on Adaptation (GCA). It aims to mobilise USD 25 billion to scale up and accelerate climate change adaptation actions across Africa. The program operates across four key pillars: (i) Agriculture and Food Security – building climate-smart agriculture and resilient food systems; (ii) Resilient Infrastructure – scaling up investment in climate-resilient infrastructure; (iii) YouthADAPT – financing African entrepreneurs and innovators; and (iv) Innovative Financial Initiatives – unlocking green investment markets to expand access to finance. Since its inception, AAAP has invested in 20 food security projects and 31 resilient infrastructure projects, provided support to 41 YouthADAPT entrepreneurs, and funded several innovative financial initiatives. To date, the AAAP has mobilised USD 9.57 billion through the AfDB's regular operations, in collaboration with the GCA, and recorded significant progress.

G7 Adaptation Accelerator Hub

The recently launched *G7 Adaptation Accelerator Hub* (AAH) seek to address constraints to private investment in innovative adaptation solutions by supporting co-ordination, pipeline development and better alignment between funding and needs. In particular, the initiative seeks to address persistent data and capacity gaps that hinder the development of bankable adaptation projects. The Hub supports developing countries — particularly in Africa — by improving access to decision-relevant climate information, facilitating investment planning processes, and fostering institutional capacity-building. Through the provision of technical assistance, support to data infrastructure, and socially informed feasibility assessments, the AAH helps translate national priorities into actionable pipelines, particularly in countries facing barriers to accessing international climate finance.

Source: AfDB (2025[60]), Africa Adaptation Acceleration Program (AAAT), https://aaap.afdb.org/.

Enabling innovative finance mechanisms

Development finance needs to be tailored to more effectively crowd-in private investment. While the use of blended finance and other private sector instruments has grown in recent years, they remain under-utilised, including for adaptation. Nevertheless, there are good practice examples from across the

development finance ecosystem of the use of blended finance for adaptation. These span a wide breadth of financing instruments and structures, including[9]:

- **Debt:** Large infrastructure projects are typically project financed through structured debt, including through debt issuance. Blended finance can support debt structuring, for example through first-loss structures. Mini-perm loans can also be used to provide flexible, shorter-term financing that can help bridge the construction and operational phases of infrastructure projects.
- **Bonds:** Bonds, including green, social, sustainability, and sustainability-linked (GSSS) and blue bonds, are effective tools for leveraging private finance. They can be used to aggregate smaller scale projects; for large-scale infrastructure projects (for example in the water and energy sectors (Convergence, 2022[61])); or to incentivise progress towards sustainability targets (as is the case of sustainability-linked bonds). Concessional finance can support bond issuances through a range of approaches, including the use of blended finance instruments (e.g. supporting bond issuances by infrastructure PPP projects through the provision of guarantees), or supporting market infrastructure to enable issuances more broadly. Bonds can also be issued by public actors, including local and regional governments, to support investment – including in adaptation – in infrastructure assets, for example mass transit systems.
- **Equity:** Equity, for example provided in the form of repayable grants or concessional equity, can support early-stage, higher-risk projects. Equity is particularly important for adaptation, as critical project design features for adaptation are typically defined at the early stage (OECD, 2022[62]). Early-stage equity and venture capital can also support financing of the application of new technologies, for example in the industrial and agricultural sectors.
- **Guarantees:** Guarantees have proven to be highly effective in mobilising private finance (OECD, 2023[63]). They can be deployed to support adaptation investment in water, transport and energy infrastructure assets, supporting projects to secure cash flows, enhance creditworthiness, and address financing risks in tested, but not widely deployed technologies. Guarantees can also be used to support the aggregation of smaller projects through portfolio approaches.
- **Structured funds:** Structured funds can help unlock financing for utilities at the investor level. They support a shift away from purely concessional donor finance and towards market-rate financing. Portfolio approaches can unlock private finance upstream, by linking capital markets and institutional investors with adaptation projects. Typically, adaptation projects are identified, evaluated, and initiated by an intermediary – for example climate fund managers and a development finance institution – and financed by a mix of development finance and commercial investment.
- **Grants and technical assistance:** Grants can be used to support private capital mobilisation by de-risking adaptation projects in a tailored way throughout project life cycle stages. In early stages of projects, for example, grants can be used to finance feasibility studies, in particular for more innovative projects with more uncertain cash-flows.

In addition to these instruments, green banks, can provide an institutional structure to support the mobilisation of resources for climate change The African Green Bank Initiative (AGBI) is expanding the availability of green finance in Africa while assisting multiple African countries to establish national Green Banks. AGBI is one of the flagship programs under the African Financial Alliance on Climate Change (AFAC), a voluntary network of African financial institutions founded by the AfDB in 2018, to foster collaboration in addressing climate change by for the derisking and financing of low-carbon climate-resilient investments (see Box 11).

