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Framing Paper

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Nicola Ranger

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**CLIMATE-RESILIENT FINANCE AND INVESTMENT: FRAMING PAPER – ENVIRONMENT
WORKING PAPER No.196**

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Abstract

Achieving climate-resilient economies and societies will not only require increasing the billions of financial flows for adaptation, but also shifting broader -- public and private -- financial flows and investment away from potentially mal-adapted activities towards those that contribute to climate-resilient economies and societies. The goal of aligning finance with climate-resilient development is included in article 2.1c of the Paris Agreement, yet efforts to define and operationalise this concept are at an early stage. This Framing Paper summarises the current status of these efforts and outlines a way forward for defining, measuring and mobilising adaptation-aligned finance.

Keywords: risk management, climate change, adaptation, finance

JEL Classification: H54, Q54, Q58

Résumé

Pour parvenir à des économies et des sociétés résilientes face au changement climatique, il faudra non seulement augmenter les milliards de flux financiers destinés à l'adaptation, mais aussi réorienter les flux financiers et les investissements plus larges - publics et privés - des activités potentiellement mal adaptées vers celles qui contribuent à des économies et des sociétés résilientes face au changement climatique. L'objectif d'aligner le financement sur le développement résilient au climat est inclus dans l'article 2.1c de l'Accord de Paris, mais les efforts pour définir et rendre opérationnel ce concept n'en sont qu'à leurs débuts. Ce document de cadrage résume l'état actuel de ces efforts et esquisse une voie à suivre pour définir, mesurer et mobiliser les financements alignés sur l'adaptation.

Mots clé: gestion des risques, changement climatique, adaptation, financement

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Acronyms and abbreviations

A&R	-	Adaptation and Resilience
CRM	-	Climate Risk Management
ESG	-	Environmental, Social and Governance
FI	-	Financial Institution
GFANZ	-	Glasgow Financial Alliance for Net Zero
IPCC	-	Intergovernmental Panel on Climate Change
MDB	-	Multilateral Development Bank
PCR	-	Physical Climate Risks
TCFD	-	Task Force on Climate-related Financial Disclosure

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Executive Summary

Adaptation to climate change is increasingly urgent and a vital part of efforts to achieve the sustainable development goals. The UNFCCC's Standing Committee on Finance identified USD 34.1 billion of global public finance for adaptation in 2017-18. Building more climate-resilient economies and societies will require scaling up the billions of financial flows for adaptation, but also driving the trillions of dollars of public and private financial flows and investment away from potentially mal-adapted activities towards those that contribute to climate-resilient economies and societies. This goal, which is usually referred to as *aligning finance* with adaptation and resilience goals, is included within article 2.1c of the Paris Agreement, which calls for finance flows to be aligned with both adaptation and mitigation. However, this goal has yet to be operationalised.

Physical risk management is a necessary and important element for *climate resilience aligned finance*. The improved quantification, pricing and management of physical climate risks by financial institutions has the potential to contribute to enhanced societal resilience, not just through ensuring the resilience of the financial system to climate change itself, but also by creating price signals that influence behaviour in the wider economy. However, experience with insurance has shown that price signals alone are not enough: they need to be accompanied with actions to manage and reduce the underlying risks. Financial institutions can also support this process through the creation of markets for climate resilience financing, thereby creating opportunities for financing products, services and innovation that support adaptation to climate change.

However, improvements in physical climate risk management may not necessarily lead to better adaptation outcomes, particularly if they lead to measures that increase the risks faced by others, such as the construction of coastal defences that increase the vulnerability of others. Alignment takes a broader perspective: it looks at whether finance flows are materially supporting the policy goal of helping societies to adapt to the impacts of climate change, consistent with the approach outlined in article 2.1b and article 7 of the Paris Agreement. Alignment takes a longer-term, social perspective while risk management tends to focus on the organisational perspective. Indeed, financial risk management without adaptation alignment risks drawing capital away from the most at risk communities and lead to maladaptation.

This paper aims to contribute to the process of defining, measuring and – ultimately – increasing the proportion of finance flows that are aligned with climate resilience. This paper is intended to contribute to discussions in this area and does not prejudge the outcome of negotiations on related topics under the UNFCCC framework. This paper focusses on alignment in OECD and emerging economies, noting the unique challenges faced for financing adaptation in least developed countries and Small Island developing states. It proposes the following principles for *climate resilience aligned finance*:

- Physical risk management: the physical risks from climate change (such as drought or heatwaves) should be identified and managed based on forward-looking analysis and considering the intersection of hazard, exposure and vulnerability
- Do No Significant Harm: the management of risks should be done in a way that does not increase the risk faced by others (e.g. by increasing downstream flood risk or damaging biodiversity)

- Alignment with adaptation strategies and objectives: the investment should be consistent with relevant adaptation plans or strategies, such as NAPs

There are inherent uncertainties when predicting the likely impacts of climate change, combined with significant gaps in the availability of data and modelling of impacts. As such, these principles should be applied in a way that is robust to uncertainty, by favouring approaches that are flexible and perform well across a range of different possible climate futures. Regular monitoring, evaluation and response measures can help to achieve this.

Public policy has an essential role to play in mobilising and aligning finance to manage the risks from climate change, ultimately increasing flows of *climate resilience aligned finance*. There are a broad range of policy levers -- including provision of data, procurement policies, and regulation -- that can work together to increase flows of adaptation aligned finance.

Moving forward on this agenda will require further work to *define* climate resilience aligned finance, *measure* current trends and – ultimately – use the right policy tools and financing instruments to *mobilise* additional resources.

1 Aligning Financial Flows with Resilience and Adaptation Goals

1.1. Introduction

Initial findings from the IPCC's Sixth Assessment Report (AR6) provide the compelling, stark evidence of the growing challenges posed by climate change¹. As the climate warms, extreme events are likely to become more frequent and more severe. Trend changes, such as rising seas and shifting climate zones will have profound social, environmental and economic consequences. This report also shows unequivocally that early, fast and substantial climate mitigation action is needed to avoid the most severe impacts of climate change. However, even with mitigation commitments and policies in line with the goals of the Paris Agreement, the world would still experience significant changes in climate patterns and consequently impacts across many natural, social and environmental systems. The extent of warming – both at the global and regional level – will determine the severity of these impacts. The economic and human costs of climate change are already becoming evident as our climate moves out of historical norms. For example, just this year, extreme climate events have included droughts in Madagascar, wildfires across Greece, heat waves in the North West of America and flooding in Western Europe. These costs are likely to increase substantially, as the climate keeps warming.

Consequently, adapting to climate change is becoming increasingly urgent. Adaptation – the process of building resilience to the effects of climate change – is a vital part of efforts to achieve sustainable development goals in a changing climate. For example, climate adaptation can help ensure water and food security; enhance access to reliable, cost-effective and climate-resilient transport options that are essential for sustainable cities, employment and economic growth; protect businesses, homes and livelihoods from extreme events; and avoid costly disruption to supply chains. There is also a huge economic opportunity for economies and individual firms and investors from adaptation investment: analysis by the Global Commission on Adaptation identified USD 1.8 trillion of investment opportunities that would yield benefits of USD 7.1 trillion².

In addressing this challenge, it is imperative to steer financial flows towards activities that build climate resilience, and away from activities that undermine resilience. Finance flows that target adaptation are an important element of this process. The UNFCCC's Standing Committee on Finance's Fourth Biennial Assessment identified USD 34.1 billion of adaptation public finance in 2017/18³. More recent data from CPI (2021) identified global investment of USD 46 billion of finance for adaptation in 2019/20⁴, noting that there is currently very limited coverage of private and domestic public finance.

However, beyond finance specifically targeting adaptation, broader finance flows, both public and private, domestic and international, will have significant impacts on climate resilience. These impacts can be positive, neutral or negative. For example, investments in buildings and infrastructure today can lock-in climate-related risks for decades to come; yet, in many parts of the world, buildings and infrastructure are still not built to minimum design standards. Even where assets are constructed to the right standards, they may contribute to systemic risks if they are built in locations that are highly exposed to climate hazards.

Total infrastructure investment globally stands at around USD 2.7 trillion each year⁵; almost 60 times larger than all tracked, earmarked climate finance for adaptation. Similarly, activities that lead to deforestation and erosion of natural capital can seriously and irreversibly undermine the resilience of communities. Conversely, investment in social sectors, such as health and education, can play a critical role in strengthening the resilience of communities. For these broader flows, outside of climate finance, there is currently no framework to identify or track how finance and investment flows portfolios is positively or negatively impacting resilience outcomes.

These financial flows are being shaped by the large stocks of assets held within the financial system. At the end of 2020, the world's 500 largest global asset managers oversaw USD 110 trillion of assets⁶. To achieve climate-resilient economies and societies, ultimately, there is a need to not just increase the billions of financial flows for adaptation, but fundamentally to align the trillions of public and private financial flows and investment with resilience. This goal, which is usually referred to as *aligning finance* with climate resilience goals, is included within article 2.1c of the Paris Agreement, which calls for finance flows to be consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. However, this goal has yet to be defined or operationalised.

Progress on defining *climate resilient finance* has lagged behind mitigation alignment to date, both for public and private finance flows (Box 1.1)⁵ and received less attention in recent policy discussions. This is despite the immediacy of the impacts of climate change felt by many communities and the issues of irreversibility and lock-in outlined above. As with mitigation alignment, having information and transparency over which finance flows are aligned and are not aligned is a necessary step to making progress towards the goal set out by article 2.1c of the Paris Agreement.

This paper aims to contribute to the discussions about how to define and operationalise *climate resilience aligned finance*. In doing so, it does not prejudge the outcome of negotiations under the UNFCCC process. It identifies the progress made to date and the key questions that need to be answered to operationalise this concept. Achieving alignment requires action by investors, financial institutions and the public sector, as well as improved disclosures by firms. The goal of this paper is to raise the importance of climate resilience aligned finance and to lay a foundation for further work to operationalise the concept, including through potential quantitative work to identify relative trends of alignment and misalignment. It also shows how adaptation policies can support greater flows of climate resilience aligned finance by targeting key areas of the enabling environment.

Box 1.1. Progress on Climate Change Mitigation Alignment

Article 2.1c of the Paris Agreement calls for finance flows to be consistent with both adaptation and mitigation objectives. However, much of the focus to date has been on mitigation alignment.

In broad terms, mitigation alignment refers to increasing investments in activities that reduce greenhouse gas emissions and reducing investment in activities that contribute to contribute to emissions. A range of frameworks have been established to define what mitigation alignment means in practice, including those focussing on alignment with a '*temperature*' goal or alignment to the goal of '*net zero*' emissions.

There are currently no comprehensive estimates of the extent to which public and private finance flows are aligned with either mitigation or adaptation goals, but there has been an increasing amount of activity in this area.

In his foreword to the 2021 Task Force on Climate-related Financial Disclosures (TCFD) guidance, Mark Carney noted that “the financial sector will need to adapt and allocate capital according to their understanding of the opportunities and risks in the transition. Financial institutions will also increasingly be expected to disclose the alignment of their investments to net zero and show how clients’ money is invested”. The urgency of aligning finance with mitigation goals comes from the fact that the greenhouse gas emissions embodied within finance risk to lock-in further warming and the associated impacts for decades, or even centuries, to come. This creates a strong imperative for alignment, both in the context of Article 2.1c of the Paris Agreement, as well as broader sustainability objectives.

