

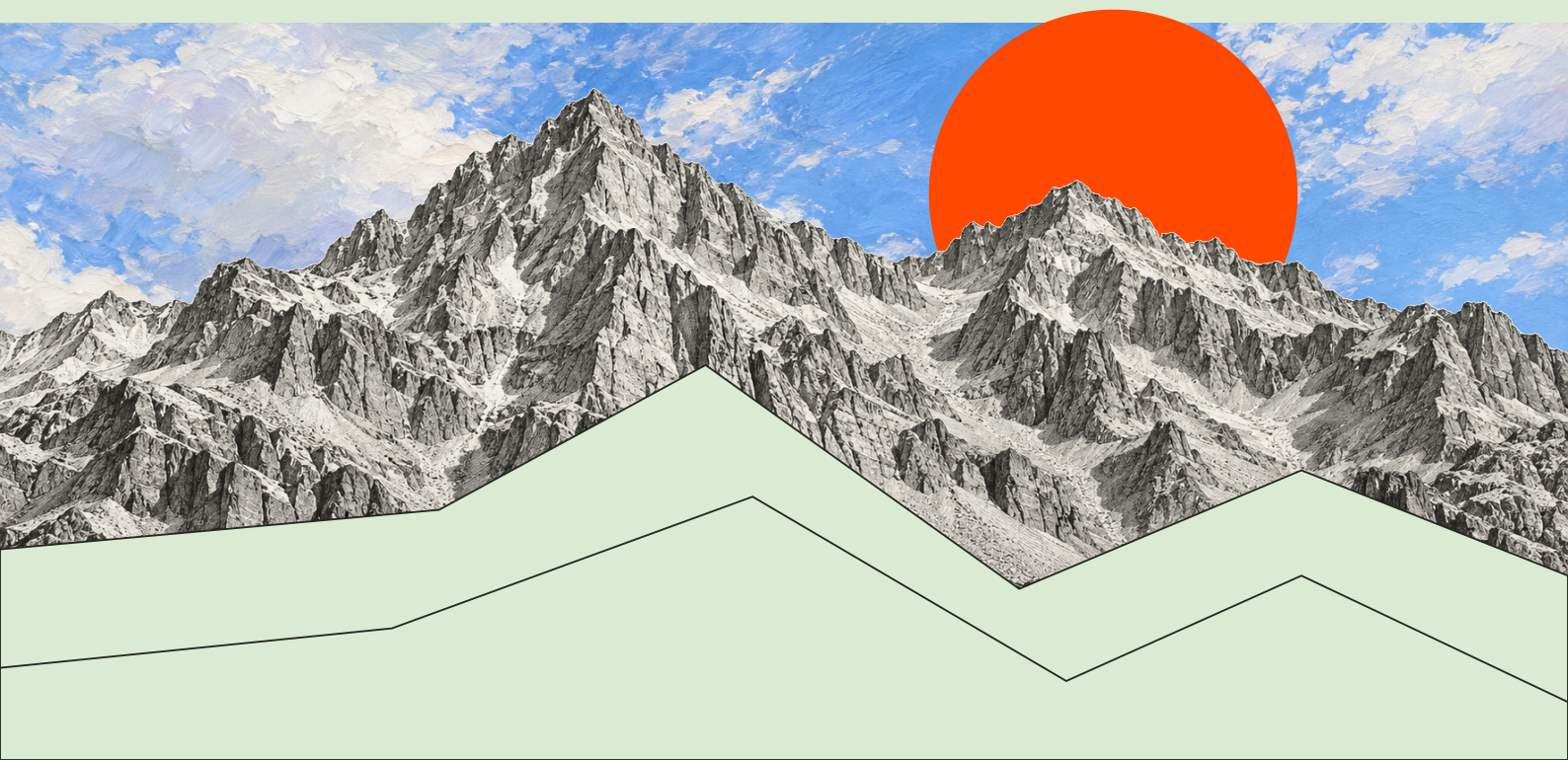
Ridgelight

ADVISORY / PAPER / OCTOBER 2026

Turning avoided loss into financial gain

Valuing investments in adaptation and resilience

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Key messages

Investments in adaptation and resilience that preserve the value of financial and physical assets benefit both businesses and society at large. In theory, efficient markets should reward such investments – yet the economic benefits of avoided losses are difficult to factor into financial decisions. This paper assesses the challenges of valuing avoided loss, and explores what would be needed for adaptation and resilience investment to be more systematically valued across the economy and within financial markets.

Why the value of adaptation is hard to price: Adaptation and resilience investments reduce exposure to risk and maintain the value of assets over time, even though they typically impose near-term costs without a clear link to future revenue generation. As such, while it may be possible to quantify the value of such investments, it may be difficult to monetise benefits, as many do not generate investable cash flows. Even where there is a strong business case, adaptation and resilience investment decision-making can be complicated by uncertainty, a lack of clarity on future benefits, third-party dependencies, and context specificity. These challenges are compounded by the counterfactual nature of avoided losses, data gaps, differences in modelling approaches, and portfolio-level factors, which together make it harder for the value of risk reduction to be priced into financial decisions.

Making the case for investment in adaptation and resilience: Promising innovations in adaptation finance are being driven by technological developments, cross-sectoral collaboration, and public-private partnership. Insurers are expanding client engagement and advisory services to help clients identify and implement adaptation and resilience solutions, and are working to share risk data and insights to inform market development. Banks are developing sustainability-linked loans with adaptation and resilience-focused KPIs, serving as underwriters for adaptation-focused bonds, and structuring sector-specific solutions to help monetise the value of risk reduction. Across the industry, there is growing interest in connecting insurers' ability to quantify physical risk to banks' credit risk assessment. Blended finance structures are being deployed to mobilise capital for projects that would otherwise not attract private investment at scale. There is an opportunity to build on these market innovations – and the aforementioned challenges can be overcome. However, doing so will require a multi-faceted response by governments (as policymakers), corporates and individuals (as implementing entities), and financial institutions (as advisors and capital allocators) to align incentives, shift the economics of investment decisions, and develop innovative market architecture. Private financial institutions will face limits in scaling up additional capital for adaptation and resilience investment in the absence of necessary data on hazards and vulnerabilities, supportive public policy, and appropriate financial architecture to align capital sources with appropriate risk/return expectations.

Key recommendations

For policymakers and regulators:

- Consider how adaptation measures and resilience standards could be embedded in policy frameworks and national adaptation plans.
- Explore the potential for tax credits and incentive mechanisms (e.g. accelerated depreciation) for adaptation and resilience investments.
- Promote consistent disclosure of physical risk across all sectors of the economy to inform market pricing of avoided loss.
- Calibrate public insurance solutions and public-private partnerships to reward adaptation investment and preserve risk signals.

For financial institutions:

- Explore ways to integrate physical risk and adaptation data into credit and investment processes.
- Where market signals suggest this is a viable strategy, seek to scale resilience-linked products supported by standardised, verifiable KPI frameworks.
- Strengthen connections between insurers and banks to help link insurers' ability to quantify risk to credit solutions provided by banks.

For market infrastructure and multilateral organisations:

- Support the development of methodologies to quantify avoided loss, drawing where possible on insurance loss data.
- Work towards scale and standardisation of blended finance instruments for adaptation, alongside other forms of development-related blended finance.
- Pilot mechanisms to monetise avoided losses and build investable revenue streams.

1. Context

With physical climate risks mounting, the need for adaptation² - to a warmer climate, increasingly frequent and severe natural disasters, and consequences for society - is front and centre. Households, companies and governments need to factor escalating physical climate risk into consumption, business and operational strategy and capital investment, including climate damage to asset values, climate-related business interruptions and the cost of risk reduction.

Many studies document that investments in adaptation which preserve the value of financial and physical assets benefit both businesses and society at large.³ It follows that efficient markets should reward adaptation measures that reduce the overall risk profile of assets or entities, for instance, through improved access to capital, lower borrowing and insuring costs or higher market valuations. However, while the economic benefits of adaptation are clear, quantifying them - and reflecting added value in market pricing - remains challenging. While some studies suggest that financial markets are more systematically pricing climate risks⁴ (including outside the insurance sector, where climate risk pricing is most advanced), the benefits of adaptation measures are still not well recognised.

In the face of increasing physical risks, systematically recognising the value of risk reduction - in short, turning avoided losses into financial gain - could significantly influence how adaptation is valued across the economy, and within financial markets. This paper examines the factors that are constraining this shift, and explores the policy, market, and regulatory solutions that could help catalyse private capital for adaptation and resilience. A brief overview of adaptation and resilience investment concepts is provided in Annex 1. Section 2 describes the challenges in factoring adaptation into market pricing and asset valuation. Section 3 discusses what would be needed for adaptation measures to be more systematically valued across the economy and financial markets, looking across: (1) real economy policy frameworks; (2) financial market practices in the insurance sector; (3) financial market practices in the banking sector; and (4) de-risking, including public insurance mechanisms and blended finance. Section 4 draws conclusions and sets out priorities for action.