Box 11. African Financial Alliance on Climate Change (AFAC)

AFAC advances the AfDB's Climate Change and Green Growth (CCGG) Strategic Framework by equipping African financial institutions with tools and skills to mobilise domestic private climate finance and help address Africa's climate financing gap. The alliance links Africa's financial institutions to unlock private finance and incentivise a shift of their portfolios towards green investments. In 2023, a new AFAC 2023-2027 Strategy was launched bringing in new partners including the Glasgow Financial Alliance on Net Zero (GFANZ) Africa Network. To date, AFAC has increased engagement with the financial sector on climate action, and deployed dedicated capacity building and awareness workshops reaching over 900 members of African financial associations including the Association of African Development Finance Institutions (AADFI), the Community of African Banking Supervisors (CABS), Capital Markets Association of the Monetary Union of West Africa (AMF-UMOA), Signatories of the Nairobi Declaration on Sustainable Insurance (NDSI).

Source: AfDB (2025[64]), African Financial Alliance on Climate Change, https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/african-financial-alliance-on-climate-change-afac.

In addition to deploying development assistance catalytically to support the mobilisation of private finance, development providers can also support country-led efforts to scaling up other innovative financial approaches to address the significant climate adaptation investment needs in developing countries (see Box 12). These include:

- **Debt for climate swaps**: debt for climate swaps – agreements between a sovereign and its creditor(s) that reallocate a portion of ongoing debt obligations towards investments in climate action (GCF, 2024[65]) – can support developing countries by freeing up fiscal space beyond the direct savings generated by the debt swap, by lowering borrowing costs and averting debt-distress. In so doing, they can improve a beneficiary's overall macroeconomic conditions, supporting the conditions for private investment, including by lowering the cost of capital.
- **Resilience bonds**: A sub-set of green bonds, resilience bonds raise capital for climate investment resilience (Global Centre on Adaptation, 2020[66]). The Climate Bonds Initiative has developed a *Climate Bonds Resilience Taxonomy Methodology (CBRT)* to promote a more consistent, transparent, and systematic approach to defining and identifying what constitutes a resilience investment (Climate Bonds Initiative, 2024[67]).
- **Natural disaster risk / climate-resilient debt clauses:** Climate-induced disasters can have catastrophic economic, as well as physical, impacts, affecting a country's ability to service its debts. Climate-resilient debt clauses can dampen these impacts, by allowing sovereigns to postpone their debt repayments if a specified set of circumstances occur (CPI, 2025[68]). Since repayments are postponed, and can be designed in a way that are neutral in terms of net present value, such arrangements can have minimal or no cost for creditors.

Box 12. The Adaptation Benefits Mechanism

The Adaptation Benefits Mechanism (ABM), developed and piloted by the African Development Bank, facilitates payments to private sector project developers in return for "Certified Adaptation Benefits" (CABs). These new cash flows act like an "investment grant" (a source of grant that makes the investment bankable) and are priced such that the cash flow plugs the project's funding gap. The ABM enables project developers to access debt capital markets by providing collateral in form of a signed purchase agreement for CABs. The ABM is recorded on the UNFCCC's Art 6.8 Platform as a non-market instrument because CABs are not fungible or tradable. Once issued, CABs can only be retired and used for reporting of financial contributions towards genuine adaptation needs.

Source: (AfDB, 2025[69]).

5 Deep dive on Africa

This section highlights the impact of physical climate risks and explores further the financing challenges and success stories relating to financing and investing in adaptation in Africa.

Understanding Africa's adaptation challenge

The impacts of climate change are intensifying at a pace that threatens the stability and development progress of economies worldwide. The increasing frequency and severity of extreme weather events—ranging from heatwaves and droughts to cyclones and floods—have profound implications for global economic and social systems. EMDEs, particularly in Africa, are on the frontlines of these challenges. These regions are experiencing disproportionate exposure to climate-induced hazards, which undermine public health, food and water security, infrastructure, and fiscal stability. Africa is especially vulnerable, not only due to its geography and reliance on climate-sensitive sectors such as agriculture but also due to historical underinvestment in resilience-building and structural inequalities.