There is growing demand for mitigation aligned finance and investment opportunities from investors, including for green bonds and sustainability-linked financial products. For example, the Glasgow Financial Alliance for Net Zero (GFANZ), launched in April 2021, brings together over 250 financial institutions responsible for over USD 80 trillion of assets and anchored in the COP’s Race to Zero to accelerate the transition to net zero emissions by 2050. This does not include adaptation. Indeed, adaptation and resilience are not covered in the recent 2021 guidance of the TCFD on measuring portfolio alignment⁵.

Source: Paris Agreement ([link](#)), TCFD 2021 Status Report ([link](#)), GFANZ website ([link](#)), CPI Landscape of Climate Finance ([link](#)).

1.2. Perspectives on risk-management and alignment to resilience

The growing physical risks posed by climate change will increasingly translate into financially material risks and opportunities for the financial system (TCFD, 2017⁷). These impacts may arise from damage and productivity losses resulting from increasingly frequent and severe climate extremes, such as heatwaves or droughts. They may also arise from trend changes, such as shifting zones of suitability for agricultural cultivation or the opening of new shipping routes as polar ice thins. The physical impacts of climate change will therefore affect revenues and/or costs in affected sectors and beyond.

Organisations – such as businesses and public bodies - will be affected by the impacts of physical climate events beyond the boundaries of their operations, given the interconnected nature of the modern economy. This can already be seen, for example, in the disruption of global supply chains due to climate events, such as wildfires in Canada leading to higher lumber costs in the US. There is also the potential of systemic risks in the event of a sudden re-pricing of asset values: such as coastal property at risk from sea-level rise.

Understanding and addressing physical climate risks is a core part of competent organisational management and fiduciary duties. As the risks from climate change become increasingly visible, organisations will manage their exposure to these risks to try and achieve their desired level of risk versus returns over time. Their ability to do so proactively will vary depending on the availability of data and access to climate services. Activities to manage physical risk exposure could include investments in protective infrastructure, diversification of supply chains or changes in business strategy. It could also include divesting from high-risk locations.

The disclosure of physical climate risks can contribute to the efficient functioning of markets by providing investors with additional information about the value of the assets in which they are investing. At the level of the financial system, proactive risk analysis and disclosure, including through “stress testing”, can also contribute to financial stability by identifying potential systemic risks in advance of those risks materialising.

Climate resilience aligned finance takes a different perspective: instead of looking at the impact of physical climate risks on profitability and stability within the financial system (financial risk management), it looks at whether finance flows are supporting the policy goal of helping societies become more resilient to the impacts of climate change. Alignment both a short-term and a longer-term, societal perspective while physical climate risk management tends to focus on the organisational perspective. For the private sector, this perspective is often driven by the profit motive, while public financial institutions will be shaped by their organisational mandates. Investors vary in the time horizons that they consider, but these will often be short compared to the timescale of climate impacts.

Financial risk management and alignment are related, but they are not identical. For example, better pricing of physical climate risk within financial decision making, e.g. in insurance premiums and interest rates on lending, will help to raise awareness of climate-related risks and encourage investments in some types of adaptation response. As such, the cumulative impact of measures to manage private risks may lead to more resilient economies and societies. For example, if enough businesses improve the management of risks to their supply chains, there should be less disruption following an extreme event.

However, improvements in physical climate risk management will not necessarily lead to alignment, and may even cause misalignments. Alignment considers not only whether risks are managed, but how they are managed. For example, a chemical plant could address drought risk by increasing its water efficiency, or by increasing groundwater extraction from an overstressed aquifer. In an imperfect regulatory environment, these responses could yield similar outcomes from the perspective of financial risk management, but increased water efficiency would be preferable from a societal perspective. As such, we define climate resilience alignment as the process of *ensuring that financial flows are consistent with those needed to achieve climate-resilient development at a societal level*.

Climate-resilient development is defined here as being development that makes progress towards the Sustainable Development Goals in a changing climate, and is also consistent with the principles outlined in article 7 of the Paris Agreement. It may be operationalised at the national level through documents such as National Adaptation Plans or strategies.

Financial risk management without alignment risks drawing finance away from those communities and firms most at risk from climate change, as firms and investors start to reduce their risks through withdrawing lending and investments from highly vulnerable areas. An alignment approach would place greater emphasis on providing *adaptation financing* to help communities and firms adapt. For example, by providing public finance to support farmers in adapting their agricultural practices to more drought-prone climate conditions, or transitioning to new economic activities.

In summary, there is a clear trajectory towards greater disclosure and management of physical climate risks, driven by a combination of regulatory reforms and market pressure. The challenge is to ensure that this makes a genuine contribution to the goal of making people better able to manage the risks posed by a changing climate. This entails phasing-out investments that undermine resilience to climate change (e.g.

those that fail to demonstrate that they Do No Significant Harm to lives and livelihoods and long-term prosperity and growth), while increasing those that make a positive contribution to societal resilience.

1.3. Climate resilience aligned finance

This paper is intended to facilitate discussions around developing and operationalising the concept of *climate resilience aligned finance*. This concept, analogous to mitigation-aligned finance (e.g. based on GHG reduction scenarios and benchmarks), would start to identify whether finance flows – both public and private – are consistent with intended climate-resilient development and objectives. Greater measurement and disclosure of adaptation-aligned finance has the potential to provide greater transparency about current trends, and support public-sector action to strengthen resilience. Over time, this would complement existing measures of climate finance for adaptation and could help to drive trillions more of financing into adaptation-aligned activities and away from activities that undermine resilience and lead to maladaptation.

There is growing private finance and investor demand for projects with positive outcomes for adaptation and resilience. For example, the first dedicated climate resilience bond was launched by the European Bank for Reconstruction and Development (EBRD) in 2019, raising USD 700 million. More than 900 green bonds have been issued to date that include climate resilience components (CBI, GCA and EBRD, 2021)⁸. These bonds are promoted as making a positive contribution to building resilience.

The concept of alignment is becoming more mainstream in public finance, even if implementation remains at an early stage. The frameworks adopted by the Multilateral Development Banks⁹ and by wider development finance institutions already include climate resilience as part of their broader concept of *alignment*. In December 2017, together with the International Development Finance Club (IDFC), the MDBs announced their vision to align financial flows with the objectives of the Paris Agreement, with one building block dedicated to adaptation and climate-resilient operations. Managing climate risk is one of five voluntary principles of the IDFC (Box 1.1).¹⁰ The OECD has called for international development co-operation to be aligned to the Paris Agreement (OECD, 2019). This call has been endorsed by members of the Development Assistance Committee (2021)¹¹.

Box 1.2. MDBs alignment approach to adaptation and climate-resilient operations

The Multilateral Development Banks have set out the following policy goal for in relation to physical climate risks.

“We will be active in managing physical climate change risks, in a manner consistent with climate-resilient development, and in identifying opportunities to make our operations more climate-resilient. In addition, we will seek to support a significant increase in our clients’ and their communities’ ability to adapt to the adverse impacts of climate change”.

Source: [Joint Declaration MDBs Alignment Approach to Paris Agreement \(worldbank.org\)](https://www.worldbank.org/en/press/2017/12/14/mdb-alignment-approach-to-paris-agreement).

However, the concept of aligning investment portfolios and private financial flows with adaptation and resilience goals is very much nascent. The EU taxonomy of the European Union’s 2021 Sustainable Finance Strategy¹² is one of the first disclosure frameworks for private financial institutions that explicitly embeds adaptation alongside mitigation. This motivates this paper’s focus on advancing the concept of adaptation-aligned finance. The goals of this paper are twofold. For investors and financial institutions, it outlines the case for adaptation-aligned finance and proposes initial steps toward operationalising the concept of adaptation alignment. For governments and regulators, it lays out a preliminary framework for how the public sector – including donors - can support the development of an enabling environment for aligning private financial flows with national adaptation and resilience goals, as well as with the international goals on climate-resilient development set out by the Paris Agreement. The following section overviews progress to date and builds toward a framework and set of principles for alignment.

2 The financial sector and alignment to climate resilience

This section outlines developments in the financial sector relevant to alignment to climate change adaptation and resilience, including the drive to improve disclosure and management of physical climate-related risks and the development of frameworks for alignment.

2.1. Pricing and management of physical climate risks

There have been considerable efforts to better understand and disclose physical risks arising from the impacts of climate change. Financial institutions (FIs) must manage material financial risks as a core part of their fiduciary duties and, in many jurisdictions, as part of financial regulations, for example, Basel III (for banks) and Solvency II (for insurers). For some investments, products and assets, physical climate shocks, like hurricanes, wildfires, floods and droughts, and slow-onset climate change could create a material risk to the FI. Examples could include providing mortgages to homes in exposed coastal regions, investing in real-estate on flood plains or agricultural finance. The size of the risk will depend upon the combination of the physical impacts from climate change (hazard), the location of the asset (exposure) and the characteristics of the asset (vulnerability).

Financial risk management of material physical risks is essential to ensure the long-term solvency, profitability and sustainability of financial institutions; but also contributes to the wider social, economic and financial resilience of societies. For example, if bank lending is impacted by climate shocks, this can delay recovery across the economy as households and firms are unable to access the finance they need to recover.

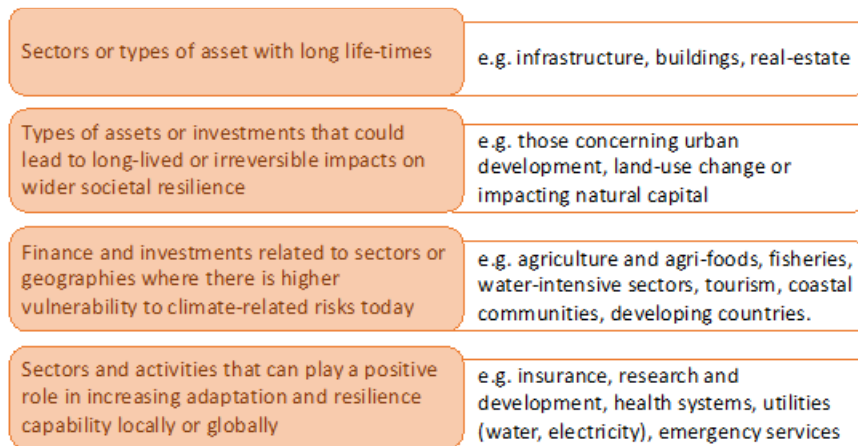
Managing physical climate-related financial risks is “business as usual” in some parts of the financial sector, like insurance, albeit the focus has been on managing current climate-related risks, rather than longer-term climate change. The property and casualty insurance industry, as well as specialised areas such as agricultural insurance, have evolved sophisticated approaches to quantifying, underwriting and managing such risks including in developing and emerging economies. Sophisticated regulatory and supervisory regimes are in place in many advanced economies to ensure minimum standards of financial risk management are in place; for example, covering risk capital requirements (e.g. Solvency II in the EU). As the climate moves further from historic norms, the availability of insurance for certain hazards may be limited as climate extremes become more frequent, severe and unpredictable.

Physical climate risks, and particularly longer-term climate change, are not yet fully seen as a material financial risk in the wider financial sector. This is largely due to the relatively short timescale of many assets and decisions, and also because physical climate risks, at least in more advanced economies, have historically been moderate compared to other sources of financial risks. This is partly related to the presence of insurance, and many banks, for example, will ensure criteria for provision of lending related to property include minimum levels of insurance. In some highly drought, pest or flood exposed countries, banks do incorporate physical climate risk into financial risk management for agricultural finance (OECD, 2021¹³).