Box 1: Key concepts in adaptation and resilience

Adaptation investment refers to financing actions that adjust systems to actual or expected climate impacts in order to reduce harm or capture beneficial opportunities. Resilience investment refers to financing measures that help people, assets, and systems anticipate, absorb, recover from, and maintain

function during climate-related shocks. Adaptation and resilience, while related, are conceptually distinct. Adaptation refers to the adjustment to changing profiles of hazards by reducing exposure and strengthening areas of vulnerability. Resilience refers to the capacity of a system to absorb extreme shocks without crossing thresholds into a worsened state. In practice, the two overlap: adaptation focuses on making specific adjustments, and resilience focuses on the broader capacity to withstand and recover.⁵ In a climate change context, where physical risks are likely to continue to rise, adaptation is necessary to ensure the resilience of assets, infrastructure, supply chains, and systems. However, adaptation actions are not necessarily all resilience-reinforcing. Adaptation can have unintended consequences – including ‘maladaptation’ as a result of investments in certain areas (e.g. seawalls, mass air conditioning, groundwater-based irrigation) that exacerbate physical impacts and create future risks – and can also pose trade-offs (e.g. between climate and nature conservation) that can compound climate impacts.

From an economic perspective, firms may place different emphasis on adaptation or resilience depending on their business models, dynamics of hazard exposure (e.g. risks to owned assets or reliance on suppliers), and active markets. An entity’s adaptation processes and resilience outcomes interact in a symbiotic relationship that evolves over different timeframes. As adaptation is a long-term and dynamic process in response to changing climate conditions, an entity’s progress on adaptation can be most easily understood in terms of its level of resilience to specific thresholds – such as extreme weather, or supply chain disruption.

The investments needed to deliver on these related priorities differ in scope and scale, and have different financing dynamics. Investments to strengthen adaptive capacity and resilience comprise a broad spectrum across the economy, from investments with no direct financial return, to those which may have a defined value that can generate a below-, near- or at-market-rate return on investment. This wide range of risk/return characteristics affects the suitability of different adaptation investments for different types of capital providers, from concessional public sector funding, grants, and philanthropy, to private sector capital. In turn, adaptation and resilience investments fall along a spectrum of cost-benefit alignment, from ‘public good’ investments with diffuse benefits, to ‘private good’ investments with clearer benefits and revenue streams (see Figure 1). Further discussion of adaptation and resilience investment mandates, incentives, and options can be found in Annex 1.

Figure 1: The adaptation and resilience investment spectrum



Redrawn from the accompanying text; original SVG not supplied.

Source: Author

2. Why aren't the economic benefits of adaptation fully priced into financial markets?

There are several factors that affect how adaptation is being factored into market pricing and valuation. These can be considered under two broad themes: real economy valuation barriers that affect investment decision-making by firms, households, and governments; and structural constraints within the financial system that impede the translation of risk reduction benefits into financial variables. Encouragingly, innovations in data, modelling, product design, and policy are beginning to address these gaps - and several of the issues set out below have corresponding solutions discussed in Section 3.

Theme A: Real economy factors

The benefits of adaptation are not consistently valued across the real economy, and can be difficult to quantify. Furthermore, the core characteristics of adaptation and resilience actions - including upfront costs, uncertainty regarding future benefits, and exposure to others' decisions - can create disincentives to invest. Key issues include:

Value preservation vs. generation: Adaptation measures reduce exposure to risk and maintain the value of assets over time - but typically impose near-term costs without a clear or immediate link to revenue generation. Compared with investments designed to drive near-term business growth, adaptation investments are more difficult to justify: the benefits are uncertain, long-dated, and conditional on climate risk materialising. In contrast, measures that more directly contribute to tangible business value preservation - such as insurance coverage - may be more readily factored into business decision-making. The evolving physical climate risk context means that the value of insurance is becoming more explicit in longer- as well as short-term decision-making; for example, awareness that assets might become uninsurable over the medium term can have 'up front' implications for investors' risk appetite, affecting access to capital. Addressing this challenge requires enhancing corporates' understanding of the links between physical risk profiles and their trajectories, implications for insurance availability and costs, and mechanisms for recognising and pricing the risk-reduction benefits.

Risk pricing and transmission: Insurance provides a price for risk exposure within the economy, and quantifies the cost of inaction arising from a lack of adaptation or resilience investment. However, the annual repricing cycle of insurance contracts creates a structural mismatch: while the trajectory of physical climate risk is rising, individual policyholders face discrete annual pricing decisions and may systematically underestimate the rate at which risks - and therefore insurance costs and availability of cover - will change over the life of an asset or investment.⁶

Uncertainties affecting return on investment: The benefits of adaptation measures are uncertain, and can be difficult to evaluate for some real economy actors. Robust cost-benefit analysis requires the consideration of an array of subjective choices, including baselines, discount rates, and integration of non-market benefits.⁷ In aggregate, however, the costs of adaptation can be modest relative to the losses they can avert - and from this perspective, make good business sense. Evidence across multiple sectors consistently shows benefit-cost ratios for adaptation investments in the range of 2:1 to 10:1.⁸ Recent analysis by the UK Climate Change Committee estimates that adaptation investment of around £11 billion per year (range £7-22 billion, 2025 prices) is needed from the public and private sectors, against climate costs to public welfare of 1-5% of UK GDP by 2050 under 2°C of global warming, equivalent to £60-260 billion per year.⁹ There is strong evidence in certain sectors (e.g. renewable energy and infrastructure) of material benefits accruing from resilience measures being taken as part of project planning and implementation, of more than six times upfront costs.¹⁰ However, for some investments - including those which are 'public good' in nature - aggregate benefits can

accrue diffusely, over long timeframes, and often to parties other than those bearing the upfront investment costs. Furthermore, in the absence of significant physical impacts, or when losses from events are less significant than expected, the return on investment from adaptation measures may be lower than projected. Strengthening resilience in certain systems, such as supply chains, may also be made more complex due to other economic imperatives (see Box 2).

Box 2: Challenges in strengthening supply chain resilience

In some cases, the economic rationale for investments in adaptation and resilience - such as supply chain redundancies - can work against the business logic that has driven the design of infrastructure and systems. For example, cost efficiency in supply chains is closely linked with levels of consolidation, standardisation, and volume. This situation is an economically rational result of actors with pricing power seeking to minimise costs arising from variations and inconsistencies that require resolution. Close interconnection between industries and a high degree of specialisation of individual firms can compound this problem by reducing the potential for diversification. As a result, entire industries can become reliant on a small group of suppliers for critical inputs - resulting in the bottlenecks and disruptions observed when localised climate events have global supply chain implications.¹¹ Here, as with the net zero transition, there is an exposure 'lock-in' effect - the dominant logic and incentives of the system itself result in negative outcomes for actors that deviate from it, in the form of additional costs without a clear return. CDP data from 11,261 companies that disclosed full environmental data in 2025 show that they expect US\$714 billion in future financial impacts from extreme weather, with lost revenue from reduced production capacity (US\$326 billion) the largest single driver.¹²

Third-party impacts and contingencies: Adaptation is an iterative process, and the return on any individual investment depends partly on factors outside the investor's control - including the choices of neighbouring actors, network infrastructure providers, and public authorities. Given uncertainty about the timing and severity of future climate events, and the often irreversible nature of adaptation measures, economic actors face a genuine trade-off with respect to the optimal moment to invest, and can gain option value by delaying, particularly where technology may make measures cheaper over time.¹³ This creates a structural 'first-mover disincentive': actors that delay can benefit from the actions of others, while early movers bear upfront costs and uncertainty. Overcoming this dynamic requires coordination mechanisms and, in some contexts, regulatory requirements that align the incentives of interdependent actors.

New build and retrofit: The investment economics of adaptation differ between new build and retrofit of existing assets. For new build, the additional cost of constructing to resilient standards is typically modest relative to total project cost, and can be embedded in financial models as a forward-looking reduction in expected loss, making the business case relatively tractable. Retrofit presents a more complex valuation challenge: upfront costs are higher, residual risk reduction is less certain, and the counterfactual - what losses would have occurred in the absence of the measure - is inherently difficult to observe. Financial instruments that explicitly recognise the improved risk profile of retrofitted assets, such as resilience-linked credit facilities and insurance structures with risk-reduction KPIs, remain underdeveloped and represent an important frontier for product innovation.

Context specificity: Adaptation is highly context-specific, responding to local hazards, levels of exposure, and vulnerability factors - and adaptation needs may shift over time in response to climate change.¹⁴ Several studies have explored the range of adaptation measures that can be implemented across sectors and geographies.¹⁵ Some international standards relating to adaptation, including those developed by ISO,¹⁶ are available. However, there is not a consistent overarching set of national or global standards for what an 'adapted' asset or entity looks like, in terms of the measures taken to achieve a certain level of resilience to a given hazard. While the absence of consistent standards compounds the valuation challenge, comparable data on loss avoidance - much of which already exists within the insurance sector - could in many cases

provide a more tractable near-term basis for recognising adaptation value.