Several systemic barriers amplify Africa's vulnerability to the impacts of climate change:

- **Technological and capacity gaps:** Limited access to digital infrastructure and innovation hampers climate risk management. The absence of real-time data, early warning systems, and smart agriculture tools reduces preparedness. While the UN's "Early Warnings for All" campaign seeks to close these gaps by 2027, current financial commitments are not yet deemed sufficient. These systems are one of the most cost-effective climate change adaptation measures, providing up to a tenfold return on investment (WMO, 2024[70]).
- **Geopolitical risks:** Geopolitical instability and protectionist trade policies can weaken economic resilience, disrupt supply chains, and reduce fiscal space for climate investments. Trade disruptions can lead to economic instability, including rising prices, inflation, and reduced economic growth. On-going conflicts continue to disrupt food and energy supply chains, increasing commodity prices and diverting global attention and finance from long-term adaptation and resilience investments.
- **Financial system vulnerability:** African economies often lack insurance coverage for climate-related losses. In 2023, over 90% of disaster-related losses in Africa were uninsured, compared to a global average of 62%. The interactions of transition and physical risks or among physical risks heightens sovereign and market vulnerability, creating financial losses (FSB, 2025[71]).
- **Migration and labour market pressures:** In Africa, the World Bank estimates that more than 105 million people could be displaced due to climate stressors by 2050 (Clement et al., 2021[72]). Africa's urban centres are already experiencing population pressure, overstretching basic services. At the same time, labour market transitions—such as the shift from fossil-fuel intensive jobs to green employment—require targeted investment in reskilling.

Closing the adaptation finance gap in Africa: Challenges and opportunities

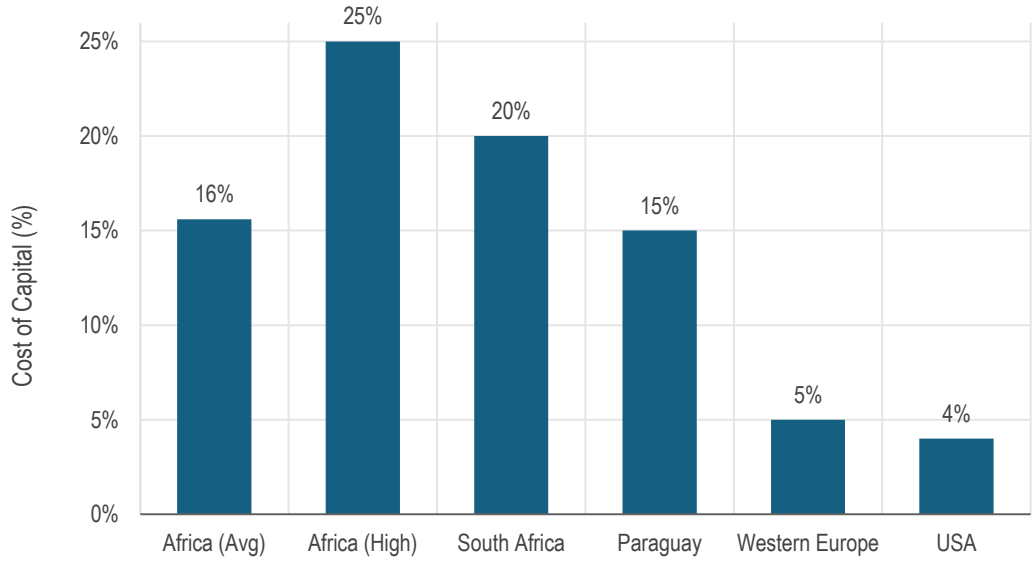
Challenges in financing adaptation

Africa currently receives just 3% of total global climate finance despite its significant vulnerability to the impacts of climate change. This disparity is stark given the continent's rising climate exposure and growing population. According to the GCA, Africa will require USD 53 billion annually in adaptation finance from 2020 to 2035, equivalent to 2–3% of its regional GDP to meet its nationally determined contributions (NDCs) (GCA, 2024[73]). Current annual flows are USD 13 billion on average in 2021-22 are less than 25% of these estimated needs (GCA, 2024[73]).

Major structural and systemic constraints include:

- **Inadequate project pipelines:** There is a lack of well-prepared, investment-ready projects in key sectors like agriculture, water, and coastal infrastructure.
- **Institutional and ecosystem gaps:** Many countries lack strong climate finance ecosystems capable of mobilising, managing, and tracking funds effectively.
- **Private sector underinvestment:** To date, private finance for African NDCs remains largely untapped. As of 2022, the private sector contributed only 14% (USD 4.2 billion) of total climate finance on the continent, much lower than in other regions (AfDB, 2023[74]).
- **Debt vulnerability:** Over half of African countries are either in or at risk of debt distress. High debt servicing costs constrain public investment in adaptation.
- **High cost of capital:** The average cost of capital for energy infrastructure in Africa stands at 15.6%, with some countries facing rates exceeding 25% (Figure 4). In contrast, developed regions like Western Europe and the United States typically have cost of capital rates around 5% or lower (Kato et al., 2024[75]). This severely restricts investment in climate-resilient infrastructure. Africa's high cost of capital deters private sector investment in adaptation and clean energy infrastructure. Addressing this challenge requires international support to de-risk projects, enhance sovereign credit ratings, deploy blended finance instruments, and improve access to concessional finance (see Box 13).