As a result, current and future physical climate risks are not fully priced within financial flows¹⁴. This has significant implications for resilience and adaptation beyond the financial sector. Climate action is viewed as suffering from the *Tragedy of the Horizons* problem, with climate impacts occurring beyond the time horizons considered by decision makers¹⁵. The results is that these are not taken into account within financial decision making unless there is a further driver, such as regulation, that encourages them to be addressed. As a result, in the words of Mark Carney in 2015, “*once climate change becomes a defining issue for financial stability, it may already be too late*”. Insofar as finance (be it a premium or cost of capital) faced by a company, small business, government or households does not fully reflect climate risk, there is less incentive to act, both to mitigate and adapt, hence risks continues to accumulate. For adaptation, similarly to mitigation, the tragedy is amplified by lock-in – as decisions made today (such as land use) limit future adaptation options. Key sectors for lock-in are identified below (Figure 2.1). Integrating physical risks more explicitly into financial decision making would enhance resilience to climate change within the financial sector, but also correct the market failure embedded in current pricing mechanisms, thereby enhancing wider societal resilience.

The picture of the *Tragedy of the Horizons* has been nuanced by the initial results of the IPCC’s 6th Assessment Report, which show that significant climate change impacts are already being observed in every continent and will intensify in the coming decades. This gives a greater immediacy to physical climate risks than was widely appreciated in 2015. Recent stress tests find that climate impacts could become an important source of systemic risk (ECB, 2021)¹⁶. Yet, some evidence suggests that physical climate risks, in particular long-term risks, are not yet fully priced into financial markets. For example, in 2019, BlackRock released a report on physical climate risk analysis, evaluating coastal real estate, the USD 3.8 trillion U.S. municipal bond market, and 269 listed utilities, concluding that climate-related risks are currently under-priced across all three of these asset classes¹⁷. This is consistent with the findings of other recent research¹⁸.

Figure 2.1. Sectors, assets, investments or geographies with particularly high relevance for adaptation and resilience



Source: Modified from the adaptation framework laid out in Fankhauser et al. 2013¹⁹ and the EU taxonomy adaptation-relevant sectors.

Nonetheless, there are signs of progress, with financial institutions now beginning to integrate physical climate risks into financial decision making, albeit the focus still lags behind climate-related transition risks. This progress has been driven by multiple factors:

- **Growing awareness of the risks posed by climate change**, including risks due to recent extreme weather events that have generated significant economic losses. There is also more research available on the scale of the financial risks of physical climate change, such as Mandel

et al. (2021), CERES (2021), and UNEPFI (2020)²⁰. In 2018, the Carbon Disclosure Project's Global Climate Change Analysis reported that many large firms highlighted concerns on physical-climate risks to supply-chains, borrowers' creditworthiness and operating costs and risks. The number of S&P 500 firms flagging "wildfire" as a potential risk factor in annual reports has risen from 9 in 2010 to 37 in 2019²¹.

- **Disclosure of physical risk.** Better information allows investors to take a view and can promote more timely responses. Voluntary initiatives, such as the Principles for Responsible Investment (PRI), and standards, have long promoted best practice and consistent standards for disclosure (albeit physical risk is more recent). The release of recommendations of the Task Force for Climate-Related Financial Disclosures (TCFD) in 2017 was a watershed moment, and this voluntary framework has been adopted by many FIs, governments and industry organisations. The TCFD framework puts equal emphasis on physical climate risks and opportunities (TCFD, 2017); albeit arguably metrics for physical risks are still less evolved than those for transition risks²². The TCFD November 2020 status report found that while the number of TCFD supporters from the finance industry had grown to 750, very few reporting organisations conducted any scenario analysis to assess physical (or transition) risks²³. In January 2021, public and private sector organisations, including 10 major financiers, called for greater focus on physical climate financial risks and more support from policymakers, regulators and Central Banks to build standards, scenarios, data and best practice to support greater integration of these risks²⁴. In June 2021, all G7 members committed to move towards mandatory disclosures of climate-related financial risks. For example, the EU introduced the EU Action Plan for Financing Sustainable Growth (Box 2.1), which incorporates several policies, regulations and initiatives to promote (and in some cases require) the integration of climate-related risks within the financial sector, including strengthened disclosure requirements²⁵. Initiatives are underway to strengthen guidance and develop best practice²⁶.
- **Investor expectations.** Institutional investors and coalitions, such as the Institutional Investors Group on Climate Change²⁷, are beginning to articulate stronger expectations from investees concerning physical climate risk assessment and management. To date, this has focussed on expectations concerning the identification and governance of risks and opportunities to the investee/firm, consistent with the TCFD framework.
- **Financial regulation,** including by Central Banks and financial supervisors. For example, in 2021 the Bank of England ran its first Climate Biennial Exploratory Scenario (CBES) for the largest banks and insurers, requiring them to assess and report on their exposure to physical (and transition) risks. The Central Bank of Brazil published a report setting out how it is addressing climate change risks and opportunities within its remit²⁸. Adaptation has been included in the EU Sustainable Finance Disclosure Regulations (SFDR), and the UK Roadmap on Sustainable Investing
- **Public-private fora,** coalitions and initiatives that support and promote best practices and provide public goods. For example, the UK's Climate Financial Risk Forum, have developed tools and guidance related to disclosure and regulation. The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) provides standardised scenarios, knowledge and guidance. Major public-private coalitions have raised the importance of climate-resilient investment and provided knowledge and tools as a public good. For example, the Coalition for Climate Resilient Investment (CCRI), supported by over 70 institutional investors, governments, FIs and other institutions, aims to create a more resilient global financial industry in which key incentive structures foster an accurate pricing of physical climate risks (PCRs) in investment decisions. The Global Adaptation & Resilience Investment Working Group (GARI) has convened over 300 private investors to share knowledge and best practice in adaptation and resilience investment. The UK Government has also established the Centre for Greening Finance and Investment to provide open data and tools to FIs to support risk management.

In summary, improved quantification, pricing and management of physical climate risks by FIs has the potential to contribute to enhanced societal resilience, not just through ensuring the resilience of the financial system to climate change itself, but also by better reflecting price signals that influence behaviour in the wider economy²⁹. It could also support the creation of markets for resilience, creating opportunities for financing adaptation and resilience, prompting investors to seek out best-in-class adaptation-aligned investment opportunities in each sector, and offering new products and services to support adaptation and resilience. This is a necessary and important element for *climate resilience aligned finance*.

Box 2.1. EU actions to strengthen the enabling environment for climate-resilient finance

The European Union is undertaking a broad set of policy reforms to support the alignment of the financial system with the green transition. The 2018 Action Plan on Financing Sustainable Growth established the following mechanisms to encourage sustainable finance, subsequently developed in the 2021 Sustainable Finance Strategy:

- Development of an EU Taxonomy to identify sustainable activities, including definitions for activities that contribute to resilience;
- Creation of an EU Green Bond Standard, a voluntary mechanism for labelling bonds that are compliant with the goals of the Paris Agreement and EU Taxonomy;
- Establishing the Sustainable Europe Investment Plan.

This package of measures is intended to promote greater transparency and protect consumers by developing a robust framework for identifying whether investments are green. It is intended to support the development of the market for green investments by building confidence in the standards being developed.

Source: [Overview of sustainable finance | European Commission \(europa.eu\)](#).

2.2. From risk management to alignment: the framework

While progress is being made on understanding and managing physical climate risks by financial institutions, climate risk management (CRM) is not the same as achieving alignment with resilience. This is analogous to those arguments made for temperature alignment versus CRM for mitigation³⁰. For example, in the context of net zero (or temperature) alignment, Caldecott (2020) noted that “[The] synergies between [Alignment with Climate Outcomes] ACO and CRM are clearly important and it makes sense to maximise them at every opportunity. But that is different from saying there is always a positive relationship between them both, or that CRM automatically and inevitably leads to ACO. It does not. CRM can make little or no contribution to ACO”. As outlined in Section 1.2, the same issue holds for adaptation alignment. This section proposes some initial criteria for assessing what counts as adaptation-aligned finance.

Figure 2.2. Climate risk management versus alignment



Source: authors building upon Caldecott (2020).

As outlined in Section 1, improving the management of physical risks within and by financial institutions can contribute to wider societal goals, such as climate adaptation and enhanced resilience, but not necessarily. For example, a bank acting to ensure all its real-estate clients have adequate flood insurance and meet current buildings standards, or that its infrastructure investments are resilient, can contribute positively to wider societal resilience. Whereas, a bank withdrawing loans from coastal properties to reduce its own risk, could threaten resilience for those communities. Similarly, a bank financing mining activities that cause deforestation might assess the direct risks from physical climate to the mining assets to be low, while the consequent deforestation caused by mining has a large negative impact on the resilience of local communities through increasing their exposure to flooding and making crop lands more vulnerable to drought. The management of physical climate risks, while being part of sound financial management, says little about the direct contribution to resilience. This is analogous to the concept of double materiality for mitigation finance.

The challenge is that the resilience of the systems in which a particular asset is embedded is only financially material to a financial institution insofar as it affects the risks to which the asset is exposed. There could be trade-offs between the resilience of a specific asset or firm and the resilience of society, either locally, nationally or globally. Climate resilience alignment is the process of *ensuring that financial flows are consistent with those needed to achieve climate-resilient development at a societal level*. As shown in Figure 2.2, this overlaps with physical climate risk management, but is not the same.

Aligning finance with adaptation and resilience goals should *not* be interpreted as necessarily meaning divestment from activities that face higher physical climate risk. Indeed, this would have negative outcomes for the most climate vulnerable communities and particularly for lower income countries and other developing countries with high vulnerability such as SIDS.

Aligning finance – both public and private -- *does* mean:

- a) divestment from activities that *create or increase physical risks* to communities and society (e.g. building critical infrastructure in flood plains thereby encouraging further development or activities associated with deforestation or environmental pollution); and
- b) Where possible, through finance, proactively supporting or incentivising activities that directly help adaptation and resilience (of a particular community, firm or society more widely) or enable more climate-resilient development.
- c) Engagement with institutions currently investing in activities that create or increase physical risk to support their transition towards new business models that enhance (rather than undermine) resilience

The former point (a) is analogous to the *do no significant harm* principle. This is an integral part of the EU Taxonomy framework, implemented as part of the 2018 EU Action Plan on Financing Sustainable Growth (Box 2.1). The concept is also implicit in many voluntary frameworks for sustainable finance, responsible

banking and investment, ESG (Environmental, Social, Governance) investing and CSR (Corporate Social Responsibility)³¹. For example, the European Commission's *Guidelines on Non-Financial Reporting (NFR): Supplement on Reporting Climate-related Information* in June 2019³² would require that companies consider and report upon not just the material financial risks of physical climate change they face, but also on the potential impacts of their activities on the resilience of communities and the environment. The minimum scope of NFR under the EU Directive 2014/95/EU is reporting on how business' policies are implemented in relation to environmental protection and social responsibility.