Box 3: Links between real economy adaptation, risks, and long-term liabilities

If market-wide adaptation is insufficient, increasing physical climate risk is likely to result in greater market volatility (beta). Climate-related economic losses from physical damage and business interruption may result in price shocks, driving structural inflation and increasing interest rates, impacting productivity, and increasing covariance between corporate cash flows and asset pricing. This could lead to an increase in the equity risk premium, driving an increase in the cost of capital for firms in highly exposed sectors and regions.¹⁷ A rising cost of capital could have wide-ranging impacts across the financial system, including a fall in asset values, and downward adjustments to market price-to-earnings (P/E) ratios. These dynamics could have significant implications for long-term investments, such as pension liabilities. According to the calculation formulae set by actuarial standards, long-term pension liabilities are likely to fall as cost of capital rises;¹⁸ due to the multi-decadal timeframes for these liabilities, minor changes in discount rates can have significant compounding effects, which may result in a large reduction in overall calculated liability. This could create risks if calculation changes produce apparent cost reductions that obscure more structural underfunding risks, particularly if asset values fall significantly. Asset-liability matching could also become more difficult due to basis risk (e.g. values of assets and liabilities changing by unequal amounts).

Theme B: Financial system factors

The valuation challenges facing real economy actors are compounded by structural barriers within the financial system that make it difficult to translate risk reduction into financial variables - including a lack of visibility, attribution challenges, and portfolio and macro-level factors. Several issues are key:

Lack of visibility of avoided losses as a counterfactual: The economic benefits of adaptation measures are not directly identifiable in historical loss data on which financial risk models are based, as such data capture realised losses rather than counterfactual outcomes.¹⁹ This contributes to a systematic under-recognition of the risk-reducing effect of resilience measures within markets.²⁰

Attribution and translation into financial variables: The implications of economic losses - and the visibility of their impacts across portfolios - may vary significantly across financial institutions, depending on their business models and levels of exposure. For insurers, climate-related economic losses are immediately visible in property and casualty (P&C) loss data. Certain risk models, including natural catastrophe (Nat Cat) models used in the insurance sector, may be best suited to integrating risk reduction measures.²¹ However, the reflection of risk reduction in other types of models - including credit risk models - may face greater challenges. One overarching issue is the need to differentiate assessment of first-order physical risk to the economy (e.g. in terms of the exposure of borrowers and financed assets), and the assessment of factors which translate into credit risk evaluation - including capacity to repay, collateral value, and probability of default.²² Further issues stem from the challenge of clearly delineating climate risk factors as drivers of the broader suite of risks affecting borrowers.²³ Analysis indicates that the direct, system-wide impacts of climate change on bank credit quality have so far been comparatively limited.²⁴ However, this finding should not be taken solely at face value - as it also reflects the methodological challenges inherent in attributing changes in borrower risk profiles to climate risk vs. other factors - as well as the challenge of integrating wide-ranging and diffuse phenomena into specific financial risk variables. This challenge attests to the need to expand the use of insurance sector data to inform assessments of physical risk exposure at the asset level as an input to the credit risk assessment process. Recognising the differences between the suitability of different types of risk models for climate-related physical risk assessment (e.g. Nat Cat, underwriting risk, credit risk, etc.) is an important step towards designing an effective supervisory response - and ensuring that

focus is placed on reducing underlying sources of risk, rather than solely their financial system impacts.

Asset- vs. portfolio-level change: A significant share of the increase in climate-related economic losses reflects higher exposure to climate hazards, due to choices to build and invest in higher-risk areas. While adaptation measures can reduce the vulnerability of individual assets, their impact at the portfolio level may be outweighed if overall exposure continues to grow.

Separating market signals: The benefits of adaptation measures can be difficult to disentangle from other factors affecting the pricing of financial assets. In both the insurance and banking sectors, the impact of traditional macro variables is generally far greater than the benefit of any adaptation measure. As such, the positive impacts of adaptation actions on risk profiles may be overwhelmed by more significant non-climate risk factors, such as high debt levels and constrained fiscal space.²⁵

Financial regulatory considerations: Regulatory frameworks for financial institutions have only limited capacity to reflect changes in risk profiles stemming from adaptation measures taken by clients and counterparties. Within the banking sector, the Basel framework focuses on credit, market, operational, and liquidity risks over near-term timeframes.²⁶ In insurance, climate risk is primarily captured through underwriting and catastrophe modelling approaches, which can in part reflect adaptation measures, although these effects may not be fully or consistently integrated in prudential metrics. More broadly, given their design, time horizons, and underlying tools, prudential frameworks are not well suited to capturing globally systemic and forward-looking phenomena such as climate change.²⁷ Nonetheless, debate on the use of different types of microprudential and macroprudential tools to respond to climate risks continues, now with more focus being placed on physical climate risks. At the same time, supervisors and regulators continue to explore options to address adaptation issues, including in the context of financial sector transition plans. Further implications are discussed in Box 4 in Section 3.3.

3. What would be needed for adaptation measures to be more systematically valued across the economy and financial markets?

Adaptation measures should be much more systematically valued within the economy - and the losses avoided as a result of such measures be made visible within financial markets. Promising innovations are emerging, driven by technological developments and growing engagement from financial institutions, standard-setters, and policymakers. Notable gaps remain - especially in terms of policy, data, and market architecture - but the trajectory is encouraging. Efforts to make adaptation measures visible would require increased coordination and engagement across corporates, financial institutions, policymakers and regulators.

3.1 Policy frameworks

Regulatory requirements and resilience standards: Many jurisdictions set regulations and standards that mandate the level of resilience to physical damage that assets such as buildings and infrastructure must meet. Where such standards are appropriately forward-looking and account for escalating levels of physical risk intensity or frequency, they can effectively require asset owners and project developers to internalise the value of future adaptation benefits into overall project capex. Where such standards require retroactive modifications to be made to existing assets, governments can provide an array of incentives and fiscal mechanisms (e.g. tax incentives, grants) which can then serve as the basis for the structuring of private finance solutions (e.g. credit products to support resilience investments). However, such standards vary significantly across jurisdictions, depending on the existing state of infrastructure, the range of hazards within a jurisdiction, and the types of solutions that are needed to strengthen resilience. To be effective, such standards need to be concrete and operationally specific - for example, building codes and planning requirements mandating climate-resilient design for new construction, permitting requirements conditioning development approval on resilience criteria, and procurement requirements for public infrastructure in exposed sectors such as agriculture, energy, logistics, and manufacturing.

Several jurisdictions have established reference models for how sector-level resilience standards can be operationalised. The Netherlands' Delta Programme sets legally binding flood protection standards linked to specific hazard return periods across its territory, backed by a dedicated investment programme.²⁸ In the United States, FEMA's Building Resilient Infrastructure and Communities (BRIC) programme provides competitive mitigation grants for certain types of infrastructure projects, and the National Flood Insurance Program (NFIP) Community Rating System links flood insurance premium discounts to community-level resilience measures.²⁹ The EU Strategy on Adaptation to Climate Change³⁰ provides an overarching cross-sectoral policy framework that supports member state adoption of sector-specific standards, while other jurisdictions - such as Australia³¹ and Singapore³² - have implemented frameworks for resilience assessment and funding mechanisms for risk reduction. The UK Climate Change Committee's Fourth Independent Assessment of UK Climate Risk (CCRA4-IA) represents a leading example of how sector-level resilience objectives can be translated into quantifiable, time-bound targets.³³ National Adaptation Plans, sectoral resilience strategies and project preparation mechanisms can help translate adaptation needs into investable pipelines, improve project bankability and provide greater visibility to private investors on future adaptation financing opportunities.

Beyond setting standards or regulatory mandates for resilience, policymakers face a temporal challenge in seeking to incentivise the most efficient response across the economy. From this perspective, policymaking for adaptation should place equal focus on addressing key coordination challenges (e.g. multi-stakeholder engagement across 'beneficiary' groups), in addition to ensuring that standards reflect the evolving profiles of climate-related risks.

In some key sectors - such as agriculture or water management - a lack of effective adaptation may have systemic consequences, yet there may be structural barriers that affect investability. Even where economic value may be visible (e.g. due to externalities being priced), projects may not be readily investable without changes to market architecture - including clearly defined payment structures, mechanisms to translate economic value into cash flows, and verification systems.³⁴

Strengthening national standards and plans: National Adaptation Plans (NAPs) represent the principal international framework through which countries are expected to develop adaptation strategies and establish monitoring frameworks.³⁵ However, the substantive integration of sector-level resilience thresholds - referenced to specific hazard return periods or performance standards - remains limited in most submitted NAPs. Most NAPs identify key sectors of concern but stop short of specifying operational standards against which adaptation progress can be measured. The more tractable objective is for NAPs to incorporate clear,

sector-specific resilience thresholds at the national level, supported by guidance from bodies such as the World Bank, World Meteorological Organization, and IPCC. Where sector standards have been established and clearly linked to insurance conditions, market participants are better positioned to develop targeted financing solutions.

Aligning the costs and benefits of adaptation measures: As described above, adaptation investments that are inherently public in nature deliver benefits to a broad range of economic actors and stakeholders. Measures that link the costs of such investments more clearly to beneficiaries could help strengthen the visibility of adaptation measures for these stakeholders (e.g. homeowners benefiting from seawall investments). A number of innovative approaches are being explored to generate revenue streams from public investments in adaptation, including tariff- or user-fee-backed models employed by utilities, and outcome-based contracts.³⁶ Developing new market architecture to create a consistent 'line of sight' from economic to financial value stands as a key research and collaboration priority.