Figure 4. Average weighted cost of capital



Source: AfDB.

Box 13. Implications of high cost of capital in Africa

The high cost of capital in Africa constrains access to development finance for adaptation and resilience building.

Limits investment in adaptation and resilience

- Interest rates in many African countries range from 10% to 25%, compared to near-zero or low single digits in developed economies.
- This makes it prohibitively expensive for governments and private actors to borrow for long-term climate projects like flood control infrastructure, renewable energy grids, or reforestation.
- High borrowing costs shrink fiscal space, especially in countries already burdened by debt service (e.g., over USD 443 billion was paid by lower-middle-income countries in 2022 alone, according to the World Bank).

Discourages private sector involvement

- High cost of capital reduces expected returns on adaptation or mitigation investments, deterring private investors, especially for projects with long payback periods (e.g., water infrastructure, agriculture resilience).
- Risk premiums in Africa are often inflated due to perceived political risk, currency volatility, and weak legal frameworks, even in otherwise viable markets.

Undermines blended finance and de-risking strategies

- Blended finance relies on concessional capital to lower risks and costs for private actors. But when baseline capital costs are high, blending becomes less effective unless sufficient concessional capital is available.
- High capital costs also erode the effectiveness of guarantees and insurance mechanisms intended to catalyse private investment

Exacerbates inequity in climate finance access

- While global climate finance is growing (reaching USD 1.46 trillion in 2022 (CPI, 2024[5])), the majority flows to countries where returns are predictable, and financing costs are low—**primarily in East Asia, Europe and North America** .
- Africa, with just 3% of global climate finance inflows, struggles to compete for capital due to structural financial disadvantages, despite having the most urgent climate needs.

Source: AfDB (2025[76]), Africa Economic Outlook 2025, https://www.afdb.org/en/documents/african-economic-outlook-2025.

Opportunities and innovations in financing adaptation in Africa

Despite these structural challenges, Africa is home to several promising innovations and financing models that are transforming the adaptation landscape. The 2024 UNEP Adaptation Gap Report identifies practical tools and enablers to accelerate adaptation investment.

- Innovative financial instruments: New instruments—such as resilience bonds, insurance-linked securities, debt-for-adaptation swaps, and payments for ecosystem services—are gaining traction. These tools diversify funding sources and offer performance-linked incentives for resilience-building.

- Public sector mechanisms: Governments are increasingly adopting tools like climate budget tagging, adaptation investment plans, and sovereign green bonds to institutionalise adaptation within public financial management frameworks. For instance, climate budget tagging initiatives in Rwanda, Kenya, and Ghana help track and allocate adaptation-relevant spending.
- Private sector engagement: The development of adaptation taxonomies, climate disclosure standards, and blended finance platforms is key to unlocking private capital. Blended finance models—where concessional public finance de-risks private investment—are being used by institutions like the African Development Bank and the International Finance Corporation.
- Debt-for-Adaptation Swaps and Blue Bonds: Sovereign debt instruments tied to adaptation outcomes offer countries a way to restructure debt while channelling investments into climate resilience. Examples include the Seychelles Blue Bonds (2018) and Belize Blue Bonds (2021), which have financed marine conservation and sustainable fisheries.
- African Green Bank Initiative: Spearheaded by the African Development Bank and aims at structuring an ecosystem of Green Finance Facilities in Africa, to increase the climate finance mobilised by the local financial institutions and support green and sustainable growth throughout the continent.
- Capacity development: Technical assistance to design, implement, and monitor adaptation finance is essential. Supporting national and sub-national institutions through climate finance readiness programs will help unlock larger and more sustained flows of adaptation funding.

By building inclusive and resilient financing ecosystems, leveraging innovative instruments, and ensuring country-driven ownership, Africa can demonstrate solutions for closing the global adaptation finance gap. The global community must now act in solidarity to scale these solutions across emerging markets.