The latter point (b) is the main purpose of adaptation finance, and can also be defined as a form of *transition finance*. In the case of net-zero alignment (Box 1.1), there is a recognised need for transition finance to support net zero alignment, which can be defined as *"the provision and use of financial products and services to support counterparties, such as companies, sovereigns, and individuals, realise alignment with environmental and social sustainability"*³³. This includes traditional adaptation finance and can be considered a form of *impact investing*; that is, investment with the intention to generate positive, measurable social and environmental impact alongside a financial return.

As such, alignment can include opportunities -- for financial institutions and wider investors -- to invest in products, services and investments that can be offered to third-parties for the purpose of supporting adaptation and thereby enhancing resilience³⁴:

- Developing new business models for investments to manage climate risks, for example flood defences or measures to reduce water consumption, including through mechanisms such as resilience bonds and other sustainability-linked financial instruments, but also smaller-scale financing, such as lending to SMEs, agricultural finance, home-owner loans, or micro-credit to farmers to help strengthen resilience.
- Investing in innovations that support adaptation and resilience, such as new smart water meters or drought-resistant crop varieties.
- Providing financial products and services to manage risks, such as insurance.

In other cases, alignment may have trade-offs with immediate returns. For example, it could mean paying more to operate in a sustainable way (e.g. reducing pollution or ecosystem impacts) to avoid negative impacts on local community resilience. It could mean avoiding investments in activities that directly or indirectly contribute for increasing greenhouse gases emissions and environmentally unsustainable practices.

Climate resilience aligned finance is synergistic with nature-aligned finance, in that financial flows that are aligned with the preservation and restoration of nature and biodiversity will also help to build climate resilience, and indeed natural capital is a key determinant of resilience and adaptive capacity (Manca et al. 2017³⁵). Hence, there are links to the frameworks developed as part of the Task-Force on Nature-Related Financial Disclosure (TNFD). It is an integral part of finance aligned with the sustainable development goals.

Box 2.2. Adaptation and the Paris Agreement

The Paris Agreement is a legally binding international agreement on climate change, which was adopted by 196 Parties at COP 21 in Paris on 12 December 2015. Article 2 of the Agreement lays out key agreements relating to mitigation, adaptation and finance alignment (from paragraph 1):

“This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

- a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
- b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and
- c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.”

Article 7 focuses on adaptation, including the following:

“Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2.

Parties recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions, and that it is a key component of and makes a contribution to the long-term global response to climate change to protect people, livelihoods and ecosystems, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change

Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate.

Parties recognize the importance of support for and international cooperation on adaptation efforts and the importance of taking into account the needs of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change.”

Article 9.4 includes the following:

“The provision of scaled-up financial resources should aim to achieve a balance between adaptation and mitigation, taking into account country-driven strategies, and the priorities and needs of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change and have significant capacity constraints, such as the least developed countries and small island developing States, considering the need for public and grant-based resources for adaptation.”

Source: [Paris Agreement text \(unfccc.int\)](https://unfccc.int/paris-agreement).

2.3. Toward a set of principles of alignment

This section explores the principles that could be used to identify climate resilience aligned finance and assets within a portfolio, drawing on learning from existing frameworks. To date, there are no internationally-agreed standards for assessing the alignment of portfolios to climate change adaptation and resilience goals, but there are a number of initiatives that aim to assess whether individual projects or investments are conducive to adaptation. The approaches vary given that they have been developed for different purposes, but there are a number of common themes.

Three existing frameworks relevant to adaptation alignment to date have explicitly targeted private sector financial institutions: the TCFD framework; the CBI Climate Resilience Principles; and the EU Taxonomy. The TCFD framework, discussed in Section 2.1, is designed to support the efficient functioning of financial markets by disclosing material climate change-related risks, including governance, strategy, risk management and metrics and targets. As TCFD does not explicitly aim to support climate resilience alignment, it is not discussed in detail here. The CBI Climate Resilience Principles are a voluntary credential that can be used to identify whether a bond contributes to build resilience, either by enhancing the resilience of a specific asset or contributing to the resilience of an entire system³⁶. The EU Taxonomy sets a detailed framework to assess if (a) a specific economic activity makes a substantial contribution to adaptation and/or (b) it complies with the do-no-harm principle. The EU taxonomy sets out the most detailed set of principles and criteria that financial or non-financial institutions can use to ensure alignment with adaptation. This is described in Box 2.3.

Box 2.3. Summary of adaptation and resilience within the EU Taxonomy

“The proposed approach for an adaptation taxonomy recognises that adaptation is context- and location- specific and requires the use of a process-based approach to determine if an activity contributes to adaptation and to the broader system’s climate resilience. The following two-step process aims to demonstrate that an activity contributes to a substantial reduction of the negative effects of climate change:

- a. Assessing the expected negative physical effects of climate change on the underlying economic activity that is the focus of resilience-building efforts, drawing on robust evidence and leveraging appropriate climate information;
- b. Demonstrating how the economic activity will address the identified negative physical effects of climate change or will prevent an increase or shifting of these negative physical effects.

The EU’s Adaptation Taxonomy covers 68 economic activities, which were originally selected for their potential to deliver a substantial contribution to climate change mitigation. A number of economic activities that might be important for climate adaptation are not yet included in the economic activities currently addressed in the Taxonomy.

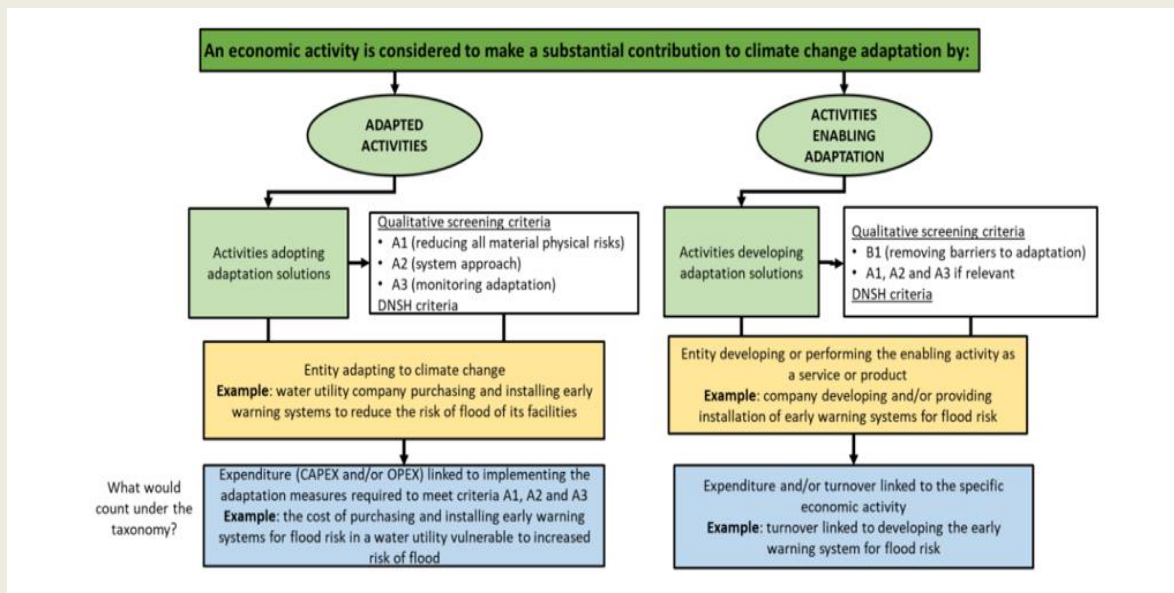
The taxonomy identifies nine sectors of high relevance to adaptation and resilience: water supply, sanitation and waste management; transport infrastructure; finance and insurance services; telecommunications; professional and scientific services; public administration; education; health and ecosystem restoration.

An economic activity is considered to contribute substantially to adaptation where:

- a. that economic activity includes adaptation solutions that either substantially reduce the risk of adverse impact or substantially reduces the adverse impact of the current and expected future climate on that economic activity itself without increasing the risk of an adverse impact on other people, nature and assets; or where

- b. that economic activity provides adaptation solutions that, in addition to the conditions laid down in Article 11a, contribute substantially to preventing or reducing the risk of adverse impact or substantially reduces the adverse impact of the current and expected future climate on other people, nature or assets, without increasing the risk of an adverse impact on other people, nature and assets.

Figure 2.3. Assessment of substantial contribution to climate change adaptation



The Delegated Act (June 2020) proposes the following guiding principles to identify an economic activity that substantially contributes to climate change adaptation:

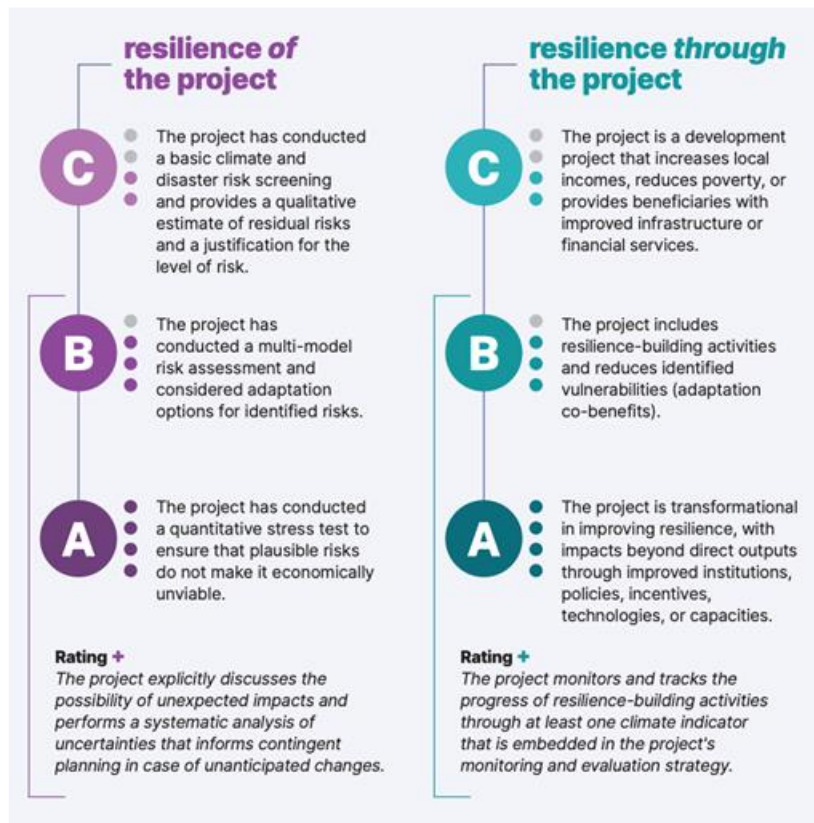
- *Principle 1: The economic activity reduces all material physical climate risks to the extent possible and on a best effort basis.* In the case of an adapted economic activity, the activity integrates measures aimed at reducing all material physical climate risks to that activity as identified through an assessment of risks posed by both current weather variability and expected future climate change. In the case of 'an economic activity enabling adaptation, the activity reduces material risks to other economic activities and/or addresses systemic barriers to adaptation. In addition, the economic activity reduces or facilitates adaptation to physical climate risks beyond the boundaries of the activity itself.
- *Principle 2: The economic activity does not adversely affect adaptation efforts by others.* Economic activities and the measures taken to address the material climate risks facing those activities should be consistent with adaptation needs in the applicable sector or region, considering opportunities to build resilience outside of the premises of a single activity. Those measures should also not increase the risk of an adverse impact on other people, nature and assets in terms of hindering adaptation efforts by others for example by shifting impacts faced by others.
- *Principle 3: The economic activity has adaptation-related outcomes that can be defined and measured using adequate indicators.* When possible, the outcomes of adaptation activities should be monitored and measured against defined indicators for adaptation results.