Better availability of data and insights: In order for the value of adaptation measures to be effectively quantified, comparisons need to be made between ex-ante and ex-post states - requiring reliable data on climate exposure, and actions taken to reduce risks. Some financial institutions report that clients are increasingly bringing information on adaptation measures, and forward-looking climate resilience plans, into commercial processes. To be meaningful from a risk pricing perspective, such actions need to be translatable into risk management processes, models, and metrics that are relevant for financial institutions. However, information is not often provided in a consistent way, requiring subjective judgements on the relative impact of a given action on a client's overall risk profile.³⁷ Greater transparency and consistency in the structuring of client information on exposures and resilience actions would in turn support financial institutions in incorporating this information into their own analyses.

Fiscal incentives for adaptation investment: Fiscal incentives can play an important role in bridging the gap between the economic benefits of adaptation investment and the financial returns available to individual actors. Options include tax credits for adaptation capital expenditure, accelerated depreciation allowances for climate-resilient construction and retrofits, concessional financing windows for resilient housing and infrastructure, and outcome-based grants tied to demonstrated resilience improvements. Drawing on experience from energy efficiency and clean energy policy, where fiscal incentives have materially catalysed private investment, analogous mechanisms can be designed for adaptation contexts.³⁸ In many jurisdictions, existing fiscal frameworks were not designed with adaptation investment in mind, and gaps in eligibility criteria, additionality requirements, and verification mechanisms may limit the direct application of models developed in the clean energy context.

3.2 Financial market practices, instruments, and policies - insurance sector

Risk modelling and contract structures: The financial system provides a broad array of products and solutions through which adaptation measures taken by clients are gradually reflected as value-preserving benefits, and rewarded through pricing. The architecture of risk models - particularly in the insurance sector, where actuarial models still rely heavily on historical loss data - is structurally designed to assess the impact of risk profiles in response to different risk drivers. In the absence of structural integration into risk models, adaptation measures can be integrated into financial sector contract structures - yet this requires targeted identification of such actions (e.g. in the form of quantifiable KPIs), as well as scenarios and climate projections. Many financial institutions are actively innovating to address these challenges.³⁹

Impacts of adaptation on insurance pricing: Adaptation investment affects not only today's insurance premium but the future trajectory of insurance availability and affordability. As physical climate risk increases, the range of perils and locations for which insurance is available at economically affordable rates may narrow. Adaptation measures - whether undertaken by policyholders or by governments through

infrastructure investment and land-use planning - can therefore help to maintain insurability by keeping expected losses and loss volatility within commercially viable bounds. Where insurance pricing appropriately reflects underlying risk trends, it also serves as a forward-looking signal to economic actors, highlighting the cost of inadequate adaptation. Against this backdrop, public and private insurance programmes increasingly act as resilience engines - reinforcing risk prevention, strengthening incentives for adaptation, and supporting faster recovery while reducing pressure on public budgets.

Insurers are also playing a critical role in helping to raise awareness about risks, identify adaptation and resilience investment options, and support implementation. Some insurers are developing multi-hazard portfolio advisory capabilities that allow clients to systematically identify adaptation priorities and quantify risk reduction potential across their asset base.⁴⁰ Other firms are expanding risk consulting service offerings, to support clients in identifying and targeting resilience measures. These advisory services operate independently of underwriting relationships and can provide financial institutions and real economy actors with the data-driven insights needed to make adaptation investment decisions. Separately, some insurers are exploring ways to link risk reduction benefits to premium credits or higher limits, through the use of KPI-linked structures, and by integrating resilience actions into client solutions. Some insurers are establishing partnerships with specialist service providers (e.g. wildfire defence) to offer risk-based discounts linked to service uptake.

Connecting insurer risk data to bank credit assessment: There is growing interest in deepening the linkage between insurers' physical risk quantification capabilities and banks' credit risk assessment processes. Insurers can perform portfolio-level physical risk assessments for corporates with large inventories of physical assets, providing granular data on exposure, expected loss, and the risk-reducing impact of adaptation measures - data that could inform credit analysis, pricing, covenants, and collateral management.⁴¹ Looking ahead, insurance availability is likely to serve as an early-warning indicator for critical climate risk situations, with direct implications for financial institutions - and strategic questions for supervisors.⁴²

3.3 Financial market practices, instruments, and policies - banking and capital markets

Risk modelling and credit products: In the banking sector, the primary approach to supporting clients' adaptation is developing adaptation-focused credit products and solutions, from sustainability-linked loans with resilience KPIs to different types of sectoral and SME resilience-related solutions and working capital products. Some banks note a shift towards the integration of resilience considerations into mainstream project financing processes. Banks are also supporting clients in their efforts to raise capital for adaptation and resilience investments in capital markets, including through structuring innovative use-of-proceeds instruments.⁴³

Debate is evolving on whether methodological shifts in the treatment of physical climate risk and resilience in bank credit risk modelling may be warranted. Theoretically, if banks were to use physical exposure data to calculate climate hazard variables in probabilities of default (PDs) and losses given default (LGDs), there could be methodological options to integrate adaptation measures taken by borrowers;⁴⁴ the ECB has reached a similar conclusion (see Box 4). The Cambridge Institute for Sustainability Leadership has also recently proposed a 'resilience-adjusted' approach to credit risk measurement integrating variables for physical climate risk exposure, insurance adequacy, and adaptation and resilience actions into adjustments to PDs and LGDs.⁴⁵

Financial sector policy frameworks: Debate is evolving around the use of financial policy frameworks to specifically target adaptation investments - including, for example, the expansion of sustainable finance taxonomies to consider adaptation⁴⁶ - and thereby make such investments more 'visible' for investors. However, there is no consistent evidence that policy frameworks such as taxonomies can materially

influence the investability or cost of capital for taxonomy-aligned companies and projects.⁴⁷ Further work is required to assess these interlinkages.

Box 4: Assessing the debate on considering adaptation within prudential frameworks - risks, challenges, and open questions

Following the logic that clients' adaptation actions contribute to improvements in underwriting or credit risk profiles, some stakeholders have suggested that reductions in portfolio-level risk achieved through financial institutions' support for clients' own risk reduction (e.g. through adaptation investment) could be reflected in prudential frameworks, including capital treatment. However, this would likely require significant investments in data, or recalibration of prudential tools - which could introduce new risks and unintended consequences.

Over the past five years, some central banks and supervisors - including the Bank of England,⁴⁸ ECB/ESRB,⁴⁹ and EBA⁵⁰ - have conducted analysis of different policy options to adjust prudential capital frameworks for regulated financial institutions to account for climate risks, with a focus on transition risks. On balance, supervisory and industry analyses have concluded that amendments to prudential frameworks are not currently warranted, due to a lack of adequate statistical evidence to prove a significant causal link between changes in emissions profiles and financial risk profiles that would be material from a capital perspective. Some stakeholders contend that modifying elements of prudential frameworks on a climate basis could create significant risks and unintended consequences.⁵¹ Nonetheless, debate on the use of different types of microprudential and macroprudential tools to respond to climate risks continues, as some supervisors seek to explore measures to address systemic risk implications.⁵²

Recently, financial supervisors, regulators, and central banks have begun to place more focus on physical risks - and there are now signals that some authorities are beginning to examine how and whether adaptation may be relevant from a capital treatment perspective. In February 2026, EIOPA launched a public consultation on issues relating to the prudential treatment of adaptation measures within the Solvency II framework.⁵³ In April 2026, the ECB released a paper exploring the links between banking regulation and adaptation outcomes, focusing on the efficacy of Level 3 prudential regulations in encouraging banks to include physical risk adaptation in their risk management and client engagement strategies.⁵⁴ While not directly addressing the question of capital, the paper concludes that adaptation measures should be 'treated as risk mitigants reflected in losses given default (LGDs), with the severity and consistency of those losses being reflected in transition plans and stress tests'. However, such efforts remain an exception to mainstream practice, where most supervisors have not taken actions to link climate risks, or adaptation action, directly to prudential capital treatment.

Some stakeholders have suggested that existing capital treatment mechanisms could potentially be adapted or expanded to specifically account for adaptation and resilience characteristics.⁵⁵⁵⁶ However, further work would be required to evaluate whether such measures could be warranted. The Institute of International Finance has set out the view that prudential approaches to broader macroeconomic risk factors such as climate change must remain risk-based and data-driven.⁵⁷ For any debate on such policy options to be robust, key challenges - including a lack of relevant data on the relative risk reduction impact achieved through adaptation, a lack of consistent and widely used methodologies, and the absence of a detailed impact assessment (including possible unintended consequences) - would need to be thoroughly addressed.

3.4 De-risking, blended finance, and public-private risk sharing

Public insurance mechanisms and fiscal capacity: The presence or absence of public fiscal capacity can impact the degree to which risks are priced in financial markets, on the basis of governments acting as the ‘ultimate holder’ of catastrophic risks. Insurance markets are a key channel to quantify risk exposure and make the value of adaptation investment visible to markets – and in many jurisdictions, markets rely on the presence of a public backstop for catastrophic risks. However, if not priced at a level that reflects underlying risk exposure, the availability of insurance could weaken the incentive to invest in adaptation measures,⁵⁸ prolonging current risk configurations. This issue can be compounded by assumptions that the pricing and availability of insurance cover will not vary significantly over the life of an asset.