The role of insurance and closing the protection gap

Insurance plays a critical role in climate adaptation by reducing financial vulnerability and enabling faster recovery after disasters. Yet the global insurance protection gap remains wide and persistent, particularly in low-income and climate-vulnerable regions. Additionally, there are indications that insurance premiums have been rising in certain vulnerable areas to reflect expected or realised increases in physical risks, with some insurers withdrawing from markets that are deemed too risky.[10]

As of 2023, 62% of global economic losses from natural disasters were uninsured. This share has remained largely constant over the past several years (Swiss Re Institute, 2024[77]). Regional disparities are stark: in the Asia-Pacific region, countries like Japan (47%) and Australia (40%) maintain relatively high insurance coverage, while the rest of the region averages around 5%[11]. In Europe, approximately 56% of losses from meteorological events such as hurricanes and storm surges are insured. This falls to 28% for hydrological events (e.g., floods and landslides) and only 7% for climatological hazards such as droughts, wildfires, and extreme heat (Rousová et al., 2021[78]).

Africa remains one of the most underinsured continents in the world. In 2023, only 3% of Africa's climate-related losses were covered by insurance, compared to the global average of around 50% (AfDB, 2023[74]; 2024[79]). As climate risks intensify, rising insurance premiums and growing physical risk exposure are prompting some providers to withdraw from high-risk markets—further exacerbating Africa's protection gap.

Key challenges and needs for expanding access to insurance:

- **Low penetration and awareness:** Financial literacy remains low in many communities. Insurance uptake is limited due to lack of understanding, limited access to suitable products, and affordability challenges - especially in rural and low-income areas.
- **Underdeveloped markets:** Many African countries lack developed insurance markets with climate-specific risk products, such as weather index insurance for smallholder farmers.
- **Lack of risk pooling and affordability:** Without adequate public-private partnerships, premiums remain unaffordable, and response mechanisms are slow.
- **Need for innovation:** Emerging solutions like microinsurance, parametric insurance, and digital platforms integrated with early warning systems and mobile money are underutilised.

Examples of key initiatives and solutions:

- **Africa Risk Capacity (ARC):** A specialised agency of the African Union providing sovereign parametric insurance against drought and other climate risks. In 2019, ARC paid out USD 23 million to Senegal, helping support 300 000 vulnerable people (see Box 14).
- **Africa Co-Guarantee Platform:** A collaborative initiative that brings together leading guarantors and insurers to scale up risk mitigation and crowd in private finance. The platform aims to close Africa's USD 200 billion annual trade and investment gap by providing guarantees that leverage multilateral institutions' strong credit ratings.
- **Africa Climate Risk Insurance Facility for Adaptation (ACRIFA):** Launched by the African Development Bank, ACRIFA aims to mobilise USD 1 billion in risk capital to expand insurance offerings to smallholder farmers and micro, small, and medium enterprises (MSMEs).
- **Index-Based Livestock Insurance (Kenya):** This satellite-data-driven product supports over 30 000 pastoralist households.
- **Room2Run Securitisation Initiative:** A USD 1 billion synthetic securitisation led by the African Development Bank that frees up capital for climate investments, including in the insurance sector.
- **National Insurance Platforms:** There is growing recognition of the need to integrate climate risk insurance into national adaptation and disaster risk management frameworks.

Closing Africa's insurance protection gap demands a multi-faceted approach: strengthening regulatory frameworks, expanding public-private partnerships, investing in climate data infrastructure, and scaling inclusive insurance models.

Box 14. Africa Risk Capacity (ARC) in Senegal

Senegal is one of the pioneering African countries to operationalise sovereign parametric insurance through the African Risk Capacity (ARC)—a specialised agency of the African Union. ARC helps member states improve their capacities to plan for, prepare, and respond to climate-induced disasters, particularly drought.

Key features:

- Risk Coverage Mechanism: Parametric insurance is triggered automatically when pre-defined thresholds (e.g., rainfall or vegetation index) are breached.
- Disbursement Efficiency: ARC disbursed USD 23 million in 2019 to Senegal following a severe drought season.
- Impact: The payout supported over 300,000 vulnerable people with food, water, and livestock feed. The intervention significantly reduced the need for post-disaster emergency appeals.

Success factors:

- Strong national contingency planning
- Integration of ARC insurance into Senegal's disaster risk financing strategy
- Rapid post-disbursement delivery to beneficiaries via local government and NGO channels

Significance:

Senegal's experience shows how ARC's model can provide fast, transparent, and predictable disaster relief, reducing reliance on humanitarian aid and strengthening climate resilience.

Source: AfDB (2025[80]), Africa Risk Capacity (ARC), https://www.arc.int.

Climate-related disaster risk financing in Africa

The widening protection gap and fiscal constraints make disaster risk financing (DRF) a vital tool for resilience in Africa. Climate-related disasters are not only humanitarian crises but also macro-fiscal shocks. As stated earlier, African countries often lack adequate ex-ante financial instruments such as insurance or contingency funds - resulting in costly and delayed ex-post responses reliant on emergency appeals or debt. This has resulted in expanding cases of public expenditure displacements on the continent.