The taxonomy also lists related criteria for 'do no significant harm' in the context of adaptation".

Source: EU Technical Expert Group on Sustainable Finance. Taxonomy Report: Technical Annex³⁷.

Public financial institutions, particularly DFIs and MDBs, are also increasingly implementing frameworks that are relevant to assessing alignment of individual projects, assets or investments. These include the World Bank's Resilience Rating System, which has been developed to identify the contribution of projects to climate resilience (Figure 2.4), as well as the EBRD Paris Alignment Methodology³⁸ and MDBs Paris Alignment Methodology³⁹.

Figure 2.4. World Bank Resilience Rating System



Source: Resilience Rating System : A Methodology for Building and Tracking Resilience to Climate Change (worldbank.org).

A common feature of each of these existing frameworks is that they do not attempt to measure alignment against a specified goal or quantify alignment in any way. They each aim to identify investments that are aligned with adaptation and resilience goals in a broad sense, and rely upon project-level assessments. All of the approaches use a *positive framing*, which means they aim to identify investments that are aligned to climate resilience, rather than those that are not. They also all rely upon a *process-based* approach to identify whether investments are aligned, rather than external characteristics of the investment (e.g. industry sector). There are, however, some differences in the following approaches, reflecting the different purposes of this work (Table 2.1):

- **Resilience of / resilience through:** several of these approaches distinguish between measures to enhance the resilience of the investment ("resilience of"), and those where the investment will contribute to the resilience of the wider system ("resilience through")
- **Systemic impacts:** the approaches vary in the extent to which they capture potential negative impacts on the resilience of the system as a whole
- **Monitoring:** requirements vary in terms of the requirements for assessing performance over time

Table 2.1. Characteristics of approaches relevant to alignment

	Resilience of / through	Systemic impacts	Monitoring
EU Taxonomy	Y	Do No Significant Harm (DNSH) principle; compliance with relevant strategies	Requirement to have monitoring plan
World Bank Resilience Rating System	Y	Normal safeguarding processes	Optional for resilience through projects
Joint MDB Paris Alignment Approach		DNSH and Consistency with relevant adaptation strategies	
CBI Climate Resilience Principles	Y	DNSH	Y
EBRD Paris Alignment Methodology	Y	Objectives do not undermine climate resilience where the project operates	

Source: OECD and UK CGFI.

The implications of a particular project for system-wide or societal resilience (a core part of our proposed definition of adaptation-aligned finance) are dealt with differently in each framework, depending on whether the aim of the framework is to safeguard the investment while doing no harm, or if the aim is for the investment to make a positive contribution to resilience of the system:

- *“Resilience of”*: analysis of systemic impacts of a particular project or investment is generally focussed upon the prevention of harm. The Joint MDB Paris Alignment approach and EU taxonomy add a further requirement to ensure consistency with relevant adaptation strategies. The EBRD strategy requires that a project does not undermine the climate resilience of the context in which the project operates.
- *“Resilience through”*: the assessment aims to identify where an investment or project contributes to societal resilience (e.g. the World Bank Resilience Rating System, Figure 2.4). It includes a combination of analysis to prevent systemic harm, combined with demonstration that the investment will yield a positive impact on some aspects of the system as a whole.

Based upon these existing frameworks, the following high-level principles have been derived that could form the basis of a framework for identifying whether an investment fits the definition and framework for adaptation-aligned finance laid out above. Compliant investments would have to meet all of the criteria below. These are based upon the lessons from existing approaches to alignment (above), the aims of the Paris Agreement (Box 2.2) and the scientific literature on adaptation.

Table 2.2. Potential core principles for assessing climate resilience alignment of finance

	Principle	Examples of how this could be assessed at the asset level
Process of risk assessment	Relevant climate-related risks have been identified and managed, in a way that is proportionate to the type of investment and vulnerability to climate risks. This process should aim to achieve robustness against uncertainty	* Existence of process for risk-assessment, including scenario analysis * Pricing of physical climate risk exposure
Consistency with adaptation/resilience strategies	The investment should be compatible with relevant strategies for adaptation or resilience (if these strategies exist)	*Cross-referencing with relevant strategies (e.g. national adaptation plans)
Consistency with Net Zero	The investment should be compatible with achieving progress towards Net Zero	* Investment also complies with standard for aligning with Net Zero * Compatibility with national strategies for decarbonisation * Consistency with NDCs
Do No Significant Harm	The investment does not undermine the resilience of people or ecosystems, for example by shifting risks to downstream users, or undermining biodiversity and ecosystems	* Compliance with safeguarding standards *Implementation of countervailing measures to manage identified risks
Monitoring strategy	Strategies in place to monitor performance over time	Plan to repeat risk assessment at set intervals and report within risk reporting framework

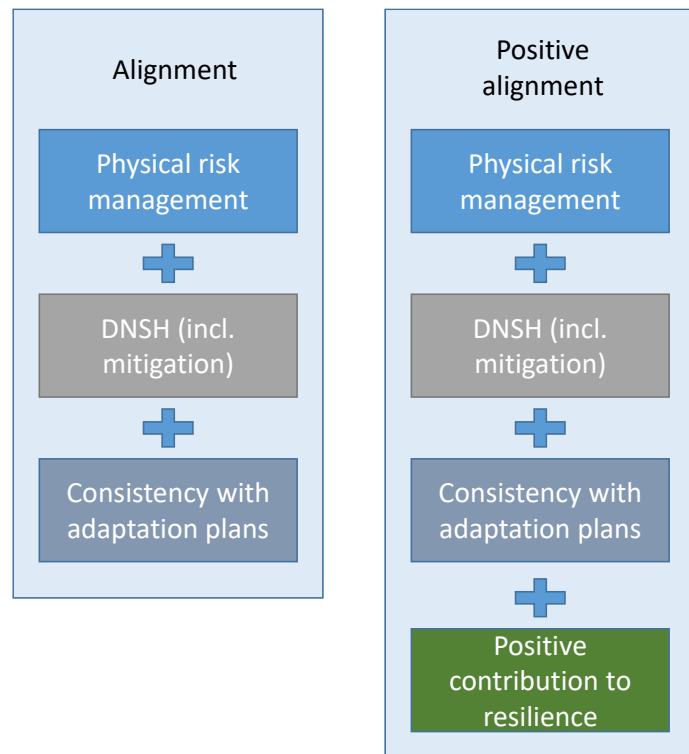
These principles could be used as a starting point by both private financial institutions and the public sector to build toward frameworks and metrics for adaptation alignment. Recognising the different perspectives on climate resilience, this is intended as a minimal set that captures the key aspects of climate resilience, while recognising that the operationalisation will differ by context.

All investments that are viewed as sustainable or *adaptation-aligned* ought to be aligned with the principles outlined above. Beyond this, however, there is a further principle that can be used to identify investments that actively contribute to building climate resilience. The relationship between these is summarised in Figure 2.5.

Table 2.3. Additional principle for positive alignment

	Principle	Examples of how this could be assessed at the asset level
Positive contribution to resilience beyond the project/investment	The project or investment actively facilitates societal resilience in line with relevant goals and plans (e.g. national adaptation plan)	* Robust analysis of potential benefits beyond the project boundaries

Figure 2.5. Alignment and positive alignment for adaptation



There are synergies between principles and metrics for adaptation-aligned financing and ESG. Environmental, social, and governance (ESG) is a set of standards that companies and investors use to screen potential activities and investments. *Environmental* criteria consider how a company performs as a steward of nature. *Social* criteria examine how it manages relationships with employees, suppliers, customers, and the communities where it operates. *Governance* deals with a company's leadership, executive pay, audits, internal controls, and shareholder rights. Criteria to screen the alignment of investments with adaptation and resilience goals could therefore become a subset of ESG criteria, and climate resilience aligned finance would be one form of sustainable investment.

3 Towards measuring adaptation alignment

Measuring alignment to adaptation and resilience goals, and disclosing that information where appropriate, could yield significant benefits for society, financial institutions and investors, synonymous with those for alignment to mitigation goals:

- Enable investors and lenders to assess the position of companies and portfolios in relation to adaptation and resilience goals at global, national and local levels, provided that there is clarity about the use of proceeds.
- Increase the ability of financial institutions to effectively allocate capital in ways that support resilience and adaptation goals.
- Increase the ability of financial institutions to track their own contributions to resilience and adaptation goals.
- Create opportunities to derive value (reputational, commercial positioning, cost of capital benefits) through increasing alignment with the Paris goals.
- Reinforce incentives for physical risk management across the private sector, and help to integrate and price risk in a comprehensive way.

Together these should help – along with the efforts to resolve market failures (Section 4) - to drive more financing into climate resilience aligned activities and away from activities that undermine resilience and lead to maladaptation. They should also help to enhance the resilience of financial institutions themselves to physical climate risks. This could be a win-win for society and financial institutions. Making clear which private investments and financial flows are Paris-aligned in terms of adaptation and climate-resilience is an integral part of achieving the Paris goals.

More widely, the disclosure of such information by private institutions will improve global understanding of the drivers, trends and outcomes relating to alignment for climate resilience and contribute to the wider assessment in progress against the Paris goals. Tracking or disclosing only adaptation finance could give a misleading picture both to investors, governments, civil society and financial institutions themselves.

3.1. Challenges in measuring alignment with adaptation

There are numerous challenges that will have to be addressed when assessing alignment with adaptation and climate resilience, some of which are shared with mitigation alignment:

- There is no clearly quantified internationally agreed goal for adaptation.
- There is no one consistent standard, methodology or set of metrics for assessing physical climate risk.
- Adaptation is context and location specific, which means it is difficult to assess whether a particular asset, portfolio, strategy or investor is aligned without detailed analyses.

- Unlike mitigation, the benefits of adaptation are felt locally first and foremost. As such, it is particularly important to consider the local and distributional impacts of any investments, as well as regional/global implications.
- Adaptation alignment will be assumption and scenario dependent given the uncertainties in future climate change projections and differences in risk appetites and preferences across different societies.
- Challenges in availability of data to assess risks and resilience.
- The level of resilience of an economy or society is driven by many factors that are difficult to capture within analysis of a given investment or portfolio. Resilience may be declining due to external factors, such as environmental degradation, even if the investment or portfolio is performing well.

Climate resilience alignment can only be assessed in relation to measurable goals. Each of the points above adds to the challenge of defining measurable, consistent and relevant goals to measure alignment against. For example, the Paris Agreement contains the global goal of strengthening resilience and enhancing adaptive capacity but there is no quantified goal. A range of national, sectoral and urban adaptation strategies provide further detail on how this goal can be achieved at different scales. However, a challenge is that these strategies are insufficiently detailed to provide a basis for objectively assessing whether a given investment is aligned to building resilience to climate change.

The approaches developed to assess alignment with net zero provide a valuable starting point, but cannot be directly transferred to climate resilience. Alignment with mitigation goals does not automatically lead to alignment with climate resilience. For example, climate change is expected to have a negative impact on hydropower production in some regions⁴⁰. There are also important methodological differences: it is not yet possible (and may not be possible) to determine investments as likely to be aligned or misaligned to climate resilience based on technology, industrial classification or other factors that can be applied without knowing the details of the investment. As it stands, the implication is that each project or investment needs to go through a process for assessing whether it is aligned to climate resilience. It also means that it would be difficult to implement a single transparent metric of alignment, analogous to a temperature goal. Alignment will, in practice, entail some form of climate risk screening, followed by a proportionate process to identify and manage risks relating to climate change and/or opportunities to contribute to societal resilience.