Government backstopping or layering of catastrophic risks can help address availability and affordability of insurance in certain regions and for specific physical risk perils. However, an expectation that governments will use fiscal resources to support individuals and businesses can dilute risk signals and reduce incentives to invest in adaptation measures. Furthermore, as the frequency and severity of physical climate impacts shift in response to climate change, public fiscal capacity to support post-disaster recovery is likely to come increasingly under strain.

Blended finance for adaptation: Blended finance – the use of concessional or public funding to improve the risk/return profile of investments for private capital providers – represents an important tool for financing adaptation activities that would not otherwise attract private investment at scale. Concessional instruments include first-loss capital, guarantees, interest rate subsidies, and technical assistance facilities. In 2024, global blended finance transactions totalled US\$18.3 billion,⁵⁹ though adaptation-focused deployments remain a small share and fall far short of estimated financing needs. By structuring layers of public and private sources of capital in alignment with risk/return expectations, blended finance structures can help address challenges associated with the lack of clearly defined revenue streams from adaptation investments, particularly those which are more ‘public good’ in nature.⁶⁰ A range of blended finance structures are being deployed to mobilise private capital for adaptation investments, illustrating different approaches to bridging the gap between economic and financial value (see Box 5). Scaling these mechanisms requires both increased public funding and progress on the measurement and market architecture necessary to attract private capital on improved terms.

Box 5: Blended finance for adaptation – emerging models

First-loss and guarantee facilities for resilient infrastructure: Multilateral development bank (MDB) first-loss capital and guarantee facilities – provided by institutions including the World Bank, IFC, and regional development banks – improve risk-adjusted returns for commercial lenders financing adaptation-aligned infrastructure projects. By absorbing first losses or guaranteeing debt service, these instruments can make projects viable for private capital at commercial or near-commercial terms.

Parametric insurance solutions: Catastrophe bonds issued on behalf of sovereigns in the Caribbean, Pacific, and Africa by the World Bank and regional development banks provide rapid post-disaster liquidity based on parametric triggers.⁶¹ By enabling faster recovery, these instruments reduce the economic costs of disasters and enable the distribution of climate risk across global capital markets.

Certified adaptation benefit structures: The African Development Bank’s Adaptation Benefit Mechanism (ABM) enables certified adaptation benefits to be generated from resilience-focused projects – such as climate-resilient cocoa farming in Côte d’Ivoire and flood barrier construction in Lagos – with offtake agreements providing future revenue visibility that supports project financing.⁶² By converting verifiable resilience outcomes into an instrument that can attract upfront capital, the ABM illustrates one pathway for monetising avoided losses at the project level.

Product development and market-building facilities: The InsuResilience Solutions Fund combines grant funding with technical assistance and investment capital to support the design, testing, and scale-up of innovative climate risk insurance products for households, SMEs, and governments.⁶³

4. Looking ahead: priorities for action and conclusions on the role of private finance

More systematic valuation of avoided losses could have a broad array of benefits for both private actors and broader civil society. However, such a shift is one of a suite of broader transformative changes that may be necessary to turn adaptation investment needs into financeable opportunities. Looking ahead, a number of priorities emerge for further collaborative work and development.

4.1 Priorities for action

For policymakers and regulators

- Strengthen resilience standards, particularly in key sectors. Governments could embed sector-specific resilience thresholds into regulatory frameworks and national adaptation plans, referenced to quantifiable hazard return periods or performance standards. Priority sectors include construction and real estate, infrastructure, agriculture, water management, energy, logistics, and transportation. Where standards apply to new development, they should be integrated into planning and permitting frameworks; where retroactive, they should be accompanied by appropriate incentive mechanisms.
- Develop targeted fiscal incentives for adaptation capex. Tax credits, accelerated depreciation allowances, and concessional financing windows for adaptation capital expenditure could be designed to address specific market failures, including the first-mover disincentive and cost-benefit misalignment. Incentives should be time-limited, well-targeted, and accessible to households, SMEs, and municipalities, not only large corporations.
- Support the availability of consistent corporate physical risk disclosure. Consistent corporate disclosure of physical risk exposures, adaptation measures, and resilience planning – aligned with emerging international standards including ISSB IFRS S2 – is an important enabling condition for markets and investors to begin pricing the value of adaptation.
- Calibrate public-private risk-sharing frameworks to incentivise adaptation. Public insurance mechanisms, disaster relief programmes, and public-private partnerships could be structured to maintain appropriate risk signals and incentivise investment in adaptation, ensuring that incentives are not muted.

For financial institutions

- Deepen integration of physical risk and adaptation data into credit and investment processes. Banks could explore new ways to incorporate physical risk exposure, insurance adequacy, and adaptation measures into credit assessments. Collaboration between firms, and with specialist risk analytics providers, could enable progress on data-sharing protocols. The key bottleneck is not necessarily the absence of methodology or data – natural catastrophe models and loss histories provide a substantive basis for quantifying avoided losses and expected loss improvement from adaptation measures – but the commercial and data-sharing arrangements needed to make this analysis available to credit and investment decision-makers.

- Expand resilience-linked credit and investment products with robust KPI frameworks. Sustainability-linked loans (SLLs), resilience bonds, and other adaptation-focused instruments could be accelerated through common approaches to structuring and choosing KPIs.
- Explore collaborative insurer-bank structures. Financial institutions could explore product and data structures that combine insurers' risk quantification capabilities with banks' credit solutions, including joint resilience assessments for adaptation-exposed clients.

For market infrastructure and multilateral organisations

- Advance avoided loss valuation methodologies. Progress on consistent, cross-sector methodologies for quantifying the avoided losses associated with adaptation measures is a key priority - drawing on the most granular available insurance loss data. In the absence of a universal unit of resilience value (comparable to the tonne of CO₂e used in carbon markets), the development of sector-specific and hazard-specific approaches may be the most tractable near-term pathway.
- Scale and standardise blended finance vehicles for adaptation. MDBs, DFIs, and multilateral donors could work to accelerate standardisation and scaling of blended finance structures - through platforms such as SCALED (Scaling Capital for Sustainable Development, a public-private blended finance initiative),⁶⁴ MDB first-loss facilities, and the AfDB Adaptation Benefit Mechanism - and document the conditions under which such structures successfully mobilise private capital.
- Develop and pilot mechanisms to monetise avoided losses. In areas where adaptation investments generate measurable avoided losses, there may be opportunities to develop market mechanisms - including outcome-based contracts and certified adaptation benefit structures - that can link beneficiaries to costs and create investable revenue streams. Further discussion of emerging structures, alongside an illustrative catalogue of instruments, is provided in Annex 2.

Other priorities

- Resolving temporal misalignment and trade-offs. The temporal misalignment of investment costs and benefits, and the uncertain nature of future returns, are critical challenges for investment decision-making in the real economy. There are open questions on the degree to which adaptation investments may be aligned with the duties of boards, and the fiduciary duties of investors. Clearly, risk reduction is beneficial for long-term financial health and business model resilience of exposed firms. The relationships between investor fiduciary duties and adaptation - and the tension between reducing long-term risks and strengthening near-term returns - are equally complex.
- Bridging the gap - finding new ways to value and monetise avoided losses. In the absence of wholesale shifts in market norms, the success of efforts to scale capital for resilience-supporting activity will be dependent on finding new ways to value and monetise avoided losses. For a significant share of adaptation investments, there is a structural disjunction between the value these investments provide and their capacity to generate cash flows. Market mechanisms - including resilience credits⁶⁵ and derivatives linked to parametric indices⁶⁶ - have been proposed as ways to monetise avoided losses and create investable revenue streams; however, these face significant valuation and market infrastructure barriers as described above.
- Addressing the risk of uneven progress across jurisdictions. Considering that fair evaluation of the risk reduction benefit of adaptation requires clear and consistent data, and that changes to risk modelling may require financial institutions to invest in upgrading internal capacities, it is possible that any shifts towards valuing avoided losses could advance more quickly in mature markets. As emerging markets have large insurance protection gaps, and vulnerable populations may face higher barriers to implementing adaptation measures (e.g. due to fiscal capacity and quality of existing infrastructure), systemic biases

could potentially emerge that impact the perceived risk profiles of these markets.

4.2 Conclusions: understanding the role of private financial institutions in supporting adaptation and resilience

This paper has described the challenges associated with valuing avoided loss, and the implications of the related structural barriers that affect incentives to invest in adaptation and resilience. It has also explored innovations across the financial system that could help address these issues. On the basis of this analysis, it is evident that private financial institutions can approach adaptation and resilience priorities through both direct and indirect channels. Understanding this distinction is important for setting realistic expectations and identifying where focused action can have the greatest impact.