Climate-related disaster risk financing is a cornerstone of Africa's climate resilience. Scaling up DRF mechanisms - especially ex-ante tools - can ensure quicker recovery, protect livelihoods, and reduce long-term fiscal burdens. Stronger collaboration among governments, development partners, and the private sector is essential to close Africa's disaster protection gap and secure a climate-resilient future.

In Africa, the share of investment going to reduce disaster-related risks is likely to be constrained due to:

- limited fiscal space for proactive investment
- weak insurance penetration and underdeveloped risk markets
- low integration of DRF into national planning and budgets
- political incentives favoring visible, short-term relief
- difficulty in quantifying avoided losses

- inadequate data and risk assessments.

Effective disaster risk financing requires a layered approach, combining instruments to address events of varying frequency and severity. Key instruments include:

- **Contingency Reserves and Budgetary Allocations**: Rapid liquidity for low-intensity, high-frequency events.
- **Sovereign Risk Insurance**: Payouts triggered by predefined disaster parameters (e.g., through the African Risk Capacity).
- **Catastrophe Bonds and Risk Pools**: Market-based tools to transfer risk and attract capital.
- **Blended Finance**: Combining concessional and commercial finance to de-risk investment in resilience-building.

A combination of Initiatives and appropriate policies/institutional imperatives have yielded modest solutions in Africa. Examples of instruments include:

- **Africa Disaster Risk Financing Programme (ADRiFi)**: Enhances access to insurance and risk analytics for African countries, backed by partners like the African Development Bank.
- **African Risk Capacity (ARC)**: A continental mutual insurance pool supporting rapid payouts for droughts, floods, and epidemics.
- **Climate Resilience Bonds and Nature-Based Solutions**: Emerging instruments that link climate adaptation and disaster risk reduction with capital markets.

The role of global partnerships in supporting Africa's adaptation and resilience building

The upcoming tenth anniversary of the Paris Agreement underscores the centrality of global partnerships in addressing the climate crisis. Since its adoption in 2015 by 196 Parties, the Agreement has galvanised international commitment to limit global temperature rise to well below 2°C, with an ambition of 1.5°C above pre-industrial levels. Africa has demonstrated strong alignment with this global goal: all 54 countries have ratified the Agreement and actively engage in climate action through the formulation of nationally determined contributions (NDCs), national adaptation plans (NAPs), and long-term strategies (LTSs). As of 2025, 53 African countries have submitted updated NDCs, 21 have developed NAPs, and eight have submitted LTSs.

Strengthening national systems for finance delivery

Accessing and effectively using climate finance requires strong national institutions and delivery systems. Strengthening national climate funds with independent governance mechanisms can accelerate the disbursement of climate resources, enhance transparency, and improve results. Direct access entities, which enable countries to access finance directly from funds such as the Green Climate Fund, Adaptation Fund, and Climate Investment Funds, require targeted capacity-building. Enhancing fiduciary standards, climate planning capabilities, and monitoring frameworks is vital to ensuring that climate funds translate into tangible adaptation outcomes on the ground.

Foreign direct investment and regional resilience

Foreign direct investment (FDI) serves as a key driver of economic diversification and infrastructure development across Africa. FDI brings not only capital, but also technology transfer and managerial expertise that enhances productivity and builds long-term adaptive capacity. Despite its importance, FDI to Africa remains volatile. In 2022, total external financial flows to Africa declined by 19.4%, reaching

USD 174.9 billion (5.9% of GDP), with FDI contracting by 44% (AfDB, 2024[79]). Simultaneous declines in official development assistance (ODA) and net portfolio investments exacerbate fiscal constraints.

Unlocking Africa's FDI potential requires policy reforms that address macroeconomic volatility, infrastructure gaps, and regulatory fragmentation. Opportunities lie particularly in renewable energy, digital transformation, and sustainable agriculture - sectors that can drive both economic recovery and climate adaptation.

International Development Assistance

International Development Association (IDA) and the African Development Fund (ADF) resources remain pivotal in supporting climate adaptation across African countries. These instruments help finance climate-resilient infrastructure, renewable energy, and nature-based solutions through grants and highly concessional loans. Beyond capital, IDA and ADF provide essential technical assistance, institutional support, and knowledge transfer to countries navigating the complexities of climate risk and sustainable development. ADF-16, the latest replenishment cycle, places a strong emphasis on adaptation, resilience, and inclusive green growth.