In summary, adaptation alignment poses different methodological challenges compared with mitigation (net zero or temperature) alignment. Further methodological development will be needed to assess alignment with climate resilience. The following section reviews how these challenges are handled within existing frameworks relevant to alignment and makes initial proposals toward approaches to resolve the challenges.

3.2. Proposed approach for assessing alignment

Given the technical challenges of measuring alignment noted above and learning from existing approaches, we propose that an approach to operationalising adaptation-alignment for private financial flows could involve, for the private sector:

- A simple framework to identify those projects or investments that are aligned with adaptation and resilience, based on compliance with the principles in Section 2.3.
- Taking a sequential approach, beginning with the most relevant sectors and investments for climate resilience, in a similar way to banks and investors in aligning with net zero. Figure 2.1 gives an indication of those most adaptation relevant sectors from Fankhauser et al. (2013), IPCC (2014) and the EU Taxonomy.

- Develop a set of simple process-based metrics, including the TCFD areas of governance, risk management, strategy and metrics and targets.
- Explore the development of more standardised outcome-based metrics, with an initial focus on the most important adaptation-relevant sectors, such as infrastructure, agriculture and those linked to natural capital (link to TNFD).

Governments can play an important role through:

- Defining clear adaptation plans with measurable targets against which corporates and financial institutions can measure progress
- Providing national, sectoral and/or local climate change risk assessments and scenarios that financial institutions and corporates can use in their analyses of alignment.
- Convening with the private sector to establish appropriate metrics and frameworks for measuring alignment, as well as best practice guidance.
- Providing clear taxonomies and guidance to identify those sectors and investments that are most relevant to adaptation and resilience.
- Investing in public good data and tools to facilitate alignment.
- Mandating disclosures of physical climate-related risks, adaptation plans and impacts on societal resilience (i.e. double materiality) for financial institutions and corporates in sectors relevant for climate resilience.

Investors and investor coalitions can drive progress through demonstrating demand for adaptation-aligned investment opportunities, as well as articulating frameworks and minimum standards for what information they require from investees. For example, IIGCC has recently released a set of investors' expectations on the management of physical risks and opportunities (IIGCC, 2021)⁴¹.

3.3. Metrics for assessing alignment

Discipline and transparency is essential in identifying and disclosing where investments are aligned (and not aligned) with adaptation and resilience. Metrics for alignment would need to be common and comparable across financial institutions and corporates. However, identification of standard metrics for alignment is still relatively nascent, even for net zero alignment. For example, in the context of alignment with mitigation goals, the recent TCFD guidance (2021) noted that *“existing climate-related measures all serve an important purpose for this community, but aren't yet as forward-looking, robust, decision useful and comparable as they need to be to measure portfolio alignment”*⁴². This statement holds true also for adaptation, though with the complexities of assessing risk and resilience noted in Section 3.1. Metrics currently under consideration related to physical climate risks (e.g. TCFD 2021b), such as proportions of assets exposed, are not comprehensive or forward-looking enough to measure alignment.

Considerable further methodological development is required to define a set of adaptation and resilience relevant metrics (Box 3.1). A starting point could be to measure finance flows that are consistent with at least one accepted standard for resilience or adaptation (e.g. EU Taxonomy for adaptation, MDB alignment principles). This could be complemented with analysis of finance flows that are likely to be detrimental to resilience, such as construction in areas highly exposed to climate risks.

Box 3.1. Portfolio-level Alignment Metrics

TCFD (2021) lays out a set of principles for measuring alignment in the case of net zero. These are restated below such that they are relevant to adaptation and resilience:

Forward looking: to communicate a direction of travel and give credit to credible efforts by companies to adapt to a changing climate and make a positive contribution to societal adaptation and resilience.

Decision useful: allowing comparisons of companies and portfolios with peers, tracking progress over time, and incentivising adaptation and resilience

Robust: analytically rigorous and consistent with climate science, including accounting for uncertainties in future climate change and data limitations

Broad coverage: across sectors, assets, and end users

Actionable: methodologically transparent and feasible given data requirements

Potential metrics could be process-based, outcome-based or input-based:

Table 3.1. Potential Portfolio-level Alignment Metrics

Principle	Description/Pros/Cons
Proportion of portfolio aligned with adaptation and resilience goals	Process-based. Clear and simple metric. Broad measure – little information on performance. Assumes alignment is binary (yes/no)
Change in societal resilience as a result of an investment or portfolio (measured e.g. as average annual losses or people at risk)	Outcome-based. Requires consistent risk modelling tool and detailed analyses to provide estimates in quantitative terms.
Governance mechanisms explicitly include monitoring of A&R alignment	Input-based. Simplest to monitor. No direct measure of alignment

Source: TCFD (2021), Guidance on Metrics, Targets and Transition Plans.

This analysis could begin with the most adaptation-critical sectors, such as infrastructure and agriculture, and expand outwards. In many cases, this methodological development will be able to build upon existing metrics. For example, methodologies already exist for measuring risks to and resilience of infrastructure and buildings, which are already used by insurance companies, the public sector and infrastructure operators. In the UK, the National Infrastructure Commission in 2021 called on the government to publish metrics for resilience of critical national infrastructure every five years to help guide investment⁴³. In 2019, the Inter-American Development Bank developed a framework and set of principles for resilience metrics in collaboration with other MDBs⁴⁴.

This could be complemented by work to develop a standardised metric of risk and resilience. A set of open, globally consistent, objective metrics that would act as a “*common language of risk and resilience*”, equivalent to tCO₂ in net zero alignment; a common and comparable set of metrics that would form the basis for transparency and discipline in assessing risks and resilience and disclosing such information in a clear and consistent way. A 2021 joint statement by the Global Commission on Adaptation, TCFD, UNEPFI and the Global Centre on Adaptation stated “*it is only in creating a market-wide, evidence-backed, comparable and standardised approach on physical climate risk that the financial sector will be able to price climate risk, thus building finance sector resilience and helping to identify where and how our economy and society need to adapt to a changing climate*”.⁴⁵

Currently, there are no standard set of metrics for risk and resilience, and no agreed standards or methodologies to create such metrics. There is also no baseline, open and globally-consistent dataset on risk or resilience. This creates a barrier to identifying which investments are aligned and could lead to patchy, inconsistent and incomplete disclosures. Proprietary data is often not transparent and not accessible to all. Initiatives that do exist, such as the new NGFS scenarios, are not designed for the purpose of alignment, are insufficiently detailed and lack representation of acute climate risks and tail risks.

While an open globally consistent dataset would be advantageous in unlocking standardised metrics for alignment at the portfolio level, such a dataset would not remove the need for more tailored local risk assessments to inform specific adaptation decisions. Any standardised risk metrics would also need to evolve continuously in view of advancements in understanding of risk and fitness-for-purpose assessed rigorously to avoid systemic biases that could undermine resilience. Section 4 further discusses the role that the public sector can play in providing data as a public good.

4 Initial directions for strengthening the enabling environment for adaptation-aligned finance

The public sector plays a critical role in enabling adaptation and enhancing resilience. In this Section, we overview the role of public sector specifically in creating the right enabling environment for private finance to be aligned with adaptation and resilience goals, which is one component of the broader role in supporting societal adaptation⁴⁶.

The public sector has an essential role in correcting market failures and ensuring the provision of public goods. There may also be a need to reform counter-productive sectoral policies, such as ex-post compensation programmes that reduce incentives to invest in risk reduction. Private finance will only flow to areas where there is a viable business case, providing investors with an attractive balance between risk and reward. Many vital investments in climate resilience will be socially and economically positive, but not commercially viable because of the “Tragedy of Horizons” or inability to internalise benefits. For example, the benefits of investing in electricity grid resilience accrue to consumers, while the costs are borne by the grid operator. In the absence of suitable regulation, these distortions can discourage adequate investment in resilience.

Subsidies, regulations and other incentives provided by the public sector can play an important role both in determining which activities represent a material financial risk to a financial institution and where commercial returns can be sought from investing in adaptation or providing adaptation and resilience products and services (see Box 4.1 for an example from the Clyde City Region). In that respect, they play a crucial role in making the link between the private incentives to manage physical risks and progress towards the policy goal of building resilience. This can include reforms to ensure that regulations are based on forward-looking climate data, rather than historic trends. It also includes reforms to policies that hinder alignment efforts, public-private partnerships to build markets or catalyse investment or policies to correct market failures and help ensure that risk is priced appropriately across the economy. The role of public policy is particularly important in managing systemic-level risks (Box 4.1). Beyond policies, targeted public finance can unlock socially-beneficial investments by the private sector.

Box 4.1. Systemic risks and alignment

The level of resilience of an economy or society is driven by many factors that are difficult to capture within portfolio analyses by an individual financial institution. This has been strongly demonstrated by the impacts of the COVID-19 pandemic. Entire economic models were upended as societies responded to the pandemic. However, amidst the many examples of adaptability, it also revealed weaknesses in key systems as infrastructure, supply chains and social systems were forced to respond to the changed circumstances. Public-private collaboration and coordination have been essential in ensuring continuity of services and welfare across critical sectors such as food, health, finance and utilities. Given the complexities, multi-dimensionality and global nature of systemic level risks associated with climate change, it would be very difficult for an individual firm or FI include all such systemic factors within an assessment of adaptation alignment. Typically, such interconnected and cascading risks can only be managed effectively at the level of overall systems. As such, there is a role for the public sector in setting the right enabling environment for these risks to be managed.

The pandemic also demonstrated that individual firm decisions in normal times can have implications for resilience. For example, modern globalised, just-in-time supply chains across many sectors were disrupted, leading to shortages in critical areas like certain foods, as well as goods such as automobiles, which remain disrupted by shortages of computer chips. Individual firms will not typically account for implications on societal resilience in decision making, particularly given the potential trade-offs with efficiency and competitiveness, and also the complexity of these interrelationships. This is well recognised within existing national frameworks for critical risk governance and infrastructure and regulation and financing structures are commonly in place to ensure corporates and private finance are aligned with societal resilience goals.

Source: authors.

Policies and interventions that support alignment can be categorised into four areas, some of which target financial institutions and investment directly, while others influence corporates in sectors most relevant to adaptation and resilience. In the case of the latter, many of these interventions listed below are not new or specific to adaptation alignment, for example sector-based regulation of critical infrastructure. Those specific to adaptation alignment, for example relating to alignment frameworks and the role of Central Banks, draw upon the COP26 priorities for building a private finance system for net zero.

The first area is setting the overarching framework for adaptation-aligned finance by FIs and mandating relevant disclosures by FIs, investors and investees/corporates:

- **Setting appropriate targets and metrics**, to provide clarity on the direction of changes required and a framework for measuring progress. This includes a national adaptation and resilience plan with clear targets and metrics.
- **Encouraging disclosure**, mandating disclosures against specific metrics, frameworks or taxonomies relevant to alignment, for example, similarly to the Adaptation Reporting Power in the UK, the 2018 EU Action Plan on Financing Sustainable Growth (Box 2.1), or TCFD/TNFD-aligned disclosures.