Through their core business activities, financial institutions influence adaptation outcomes in several important ways. Insurers are expanding advisory services for clients to help strengthen understanding of the return on risk reduction and implement adaptation and resilience solutions, and are working to share risk data and insights to inform market development; claims processes are also used as an intervention point to drive adaptation during recovery, often paired with advisory on resilient reconstruction. Banks are developing sustainability-linked loans with adaptation KPIs, serving as underwriters for adaptation-focused bonds, and structuring sector-specific resilience credit facilities, to help monetise the value of risk reduction. In investment and portfolio management, asset managers are increasingly incorporating physical risk and adaptation considerations into portfolio construction and stewardship activities. In risk pricing and assessment, financial institutions with more sophisticated physical risk modelling capabilities are progressively linking these to credit and investment decision-making, helping to make the financial value of adaptation more visible. Beyond direct product design, pricing, and service relationships, financial institutions could be more active in supporting adaptation measures through:

- Data sharing, in terms of contributing physical risk datasets, loss experience, and modelling insights that improve the overall information environment for adaptation investment decisions;
- Client engagement and advisory, by helping corporate and infrastructure clients understand their physical risk exposure and develop adaptation measures and plans, integrated into relationship banking and insurance advisory; and
- Investor stewardship and advocacy, both to encourage investee firms to better understand exposures and the benefits of adaptation and resilience investments for preserving value, and to help create enabling environments for adaptation finance.

These indirect contributions could play a significant part in shaping the pace of risk reduction and adaptation investment across the real economy.

At the same time, it is important to be clear about the constraints on financial sector action. Financial institutions cannot independently scale adaptation-linked activity in the absence of appropriate enabling conditions and risk environments. Insurance pricing and underwriting decisions play a critical role in signalling risk and incentivising risk reduction, but they do not, on their own, generate sustained adaptation investment without supportive public policy, risk mitigation measures, and data availability. Financial institutions also face the risk of countervailing outcomes: rational risk management responses to increasing physical climate risk – such as adjusting insurance pricing, tightening lending terms, or reallocating capital away from exposed geographies – can reduce the adaptive capacity of the very clients and communities most at risk. This raises a challenging policy conundrum at the intersection of three interlinked imperatives: the need to ensure that markets price risk efficiently; the need to ensure that households, corporates, and governments can access finance to invest in adaptation; and the need for financial institutions to manage risks while enabling economic growth.

Scaling up adaptation finance therefore requires concerted action across policymakers, regulators, corporates, financial institutions, and market infrastructure providers. The priorities for action outlined above reflect this shared responsibility. The key challenge is not classifying what counts as adaptation - but clarifying who pays, who benefits, who bears residual risk, what is contractible, what is insurable, and what sits on the public balance sheet. Where enabling conditions are in place, financial institutions are well positioned to mobilise capital, structure appropriate products, and support adaptation at scale.

Annex 1: Understanding adaptation and resilience investment

The table below compares adaptation investment decision-making across different types of economic actors, including the role of financial institutions in providing risk assessment, advisory services, and financing solutions across the spectrum.

ACTOR TYPE

Corporates

Real economy firms, utilities, agribusiness, infrastructure operators, SMEs

Core role in adaptation & resilience ▪ Integrate physical climate resilience into business models ▪ Protect assets, manage operations and local ecosystems	Main investment case / objective ▪ Avoid economic losses from asset damage ▪ Enable business continuity of operations and supply chains ▪ Protect firm value; manage legal risks and insurance costs
Typical instruments & actions ▪ Capex for resilient infrastructure and operations ▪ Climate-proofing of facilities ▪ Supply chain resilience programmes ▪ Risk transfer via insurance	Risk/return profile & horizon ▪ Commercial risk/return ▪ Costs upfront; benefits uncertain and long-dated ▪ Asset-specific and location-specific
Key incentives shaping behaviour ▪ Direct exposure to risk, threat of economic damage, business interruption, etc. ▪ Engagement from lenders, investors and insurers ▪ Disclosure and regulatory regimes ▪ Reputational benefits ▪ Cost of disruptions already being felt	Main constraints / barriers ▪ Difficulty monetising avoided losses ▪ Short-termism and internal competition with growth capex ▪ Limited tools to invest beyond the firm ▪ Balance sheet / cash constraints

Governments

National and subnational, including sector ministries and local authorities

Core role in adaptation & resilience

- Set policy, regulatory and planning frameworks
- Provide public goods and social protection
- Coordinate adaptation strategies and investments at national and local levels

Main investment case / objective

- Protect citizens and public assets
- Maintain fiscal stability
- Deliver public goods

Typical instruments & actions

- Budget allocations, grants and subsidies
- Infrastructure investment
- Nature-based solutions
- Blended finance facilities
- Enabling regulation and standards

Risk/return profile & horizon

- Public welfare objective
- Accepts lower or no direct financial return
- Very long-term horizon
- Large aggregate social and economic benefits

Key incentives shaping behaviour

- Political mandate to protect citizens
- International commitments (NAPs)
- Pressure from rating agencies and IFIs
- Portfolio-level hedging of sovereign physical risk

Main constraints / barriers

- Fiscal space and debt constraints
- Political cycles favouring short-term projects
- Weak project pipelines
- Implementation capacity; engaging impacted communities

Public financial institutions

National/international DFIs, multilaterals, green banks

Core role in adaptation & resilience

- Act as catalytic investors
- Mobilise co-financing and de-risk adaptation projects
- Channel finance to underserved markets and geographies
- Support inclusive financial systems

Main investment case / objective

- Achieve development outcomes and mandates
- Address financial sustainability risks from climate
- Invest in underserved capital markets

Typical instruments & actions

- Concessional loans and equity
- Infrastructure project debt
- Resilience bonds; first-loss and blended funds
- Technical assistance; grants
- Adaptation-focused funds and facilities

Risk/return profile & horizon

- Below-market or concessional returns
- Long-term horizon
- Accepts higher risk in exchange for development outcomes

Key incentives shaping behaviour

- Shareholder mandates focused on development outcomes
- Access to concessional resources
- Role in implementing standards and regulations
- Taxonomy recognition of adaptation assets

Main constraints / barriers

- Mandate and capital constraints
- Complex procedures
- Difficulty building pipelines of bankable adaptation projects
- Limited locally led pipelines

Commercial banks

Private financial institutions

Core role in adaptation & resilience

- Assess and price physical risk in loan books
- Finance corporate and household adaptation investments
- Help clients manage transition to resilient business models

Main investment case / objective

- Protect asset quality
- Develop credit products for resilient sectors
- Develop new lending products and advisory services
- Respond to client demand for resilient products

Typical instruments & actions

- Sustainability-linked products with A/R KPIs
- Corporate and project loans for resilient infrastructure
- SME and agricultural finance
- Climate-smart mortgages

Risk/return profile & horizon

- Commercial risk-adjusted returns with regulatory capital requirements
- Horizons aligned with loan tenors
- Focus on downside risk management

Key incentives shaping behaviour

- Market demand for adaptation-relevant financing and services
- Opportunities for new products
- Supervisory expectations relating to physical risks
- Disclosure frameworks and expectations

Main constraints / barriers

- Uncertainty on how to measure adaptation outcomes and price risk
- Limited local climate risk data and models
- Small ticket sizes; high transaction costs
- Basis risk in product structures

Institutional investors

Asset owners, managers, private equity, private capital

Core role in adaptation & resilience

- Allocate capital to resilient asset classes
- Engage companies; manage portfolio exposure to physical climate risk
- Develop and scale adaptation solutions

Main investment case / objective

- Protect portfolio value from physical climate risk
- Manage long-term liabilities
- Invest in growth capital for adaptation technologies
- Access thematic adaptation funds

Typical instruments & actions

- Equity and debt in resilient infrastructure
- Resilience and green bonds
- Thematic funds for adaptation technologies
- Long-term equity in adaptation services

Risk/return profile & horizon

- Market rate or above
- Long-term investment horizons
- Benchmark-driven performance

Key incentives shaping behaviour

- Regulatory expectations including climate risk disclosure
- Policy frameworks for adaptation investment
- Portfolio-level hedging of physical risk

Main constraints / barriers

- Difficulty attributing value to avoided losses
- Limited benchmarks for adaptation investments
- Illiquidity of many adaptation assets
- Small and fragmented ticket sizes

Insurers & reinsurers

Private financial institutions

Core role in adaptation & resilience

- Underwrite and price physical risk; maintain insurability
- Provide risk transfer and balance sheet support
- Leverage risk insights to steer capital and influence client behaviour
- Provide adaptation advisory services to clients and policyholders

Main investment case / objective

- Preserve insurability and economic continuity by reducing physical climate risks
- Turn resilience into an investable and yield-generating opportunity rather than a cost

Typical instruments & actions

- Indemnity and parametric-based insurance products
- Micro-insurance; public/private disaster risk pools
- Business interruption and supply-chain products
- Nature-based risk buffers; cat bonds / ILS
- Risk consulting and advisory services
- Partnerships with specialist risk reduction firms (e.g. wildfire defence)

Risk/return profile & horizon

- Underwriting risk and managing investment portfolios
- Asset-liability management
- Capital and solvency rules
- Annual pricing cycle for P&C products

Key incentives shaping behaviour

- Policy measures on building standards and resilient infrastructure
- Risk-based pricing
- Regulatory expectations; disclosure and other policy frameworks
- Growing client demand for risk advisory services
- Reputational value of maintaining insurability in climate-exposed markets
- Regulatory and public-policy incentives: risk-based pricing, product innovation, public-private risk-sharing structures

Main constraints / barriers

- Affordability and availability constraints; risk of market withdrawal
- Uncertainty in valuing long-term adaptation benefits
- Weak public-private partnerships in some markets

Annex 2: Instruments for monetising avoided losses and financing adaptation

Developing practical mechanisms to monetise the economic value of avoided losses is a foundational challenge for adaptation finance. This annex describes the emerging market mechanisms and instruments being explored to address this gap. It also provides a catalogue of adaptation financing instruments currently in use across sectors and geographies.