Debt relief and sustainable financing models

High debt burdens remain a binding constraint on adaptation investment in many emerging markets. According to the World Bank's 2023 International Debt Report, lower-middle-income countries paid USD 443.5 billion in debt service in 2022 alone. Rising interest rates and exchange rate depreciation have further eroded fiscal space (World Bank, 2023[81]). The G20 Common Framework for Debt Treatment, while conceptually sound, has progressed slowly. Ghana, Zambia, and Sri Lanka have pursued restructuring under or outside the framework, but broader progress remains limited. Innovative instruments such as state-contingent debt instruments, which adjust debt service based on economic performance, could ensure long-term fiscal sustainability.

In parallel, debt-for-climate and debt-for-adaptation swaps are gaining traction as mechanisms that alleviate sovereign debt burdens while funding investments in climate resilience. Strategic partnerships between creditors, MDBs, and climate funds will be critical to scaling these instruments and ensuring that adaptation financing does not exacerbate debt vulnerabilities.

Africa's role in global climate and economic governance

Africa's economic outlook remains resilient despite ongoing global shocks—from geopolitical tensions and rising debt to intensifying climate impacts. The continent's economic growth is expected to increase to 4.3% in 2025, reflecting a strong recovery trajectory (AfDB, 2024[79]). However, this growth remains constrained by structural weaknesses. Africa continues to experience sluggish industrialisation, low investment in manufacturing and infrastructure, and inadequate skills development—challenges that undermine its ability to undergo deep structural transformation.

According to the African Development Bank, Africa faces an estimated USD 402 billion annual financing gap to close the development gap and realise its economic and climate goals. To address this, the AfDB is championing the reform of the global financial architecture to unlock greater access to concessional and scalable climate finance. A central pillar of this effort involves revaluing Africa's GDP by integrating its vast natural capital—forests, water resources, biodiversity, and ecosystem services—estimated at over USD 6 trillion (AfDB, 2023[74]). Properly accounting for these assets can significantly improve sovereign credit ratings, lower borrowing costs, and attract long-term investment into adaptation.

Beyond macroeconomic reforms, Africa is increasingly engaging with emerging financial instruments such as carbon markets, biodiversity credits, and sustainability-linked bonds. These mechanisms offer pathways to channel global capital toward local adaptation priorities and nature-positive development, particularly under new international frameworks such as the Nature-Positive Finance Principles introduced at COP28.

Regional trade integration as a resilience strategy

Africa's resilience also depends on robust economic governance and trade integration. The African Continental Free Trade Area (AfCFTA) provides a powerful framework for building economic and climate resilience through regional integration. By reducing trade barriers, promoting intra-African commerce, and localising value chains, AfCFTA can lower dependency on volatile external markets. Crucially, it can accelerate adaptation by scaling local climate solutions, supporting regional technology transfer, and increasing competitiveness in sectors such as sustainable agriculture, renewable energy, and green manufacturing. Realising these benefits requires structural reforms aimed at expanding local value addition, negotiating fairer terms in global value chains, and strengthening productive capacities. A shift toward strategic partnerships and self-reliance—anchored in regional collaboration and climate-smart development—must underpin Africa's transformation agenda.

Bridging the structural transformation gap

A major impediment in Africa playing a larger role in the global economy is the continent's structural transformation progress, which has been slow, uneven, and characterised by a slow-paced industrialisation and the predominance of a low-skill services sector, mainly because of low manufacturing activity. The region remains heavily reliant on commodity exports and low-skilled services, with limited investment in high-productivity sectors such as manufacturing and digital technology. To close the USD 402 billion annual transformation gap by 2030, Africa must dramatically scale investment in energy systems, education, research and innovation, transport infrastructure, and industrial capacity (AfDB, 2024[79]). While domestic resource mobilisation will be essential, it is not sufficient to bridge this financing gap. Multilateral support and private capital must be mobilised through reformed global financial mechanisms. These include increased concessional financing, risk mitigation instruments, and more equitable allocation of climate finance.

Seizing the opportunity: The Baku Climate Unity Pact

The Baku Climate Unity Pact offers an unprecedented opportunity for Africa to advocate for greater access to climate finance. By tripling the previous USD 100 billion annual goal to USD 300 billion by 2035 under the New Collective Quantified Goal (NCQG), the Pact reflects the growing recognition that financing must align with actual needs and vulnerabilities. The AfDB is playing a central role in supporting African countries to access these new financial flows. Strengthening national and regional financial institutions, aligning investment pipelines with adaptation priorities, and promoting public-private collaboration are key strategies to leverage this moment.

Advancing climate governance and policy implementation

Africa's progress on climate policy frameworks has been notable. Many governments have developed national climate strategies and integrated climate objectives into long-term development planning. However, implementation remains uneven. Institutional and capacity gaps continue to limit the translation of policy into action. To address this, more targeted investment is needed in governance systems, budget reform, and institutional strengthening. Embedding climate risk considerations into public investment management, agriculture, infrastructure, and urban development policies is essential. Scaling these efforts

will require international cooperation, domestic political will, and greater alignment between climate, development, and fiscal policy.