The second area involves the provision of public goods for both FIs, investors and investees/corporates, including data, knowledge and guidance, as well as convening:

- **Enabling the provision of data as a public good**. This can include directly investing in open risk and resilience data and metrics or developing platforms and tools to share relevant datasets, such

as those collected by insurance companies. Governments could also provide national scenarios against which institutions can assess risks and alignment.

- **Convening and supporting the development of best practices.** Bringing together FIs and investors to develop harmonised metrics and frameworks for adaptation alignment and to develop best practice and guidance. This includes convening to develop consumer-friendly metrics for alignment. Work with standard setters to incorporate data requirements into core reporting frameworks to improve the measurement of portfolio alignment.

The third area includes a range of regulation and incentives, including those that directly target financial institutions and those that targets investees/corporates:

- **Sector-based regulation, incentives and public-private partnerships,** including minimum standards of resilience and adaptation in adaptation-critical sectors, such as infrastructure and utilities; and establishing public-private mechanisms, such as insurance risk pools to promote market development.
- **Economic incentives, including taxation and subsidies.** For example, green taxation and subsidies to promote investments in natural capital recovery or nature-based solutions, or to catalyse new innovations necessary for adaptation such as drought-resistant crops or new water-saving technologies.
- **Financial regulation and supervision,** including to ensure physical climate risks are incorporated into risk management practices, to assess macro-level and systemic physical climate risks and resilience, to eliminate greenwashing, to encourage appropriate risk pricing and to set standards for resilience-linked financial instruments such as resilience bonds.

The final area includes a range of wider public policy and expenditure linked to national resilience and adaptation planning, the government's own investment in, for example, public infrastructure, the role of the Central Bank, and government procurement.

- **Providing clarity on risk ownership,** so incentivising resilience and enabling appropriate risk pricing. The physical incidence of a climate-related risk does not always match the financial incidence. For example, the existence of public disaster relief mechanisms means that some of the costs will be borne by taxpayers. Even if there is no formal commitment for the government to provide relief, asset owners may nonetheless anticipate that such relief will be forthcoming if an event occurs. This can reduce incentives for resilience and mean that risk is not priced appropriately. Government can provide clarity on who owns risks through regulation or through communication of risk management strategies⁴⁷. Designed well, such plans help manage the contingent liabilities faced by the government and provide the incentive for risks to be managed by those best placed to do so. The regulatory and legal framework also affects the extent to which spill over effects are borne by the asset owner. For example, failure of containment ponds after flooding can lead to environmental damage downstream. The design and implementation of the regulatory and legal framework will affect asset owners' incentives to manage those risks.
- **Mainstreaming physical climate risks and adaptation into government processes, including government expenditure, and disclosing alignment of government spending with adaptation goals.** This includes the contribution of central banks in disclosing their exposure to physical risks in line with TCFD, including on alignment of their investment portfolios (as proposed in the COP26 priorities).
- **Public sector procurement.** Public procurement accounted for around 12% of global GDP in 2018 for a total of USD 11 trillion⁴⁸. The rules and practices governing these procurement decisions have the potential to stimulate innovation, helping to develop markets for solutions that help to build resilience. Innovation does not just mean new technology: resilient procurement can encourage the use of nature-based solutions, as a complement or substitute to grey infrastructure. It can also encourage the use of different management techniques to ensure better performance over time⁴⁹.

Procurement policies can support resilience by defining desired outcomes and standards of performance, instead of mandating the use of specific technologies or approaches (Baron, 2016⁵⁰). The use of transparent and verifiable indicators linked to resilience can be used to ensure that these benefits are captured in investment decisions.

Box 4.2. Public policy for adaptation alignment: Glasgow city region case study

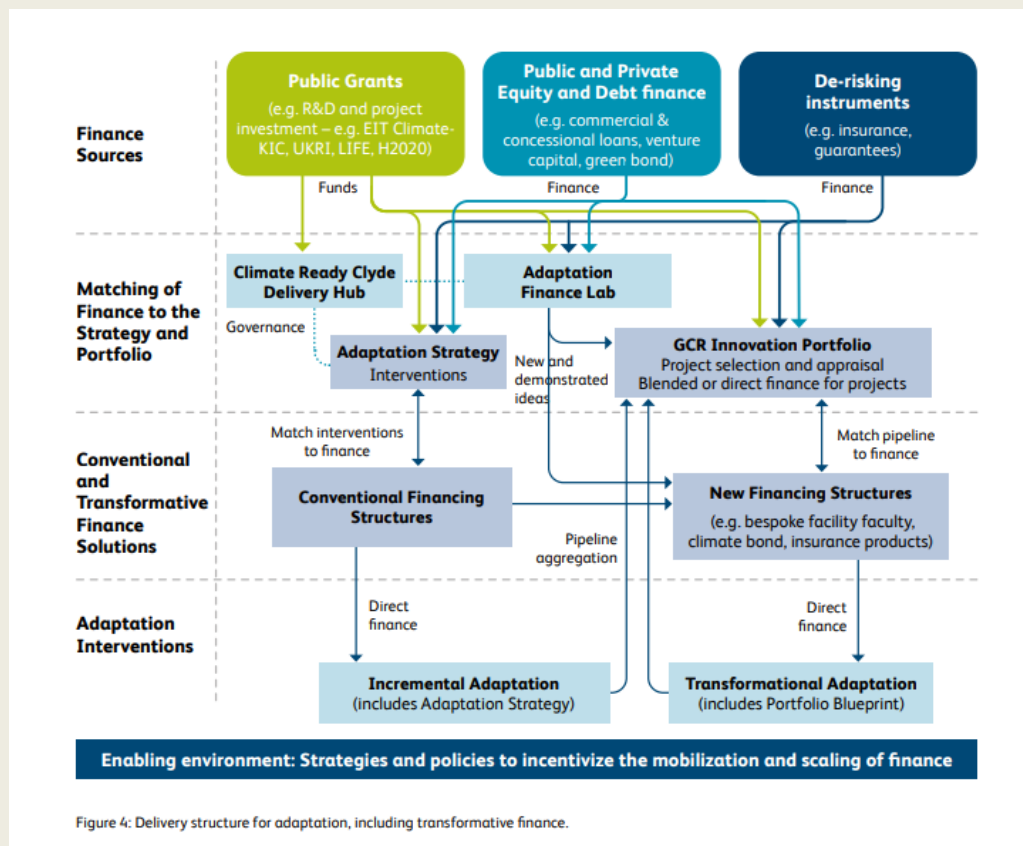
Climate Ready Clyde⁵¹ [developed Glasgow City Region's first Adaptation Strategy and Action Plan](#), launched in June 2021, ahead of COP26 in Glasgow.

The Strategy aims to ensure Glasgow City Region's economy, society and environment is not only prepared for, but continues to flourish in the face of the impacts arising from the climate crisis. The Strategy outlines the processes and early interventions needed to manage climate risks and realise opportunities, and provides a strategic framework for adaptation in the Region that fits alongside and supports key plans, policies and activities to enable delivery.

The Strategy had a number of innovative aspects. First, it used a vision-led approach to highlight the opportunities for adaptation, and provides a more positive framing, including co-benefits. Second, it applied system thinking to develop the approach, third, it had a strong focus on political economy and social network analysis to understand the landscape for policy change, and fourth it included a range of interventions spanning incremental to transformational change.

A key part of the Strategy was to look at the opportunities for finance, and a separate [Economic and Financial Assessment](#) and [Resource Mobilisation Plan](#) was carried out, to analyse the economic case, to identify funding sources, and to map pipeline propositions to potential investors/funders for adaptation, including an Innovation Portfolio. This has a focus on mobilising and de-risking private sector investments by looking at viable business models that use blended finance approaches. In essence, supporting the delivery of positively-aligned finance for adaptation. The Strategy recognised that to deliver the interventions, public funds will need to be scaled up and used in more considered ways, directed at funding early stage innovation and creating an enabling investment environment for the private sector. Doing this requires the private, public and third sectors to collaborate in a process for mobilising public and private resources, using a broader range of financing instruments and models, as well as developing long-term transformative financing solutions that are aligned to the different interests and requirements of the public and private sectors.

Figure 4.1. Delivery structure for adaptation finance in Glasgow



The analysis produced a number of recommendations on how to successfully unlock additional finance streams for adaptation interventions identified in the Strategy. This focused on three strategies, in partnership with local, national and UK actors.

- 1. Increasing the proportion of direct grants and creating the conditions for adaptation.** There are some adaptation activities and investments that require (and justify) public intervention, notably because of market failures, or because they involve investments or changes where there is limited private sector interest. In these cases, public investment can support core adaptation, but there are opportunities to also use public funds to create the enabling environment for actions by the private sector and others.
- 2. Encouraging public organisations operating in Glasgow City Region to move a more commercial mindset.** There are opportunities to use public funds or assets to support public-private sector partnerships or unlock investment from the private sector for adaptation. These opportunities could be very significant and can help to address the adaptation finance gap.
- 3. Developing innovation for adaptation.** There are many emerging opportunities for adaptation and these can be developed through a cycle of innovation. This pilot can demonstrate new approaches with new actors. This can be developed through partnerships including local research institutions and national and European research funders, local, Scottish and UK government, and the private sector. This would also position Glasgow City Region as an innovation hub for the emerging adaptation economy, i.e. for new adaptation goods services.

Source: case study contributed by Paul Watkiss, Kit England and Sumalee Khosla.

5 Future work on climate resilience aligned finance

As discussed throughout this paper, a framework is needed to define, measure and – ultimately - increase the alignment of investments with adaptation and resilience goals, consistent with Article 2.1c of the Paris Agreement. There is growing demand from the investment community and wider financial institutions for investment opportunities that are aligned with adaptation goals, including resilience-linked financial products, such as resilience bonds. This framework should incorporate – but goes beyond – the sound management of physical climate risk.

This note has identified some of the key elements for a framework for defining and assessing alignment with climate resilience. The following steps are proposed to move forward in developing an assessment framework that is robust, measurable and accepted by key stakeholders within the financial system:

5.1. Work starting in 2022

- **Convening stakeholders** from the financial sector, regulators and government to develop the framework for alignment with climate resilience. This will work in close collaboration with existing initiatives;
- Undertaking a **pilot study** to quantify the extent to which finance flows are currently aligned to climate resilience, testing the methodology in 1 or 2 key sectors. Such pilot study would be conducted jointly with the OECD Research Collaborative on Tracking Finance for Climate Action and built on experience it has gained to date in conducting similar pilots for mitigation alignment, e.g. (Jachnik and Dobrinevski, 2021^[1])⁵²;
- Expanding the analysis of how the **enabling environment** can be strengthened to support greater alignment of finance flows within key sectors. This will include analysis of current barriers to alignment;

5.2. Potential work for 2023-24

- Extending the framework to identify the **alignment of domestic public finance** with climate resilience, building on existing work on green budgeting.
- Analysis of transition pathways for addressing transition pathways for “**stranded assets**”, such as houses that lose their value due to increased wildfire risk, or water-intensive industries that are no longer.