Annex 2.1: Emerging instruments

Tradeable resilience credits. A 2024 paper from Duke University's Nicholas Institute proposes a system of tradeable 'resilience credits' as a new asset class to translate avoided climate losses into a standardised instrument.⁶⁷ Under this model, the primary beneficiary of an adaptation investment (e.g. a municipality investing in flood infrastructure) would generate resilience credits representing verified avoided losses - which could then be sold to indirect beneficiaries such as multinationals with exposed supply chains or institutional investors seeking to offset portfolio-level physical risk exposures. The mechanism draws structural parallels with carbon credit markets, applying similar approaches to measurement, reporting, and verification to a physical risk context. However, it faces a fundamental valuation barrier linked to the challenges described in the main text: the absence of a universal unit of resilience value, the localised nature of benefits, the difficulty of attributing avoided losses to specific measures, and the lack of robust measurement and verification methodologies at scale.

Climate Damage Index derivatives. A 2024 paper by Ilinski, Bouev and Lobanov proposes creating a derivatives market for swaps on parametric Climate Damage Indices (CDIs) representing modelled insured expected losses by region from climate events.⁶⁸ Under this structure, a portion of swap premiums would flow into state-run adaptation funds, creating a financial nexus between the pricing of climate risk in capital markets and public investment in resilience. The CDI approach leverages existing insured loss modelling capabilities and could in principle operate without requiring a universal unit of avoided loss. Significant development work would be needed to establish credible CDI methodologies, standardise contract terms, and establish market infrastructure.

Both mechanisms are at early stages of development and face significant valuation and market infrastructure barriers. Progress would require standardised avoided loss measurement frameworks, coordination between public and private actors, and regulatory clarity on the treatment of adaptation-linked instruments. Notwithstanding these challenges, they represent potentially important pathways for bringing private capital into adaptation at scale.

Annex 2.2: Catalogue of adaptation financing instruments

The tables below provide an illustrative catalogue of adaptation financing instruments currently in use or in development, spanning credit, insurance, equity, and blended finance structures across key sectors. For each instrument type, the tables set out illustrative real-world examples and the types of KPIs and metrics used to link financing terms to adaptation outcomes.

Credit and debt instruments

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Built environment	Climate resilience bonds / green bonds with resilience use-of-proceeds for flood protection, drainage, resilient urban services, and climate-proofed buildings.	EBRD Climate Resilience Bond (US\$700 million, 2019); municipal and utility green bonds financing drainage, flood protection and resilient urban services.	Physical risk assessment completed; asset compliance with resilience design standards; beneficiaries / assets protected; avoided damage estimates; reduced outage or downtime days; service continuity metrics.	Economic value comes from lower expected loss, lower repair capex, more stable revenues, better debt service coverage, and sometimes broader investor demand and pricing support from labelled-bond buyers.
Built environment	Sustainability-linked loans / bonds with adaptation KPIs for property and infrastructure operators.	Emerging structures highlighted in adaptation KPI guidance for infrastructure and resilience-linked finance.	Share of portfolio / assets meeting climate-resilient standards; implementation of adaptation capex plans; reduction in interruption time; resilience governance milestones.	Margin step-downs or step-ups translate KPI achievement into lower or higher financing cost; lenders can also justify stronger credit appetite if resilience lowers physical risk exposure.
Built environment	Vanilla project finance / corporate loans for resilient real estate, coastal protection, cooling, drainage, and urban heat adaptation.	Standard project finance and corporate borrowing used for flood protection, cooling systems, drainage and coastal resilience even where the instrument is not explicitly labelled as adaptation finance.	Design return period; insurance grade / engineering certification; avoided maintenance events; occupancy or operational continuity metrics.	Value is captured through avoided asset impairment, stronger occupancy, lower insurance costs, and fewer operational disruptions even without a dedicated adaptation label.
Energy	Loans and project finance for grid hardening, undergrounding, stormproofing, storage, and resilient distributed energy.	Loans, bonds and blended structures supporting resilience to storms, floods and heat across energy systems.	SAIDI/SAIFI or equivalent outage metrics; share of network hardened; customers served during extreme events; critical load hours maintained.	Cash flow channels include more stable tariff revenue, reduced restoration cost, lower penalties under regulatory performance regimes, and higher willingness to lend against predictable utility cash flows.

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Energy	Sustainability-linked utility debt with resilience or reliability KPIs.	Infrastructure and utility financing structures that link financing terms to network hardening, service continuity and resilience implementation.	Service reliability; adaptation capex deployment; climate-risk management systems; resilience stress-testing and implementation milestones.	Financing cost adjusts via margin ratchets, while improved resilience can also support better credit perception and preserve regulated returns or concession revenues.
Agriculture	Adaptation credit lines and on-lending facilities for climate-resilient agriculture.	UNDP-supported line of credit with incentives for farmers to practise climate-resilient agriculture; tailored agri lending and de-risking facilities in Tanzania.	Number / share of farmers adopting climate-smart practices; hectares under resilient practices; irrigation efficiency; storage capacity; use of drought-tolerant seed.	Interest rebates, concessional tranches, or guarantee support lower borrowing costs when adoption targets are met; lenders also benefit from lower defaults due to reduced climate volatility.
Agriculture	Resilience or green bonds financing farm and value-chain adaptation.	FIRA's green bond linked to climate resilience in Mexico; proceeds directed to resilience in farmer communities and agricultural projects.	Hectares covered; volume of adaptation loans on-lent; water saved; protected agriculture installed; farmer communities reached.	Proceeds are earmarked into resilience-enhancing capex that should stabilise productivity, reduce borrower losses, and improve underlying loan portfolio performance.
Agriculture	Sustainability-linked loans for agri corporates / traders / banks.	Emerging structures tying financing terms to supplier resilience, water efficiency, climate-smart sourcing, or other adaptation-linked targets.	Supplier resilience coverage; share of sourcing base trained; yield stability in stress years; insurance penetration; water productivity.	Margin ratchets reward operational resilience; cash flow value also appears through more reliable supply, fewer disruptions, and lower earnings volatility for borrowers.
Water	Utility and project finance loans for resilient water supply, wastewater, stormwater, drainage, desalination, reuse, and storage.	Water-sector debt finance for resilient utilities and water systems, including wastewater, flood management and drought resilience.	Water-supply reliability; non-revenue water; drought storage days; people with resilient access; flood-protection standard; leakage reduction.	Water utilities monetise resilience through protected tariff revenue, lower emergency procurement costs, less service interruption, and stronger credit quality.
Water	Blue bonds and green bonds with water/coastal adaptation use-of-proceeds.	Seychelles sovereign blue bond; Indonesia sovereign blue bond; Nordic Investment Bank blue bonds financing stormwater, flood protection and other water-related investments.	Coastal area protected; mangroves restored; water quality; stormwater capacity; marine ecosystem resilience; population served.	Bond cash flows are standard debt cash flows, but project economics are improved by guarantees, concessional interest support, and the avoided-loss value of coastal and water resilience.

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Transport	Loans and bonds for climate-proofed roads, bridges, ports, airports, and rail.	Debt-financed transport cases addressing floods, storms and heat through upgraded design standards and hardening.	Availability during extreme events; closure days avoided; design threshold met; restoration time after event; throughput continuity.	Value is captured through protected tolls, availability payments, concession revenues, and lower emergency repair costs.
Industrial / supply chains	Corporate loans, revolvers, and bonds for resilient sites, warehousing, cooling, inventory, and supplier diversification.	Loans and bonds financing resilient industrial facilities, cooling systems, warehousing, continuity planning, and supply-chain diversification.	Business continuity KPIs; supplier diversification; stock-loss reduction; critical-site hardening; reduced weather-related shutdowns.	Cash flow improvement comes from lower disruption, preserved sales, lower spoilage, and reduced volatility of EBITDA and working-capital needs.