Opportunities to support investment in adaptation in Africa

The African Development Bank have identified the following opportunities to support adaptation investment in Africa, applying and expanding the overall good practices and options identified in section 4.

Table 6. Policy options for scaling up adaptation investment in Africa

Theme	Action area	Opportunities to support adaptation investment in Africa
Capacity and data	Strengthening access to high-quality climate data and tools	• Build institutional capacity for risk assessment and management • Enhance climate risk data and early warning systems
Domestic policies	Strengthening the domestic enabling environment	• Expand adaptation investment plans across all African regions • Mainstream climate resilience into infrastructure, agriculture, and industrialisation strategies.
	Scaling up domestic resource mobilisation	• Integrate disaster risk financing into national climate and fiscal policies • Expand climate budget tagging across African regions • Implement COP28 nature-positive finance principles in national budget frameworks and climate plans. • Build capacity of Direct Access Entities to apply to and absorb funding from vertical climate and environment funds (VCEFs)
	Enhancing the contribution of insurance markets to encouraging adaptation	• Scale parametric and index-based insurance for agriculture and infrastructure. • Support ARC and ACRIFA with capital and technical assistance to widen access for MSMEs and farmers.
International support to mobilise investment	Improving the quantity and accessibility of international concessional finance for adaptation	• Operationalise the New Collective Quantified Goal (NCQG) by 205, ensuring a fair allocation of the USD 300 billion annual target to adaptation needs. • Prioritise grant and highly concessional finance for the most vulnerable, particularly African LDCs and SIDS.
	Mobilising private investment through blended finance and project preparation facilities	• Create regional climate risk guarantee platforms supported by multilateral development banks. • Implement sovereign credit enhancement tools based on natural capital valuation to improve risk ratings and reduce borrowing costs.
	Enabling innovative finance mechanisms	• Expand debt-for-adaptation and state-contingent debt instruments (SCDIs). • Leverage Baku Pact momentum to advocate for Africa's fair share in debt restructuring linked to resilience. • Monetise Africa's natural capital through biodiversity credits, blue bonds, and carbon markets.

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Notes

[1] Investment in this context refers to the acquisition of assets that are intended to produce goods or services, such as residential and commercial property, infrastructure, machinery and research & development (Gross Fixed Capital Formation).

[2] OECD calculations based on data using data from Swiss Re, sigma database. All rights reserved (includes only loss years with an insured loss estimate).

[3] The International Association of Insurance Supervisors and the World Bank are developing a report for the SFWG on identifying and addressing insurance protection gaps.

[4] Relevant strategies can include national adaptation plans or strategies, nationally determined contributions, and other strategies that are relevant for adaptation, such as disaster management plans.

[5] This builds on the G20/OECD Report on approaches for financing and investing in climate-resilient infrastructure, (2024[82]) which was prepared for the IWG in 2024.

[6] In a number of countries, insurance supervisors limit the ability of insurance companies to set premiums for the coverage they offer by requiring prior approval of pricing models or setting quantitative restrictions on the premium rates that insurers can impose.

[7] In some jurisdictions, insurance supervisors have established specific initiative to improve the understanding of the complex catastrophe models that insurance companies use to underwrite coverage (e.g. EIOPA's Centre of excellence for catastrophe modelling and data or NAIC's Catastrophe Modeling Center of Excellence).

[8] Some insurance supervisors have established regulatory requirements or supervisory expectations that insurance companies provide premium discounts for specific risk reduction measures. For example, a "Safer from Wildfires" regulation in the US state of California requires insurance companies that use risk-based pricing to incorporate specific property and community-level risk mitigation factors into their premium pricing.

[9] These examples and cases are drawn from [the forthcoming] *OECD Blended Finance Guidance for Climate Change Adaptation* (OECD, forthcoming[59]). The Guidance explores blended finance approaches for adaptation across various key adaptation themes and sub-themes in more depth.

[10] See, for instance, BBC, Climate change is fuelling the US insurance problem, 18 March 2024; Bloomberg, Here's why insurers are leaving disaster-prone places, 26 September 2023; EIOPA (2022), European insurers' exposure to physical climate change risk, May; Chen, C. et al. (2024), Changing climate in Brazil: Key vulnerabilities and opportunities, IMF working paper; Financial Times, The crippling home insurance crisis hitting America, April 24, 2024.

[11] Data drawn from Munich Re website. https://www.munichre.com/landingpage/en/extreme-weather-apac.html.


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