Notes

¹ <https://www.ipcc.ch/report/ar6/wg1/>

² Example based on adaptation measures in infrastructure, nature-based solutions, water management and early-warning systems. NPV to 2030 for costs and benefits. https://gca.org/wp-content/uploads/2019/09/GlobalCommission_Report_FINAL.pdf

³ <https://unfccc.int/topics/climate-finance/resources/biennial-assessment-of-climate-finance>

⁴ [Global Landscape of Climate Finance 2021 - CPI \(climatepolicyinitiative.org\)](https://climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021-cpi/)

⁵ Mirabile, M, Marchal, V. and Baron, R. (2017) Technical note on estimates of infrastructure investment needs, OECD. Technical note to OECD (2017), Investing in Climate, Investing in Growth, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264273528-en>

⁶ Thinking Ahead Institute/Willis Towers Watson (2020) The world's largest 500 asset managers. Joint study with Pensions and Investments. https://www.thinkingaheadinstitute.org/content/uploads/2020/11/TAI_PI500_2020.pdf

⁷ [FINAL-2017-TCFD-Report.pdf \(bbhub.io\)](https://www.bbhuh.io/2017/12/15/final-2017-tcfd-report/)

⁸ Climate Bonds Initiative, Global Centre for Adaptation and EBRD (January 2021) <https://gca.org/green-bonds-for-resilience-mobilizing-trillions-for-a-resilient-future/>

⁹ <https://pubdocs.worldbank.org/en/784141543806348331/Joint-Declaration-MDBs-Alignment-Approach-to-Paris-Agreement-COP24-Final.pdf>

¹⁰ <https://www.mainstreamingclimate.org/5-principles/>

¹¹ [OECD DAC Declaration on a new approach to align development co-operation with the goals of the Paris Agreement on Climate Change - OECD](https://www.oecd.org/dac/2018/09/2018-09-14-oecd-dac-declaration-on-a-new-approach-to-align-development-co-operation-with-the-goals-of-the-paris-agreement-on-climate-change/)

¹² [EU taxonomy for sustainable activities | European Commission \(europa.eu\)](https://ec.europa.eu/economy_finance/eu-taxonomy-for-sustainable-activities/)

¹³ [Lessons on engaging with the private sector to strengthen climate resilience in Guatemala, the Philippines and Senegal | en | OECD](https://www.oecd.org/dac/2018/09/2018-09-14-oecd-dac-declaration-on-a-new-approach-to-align-development-co-operation-with-the-goals-of-the-paris-agreement-on-climate-change/)

¹⁴ Even in the case of agricultural finance noted above, in many countries public subsidies provided in the form of concessional finance (for purposes of protecting the livelihoods of farmers and maintaining food production) distort the price signal related to physical risk.

¹⁵ 'Breaking the Tragedy of the Horizons', Mark Carney 2015. <https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability>

¹⁶ [Occasional papers \(europa.eu\)](https://www.ecb.europa.eu/press/pr/occasional_papers/2019/01/20190123_occasional_papers_en.html) – ECB Climate Stress Test

¹⁷ Blackrock (2019). Getting Physical: Scenarios analysis for assessing climate-related risks, April 2019.

¹⁸ E.g. Faccini, Matin and Skiadopoulos (2021) Dissecting climate risks: are they reflected in stock

prices? https://www.qmul.ac.uk/sef/media/econ/events/FMS_17_June2021_Dissecting-Climate-Risks.pdf and UNEPFI (2021) Climate Risk & Commercial Property Values. <https://www.unepfi.org/news/industries/investment/new-report-examines-how-real-estate-markets-respond-to-physical-impacts-of-climate-risks/>

¹⁹ Fankhauser, S. Ranger N. et al. (2013) An Independent National Adaptation Programme for England. Grantham Research Institute on Climate Change and the Environment. <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2014/02/PB-independent-national-adaptation-programme-for-england.pdf>

²⁰ Mandel, A., Tiggeloven, T., Lincke, D. et al. Risks on global financial stability induced by climate change: the case of flood risks. *Climatic Change* 166, 4 (2021). <https://doi.org/10.1007/s10584-021-03092-2>; UNEPFI 2020 Charting a New Climate: a TCFD Banking Programme Report. CERES (2021) Financing a Net Zero Economy: The Consequences of Physical Climate Risk for Banks.

²¹ <https://www.cnbc.com/2019/11/10/more-companies-are-flagging-wildfire-risk-as-suppression-costs-climb.html>

²² For example, recent proposed guidance on climate-related metrics, targets and transition plans (TCFD, June 2021) includes more limited guidance on physical risks. Metrics include proportions of assets/investments/financing materially exposed to physical risks, with some mentions of more specific financial risk metrics such as impairment charges due to exposure to physical or changes to the carrying amount of assets due to exposure to physical risks, and amount of expenditure or capital investment toward managing physical climate risks. It also notes target metrics such as amount of investment in physical risk reduction or % portfolio focussed on physical risk mitigation, and transition plans that outline an adaptation plan for the organisation to manage its own risks and capture opportunities.

²³ TCFD (2020). "2020 Status Report". Financial Stability Board, Basel, Switzerland. Available at: https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Status-Report.pdf

²⁴ https://www.unepfi.org/wordpress/wp-content/uploads/2021/01/PRRC-Statement_CAS2021.pdf

²⁵ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_en

²⁶ For example, see EBRD & GCA (2021) Advancing TCFD Guidance on Physical Climate Risks and Opportunities. <https://www.physicalclimaterisk.com/index.html>. See also CISL (2019) for specific case of real-estate lending and investment portfolios: Cambridge Institute for Sustainability Leadership (CISL). (2019). Physical risk framework: Understanding the impacts of climate change on real estate lending and investment portfolios: the Cambridge Institute for Sustainability Leadership. As well as UNEPFI (2021) The Climate Risk Landscape: A comprehensive overview of climate risk assessment methodologies. Golnaraghi (2021) Climate Change Risk Assessment for the Insurance Industry. Also, see the TCFD Knowledge Hub.

²⁷ IIGCC (2021) Building Resilience to a Changing Climate: Investor Expectations of Companies on Physical Risks and Opportunities. <https://www.iigcc.org/resource/building-resilience-to-a-changing-climate/>

²⁸ Banco Central do Brasil (2021), Report on Social, Environmental and Climate-related risks and opportunities. [Report on Social, Environmental and Climate-related Risks and Opportunities \(bcb.gov.br\)](https://www.bcb.gov.br/ingles/relatorio-social-ambiental-e-clima)

²⁹ It is notable however that even in the insurance sector, there are challenges to this hypothesis. For example, well documented issues in risk-based pricing and the short-term nature of insurance contracts (See Herweijer, C., Ranger, N. & Ward, R. (2009) Adaptation to Climate Change: Threats and Opportunities for the Insurance Industry. Geneva Papers on Risk Insurance. <https://doi.org/10.1057/gpp.2009.1313>

³⁰ Caldecott, B (2020) ALIGNING FINANCE FOR THE NET ZERO ECONOMY: New ideas from leading thinkers: ACHIEVING ALIGNMENT IN FINANCE. Climate-KIC [200902_J932-CKIC-UNEP-ThoughtLeadershipSeries-DrBenCaldecott-1.pdf](https://climate-kic.org/ThoughtLeadershipSeries-DrBenCaldecott-1.pdf) (climate-kic.org)

³¹ [Adams et al. \(2021\) The double-materiality concept: application and issues. Global Reporting Initiative \(GRI\).](https://www.gri.org/Adams-et-al.-2021-The-double-materiality-concept-application-and-issues)

³² European Commission (2019), “Guidelines on non-financial reporting: supplement on reporting climate related information”, available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019XC0620\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019XC0620(01)&from=EN) (accessed 20/02/2021).

³³ Ben Caldecott (2020) Defining transition finance and embedding it in the post-Covid-19 recovery, Journal of Sustainable Finance & Investment, DOI: 10.1080/20430795.2020.1813478

³⁴ See for example, UNEPFI/GCA (2019) Driving Finance Today for the Climate Resilient Society of Tomorrow. <https://www.unepfi.org/wordpress/wp-content/uploads/2019/07/GCA-Adaptation-Finance.pdf>. And Tall et al. (2021) Enabling Private Investment in Climate Adaptation and Resilience : Current Status, Barriers to Investment and Blueprint for Action. World Bank <https://openknowledge.worldbank.org/handle/10986/35203> License: CC BY 3.0 IGO

³⁵ Manca, A, Benczur, P and Giovannini, E. (2017) Building a Scientific Narrative Towards a More Resilient EU Society Part 1: a Conceptual Framework.

³⁶ CBI (2019) Climate Resilience Principles: A framework for assessing climate resilience investments. <https://www.climatebonds.net/files/page/files/climate-resilience-principles-climate-bonds-initiative-20190917-.pdf>

³⁷ https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf

³⁸ <https://www.ebrd.com/documents/comms-and-bis/ebd-paris-alignment-methodology.pdf?blobnocache=true>

³⁹ <https://www.mainstreamingclimate.org/>

⁴⁰ <https://www.iea.org/reports/climate-impacts-on-south-and-southeast-asian-hydropower>

⁴¹ [Building Resilience to a Changing Climate: Investor Expectations of Companies on Physical Risks and Opportunities – IIGCC](https://www.iigcc.org/Building-Resilience-to-a-Changing-Climate-Investor-Expectations-of-Companies-on-Physical-Risks-and-Opportunities)

⁴² [2021-Metrics Targets Guidance-1.pdf](https://www.bbhub.io/2021-Metrics-Targets-Guidance-1.pdf) (bbhub.io)

⁴³ <https://www.gov.uk/government/publications/government-response-to-the-national-infrastructure-commission-report-anticipate-react-recover-resilient-infrastructure-systems/government-response-to-the-national-infrastructure-commission-report-anticipate-react-recover-resilient-infrastructure-systems>

⁴⁴ IADB (2019) A Framework and Principles for Climate Resilience Metrics in Financing Operations <https://www.ebrd.com/documents/climate-finance/a-framework-for-climate-resilience-metrics-in-financing-operations.pdf>

⁴⁵ https://www.unepfi.org/wordpress/wp-content/uploads/2021/01/PRRC-Statement_CAS2021.pdf

⁴⁶ For an overview of the wider roles of the public sector, see: Hallegatte, Stephane; Rentschler, Jun; Rozenberg, Julie. 2020. Adaptation Principles: A Guide for Designing Strategies for Climate Change

Adaptation and Resilience. World Bank, Washington, DC. © World Bank.
<https://openknowledge.worldbank.org/handle/10986/34780> License: CC BY 3.0 IGO

⁴⁷ See, for example, World Bank (2021) for the case of critical infrastructure

⁴⁸ [How large is public procurement? \(worldbank.org\)](https://www.worldbank.org/)

⁴⁹ The key element for ensuring alignment is for procurement policies to consider costs over the entire lifecycle, rather than choosing the option with the lowest upfront costs. Lifecycle costing includes consideration of lifespan, operating and maintenance and decommissioning costs. The projected impacts of climate change should be included throughout the lifespan of the asset, particularly for long-lived investments such as infrastructure. In doing so, they can lead to overall savings for the purchasing authority, while stimulating more resilient approaches.

⁵⁰ [The Role of Public Procurement in Low-carbon Innovation.pdf \(oecd.org\)](https://www.oecd.org/)

⁵¹ A cross-sector initiative funded by fifteen member organizations and supported by the Scottish Government

⁵² Jachnik, R. and A. Dobrinevski (2021), "Measuring the alignment of real economy investments with climate mitigation objectives: The United Kingdom's buildings sector", *OECD Environment Working Papers*, No. 172, OECD Publishing, Paris, <https://dx.doi.org/10.1787/8eccb72a-en>.