Insurance instruments

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Built environment	Catastrophe bonds / insurance-linked securities.	World Bank cat bonds for Mexico, the Philippines, and Jamaica; private-sector cat bonds such as USAA Residential Reinsurance.	Parametric hazard triggers; modelled loss thresholds; attachment/exhaustion points; speed and accuracy of payout calculation.	Value is expressed directly as contingent liquidity after events, reduced fiscal or balance-sheet shock, and lower post-disaster funding uncertainty.
Built environment	Traditional catastrophe / property insurance with resilience-linked underwriting.	Property insurance with premium discounts, deductible adjustments, or underwriting benefits for stronger resilience standards and retrofits.	Building code compliance; retrofit completion; risk-score change; claims frequency / severity.	Resilience lowers expected loss and can reduce premiums, deductibles, or coverage restrictions; policyholders monetise this through lower recurring insurance cost and better insurability.
Energy	Asset damage and business interruption insurance for utilities and energy infrastructure.	Insurance and risk transfer products used for storms, floods, heat, and broader resilience across energy assets.	Outage duration; asset risk scores; hazard intensity thresholds; revenue interruption period.	Payouts protect revenues and debt service after shocks; better resilience can lower premiums or improve terms.
Agriculture	Index-based crop and livestock insurance, often bundled with credit or inputs.	Rainfall, temperature and vegetation-index insurance products for farmers, often bundled with credit or input supply.	Rainfall, temperature, or NDVI triggers; claim turnaround time; coverage ratio; insured farmer numbers; loan repayment stability.	Fast payouts stabilise household and farm cash flows, support debt repayment, reduce distress sales, and can support lender willingness to extend credit.
Water	Drought or flood parametric covers for utilities, irrigation systems, and municipalities.	Parametric covers based on rainfall, reservoir levels, or flow conditions for water-dependent entities.	Reservoir thresholds; rainfall deficit; streamflow; days of service continuity; emergency procurement trigger.	Liquidity arrives when water availability collapses, helping utilities finance emergency supply and maintain operations.
Transport	Parametric storm and flood insurance for transport operators and logistics hubs.	Risk-transfer instruments across storm and flood risks relevant to ports, airports, and logistics assets.	Wind speed, flood depth, surge threshold; downtime duration; throughput restoration time.	Economic value comes via payout for damage and interruption and, ex ante, from reduced residual risk on asset cash flows.

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Industrial / supply chains	Contingent business interruption insurance and supply-chain covers.	Insurance products covering weather-linked disruption to supplier facilities and logistics chains.	Supplier disruption incidence; trigger metrics; restoration time; claims severity.	These products protect revenue and working capital when supplier failures or transport shocks interrupt production.

Equity instruments

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Built environment	Equity in resilient real estate, urban infrastructure, and adaptation solutions.	Equity funds and vehicles investing in resilient real estate, drainage, cooling, and urban adaptation infrastructure.	Portfolio share meeting resilient standards; occupancy / rent stability; avoided capex spikes; asset risk-score improvement.	Lower physical-risk exposure supports valuation resilience, lower discount rates, and more stable rental or concession income.
Energy	Equity in microgrids, storage, hardening technologies, and resilience services.	Equity backing businesses whose revenues depend on reliability and continuity solutions in energy systems.	Uptime, resilience service contracts, customers served in outages, avoided interruption hours.	Returns arise from differentiated service revenues, availability premia, and growth in demand for resilience solutions.
Agriculture	Impact / venture equity in agtech, irrigation, climate data, protected agriculture, and storage.	Equity investments in drought-tolerant seed, irrigation, weather services, storage and farm-management technologies.	Yield stability, farmer income resilience, hectares served, water-use efficiency, crop-loss reduction.	Cash flow channels include product sales, subscriptions, licensing, service contracts with buyers or lenders, and growth from resilience demand.
Water	Equity in desalination, leak detection, smart metering, reuse, and resilience technology.	Equity investments in water-efficiency and resilience businesses serving utilities and industrial users.	Water saved; service continuity; non-revenue water reduction; emergency supply avoided.	Savings-sharing and long-term service contracts convert resilience performance into recurring revenues.
Transport	Equity in climate-proofed ports, logistics hubs, and resilient concession assets.	Equity ownership in transport-adjacent infrastructure designed to maintain throughput under climate stress.	Throughput continuity; closure days; asset reliability; restoration speed.	Equity value is supported by more stable earnings and lower downside risk from climate disruption.
Industrial / supply chains	Equity in climate-risk analytics, resilient cold chain, climate adaptation engineering, and supply-chain platforms.	Private equity and growth equity in businesses monetising reduced disruption, better forecasting, cooling, and continuity solutions.	Clients onboarded; disruptions reduced; forecast accuracy; spoilage avoided; response time.	Revenue comes from SaaS fees, consulting, managed services, hardware sales, or success-based contracts tied to avoided loss or continuity improvements.

Blended finance instruments

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Built environment / cross-sector	Blended facilities combining grants, concessional capital, guarantees, and private capital for resilience infrastructure.	Multi-country or thematic resilience facilities and funds combining concessional and commercial capital.	Mobilisation ratio; project eligibility against resilience criteria; beneficiaries protected; avoided losses; co-finance crowd-in.	Concessional elements improve project bankability by lowering WACC, extending tenors, absorbing first loss, or de-risking construction and revenue uncertainty.
Agriculture / ecosystems	Global Fund for Coral Reefs and related blended vehicles investing in nature-based and resilient livelihoods.	GFCR as the first global blended finance vehicle dedicated to coral reef ecosystem and livelihood resilience.	Ecosystem resilience; livelihoods protected; reef health; revenues from reef-compatible businesses; private capital mobilised.	Grant and concessional layers finance early-stage risk and technical assistance so commercial investors can invest in businesses with resilience-linked cash flows.
Insurance / cross-sector	InsuResilience Solutions Fund and related premium-support / product-development facilities.	Grant-backed support for design, testing, and launch of innovative climate-risk insurance products for households, SMEs, humanitarian actors, and governments.	Uptake; affordability; claims speed; households or SMEs covered; product viability milestones.	Grants pay for product development and market creation, helping insurers reach viable scale while reducing end-user premium cost.
Water / coastal / sovereign	Blended blue bonds and debt-for-nature / debt-for-resilience structures.	Seychelles' sovereign blue bond with World Bank guarantee and GEF concessional support; Gabon debt-for-nature / blue bond-style structure.	Conservation area; coastal protection outcomes; fisheries governance; adaptation expenditure tracked over time.	Guarantees and concessional support reduce financing cost and create fiscal space; resilience benefits then support tourism, fisheries, coastal protection, and sovereign risk management.
Agriculture / flood / water	Adaptation Benefit Mechanism and certified adaptation benefits with offtake agreements.	AfDB Adaptation Benefit Mechanism pilots including climate-resilient cocoa in Côte d'Ivoire and flood barriers in Lagos.	Certified adaptation benefits; farmer resilience improvements; flood losses reduced; methodology-specific verified outcomes.	Offtake agreements provide future revenue visibility and collateral value, helping projects attract upfront loans or equity that might otherwise not be financeable.

Sector	Instrument / model	Illustrative examples	KPI / metric types	Economic value / cash flow linkage
Ecosystems / nature-based solutions	Conservation impact bonds and pay-for-success structures.	Deshkan Ziiibi Conservation Impact Bond in Canada.	Hectares restored; native species counts; biodiversity / habitat indicators; climate-smart habitat improved.	Outcome payments convert resilience and ecosystem benefits into an investable revenue stream; investors bear performance risk and earn return only if outcomes are delivered.
Banking system / MSMEs	Guarantees and risk-sharing facilities for local banks to expand adaptation lending.	Guarantee-backed and blended lending facilities reducing loss given default and encouraging local banks to finance resilience investments.	Volume of adaptation loans; NPL rates; end-borrower adoption rates; private capital mobilised.	Guarantees lower expected losses and capital consumption, making smaller or riskier adaptation transactions lendable at viable pricing.

Notes and sources

Sources: African Development Bank; EBRD; Global Environment Facility; Global Fund for Coral Reefs; G20 Sustainable Finance Working Group / WRI; IFC; IISD / NAP Global Network; InsuResilience Solutions Fund; LSE Grantham Research Institute; Nordic Investment Bank; UNDP; World Bank; WRI.

1. The views and opinions expressed in this report are those of the author and do not necessarily reflect the official policy, position, or views of any international financial institution, its management, or its affiliates. This paper was informed by bilateral interviews and group discussions with representatives of global financial institutions, multilateral organisations, and research entities during the period April–June 2026. The author would like to thank Judson Berkey and Sonja Gibbs for their review and comments on working draft versions of this document.
2. This paper defines climate adaptation as measures taken to reduce exposure and vulnerability to climate-related hazards, such as extreme weather. Such measures span a spectrum, from capital investment (e.g. in resilient infrastructure, building codes), to strategic actions (e.g. supply chain diversification to reduce business interruption risk). For further discussion of these concepts, see Annex 1.
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4. See: Carroll, J. et al. (2025). [Firm Credit Conditions and Flood Risk: Evidence from Ireland](#). The Economic and Social Review; Hirschbühl, D. et al. (2025). [The climate-biodiversity-pollution nexus: the pricing of environmental credit risks for European industrial polluters](#). ECB Working Paper Series No 3164; Giuzio, M. et al. (2026). [Climate change, bank liquidity and systemic risk](#). ECB Working Paper Series No 3168.
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18. Pension accounting standards (IAS 19 under IFRS; ASC 715 under US GAAP) require liabilities to be calculated using a present value discount rate linked to high-quality corporate bond yields. As interest rates and the cost of capital rise, discount rates increase, thereby reducing the current total value required to fund future liabilities.
19. Historical loss data records losses that occurred – not losses averted by risk reduction investments. In a context of non-stationarity and increasing climate damage, adaptation measures that keep losses stable may conceal how far losses would otherwise have increased.
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