

GLOBAL
COMMISSION ON
ADAPTATION



FINANCE
UNEP INITIATIVE

Driving Finance Today for the Climate Resilient Society of Tomorrow

for the Global Commission
on Adaptation

About

This report was prepared by Climate Finance Advisors for the United Nations Environment Programme Finance Initiative (UNEP FI) and the Global Commission on Adaptation (GCA) as a contribution to a series of technical background papers on finance for adaptation and resilience supporting the GCA's inaugural flagship report scheduled for September 2019.



GLOBAL
COMMISSION ON
ADAPTATION



CLIMATE
FINANCE
ADVISORS

UNEP FI

United Nations Environment Programme – Finance Initiative (UNEP FI) is a partnership between United Nations Environment and the global financial sector created in the wake of the 1992 Earth Summit with a mission to promote sustainable finance. More than 200 financial institutions, including banks, insurers, and investors, work with UN Environment to understand today's environmental, social and governance challenges, why they matter to finance, and how to actively participate in addressing them.

www.unepfi.org

Global Commission on Adaptation

The Global Commission on Adaptation was launched in The Hague on 16th October 2018 by 8th UN Secretary General Ban Ki-moon. The Commission launched with the mandate to encourage the development of measures to manage the effects of climate change through technology, planning and investment. Secretary General Ban Ki-moon leads the group with co-chair of the Bill & Melinda Gates Foundation, Bill Gates, and World Bank CEO, Kristalina Georgieva.

www.gca.org

Climate Finance Advisors

Established in 2015 as a mission-driven Benefit LLC, Climate Finance Advisors (CFA) is a women-owned consulting and advisory firm that works at the nexus of private investment and climate change. We advise a range of investors and investment seekers to bring to fruition low-emissions, resilient solutions in the context of a warmer planet. We help to integrate climate considerations into investment decision-making, portfolio management, financial products, services, and policies.

climatefinanceadvisors.com

Primary Authors

Alan Miller

Senior Advisor
Climate Finance Advisors

Stacy Swann

CEO and Founding Partner
Climate Finance Advisors

Contributing Authors

Sheldon Cheng

Consultant
Climate Finance Advisors

Andrew Eil

Partner
Climate Finance Advisors

Review Panel

Amal-Lee Amin

Inter-American Development Bank

Edward Baker

Principles for Responsible Investment

Murray Birt

DWS

Richenda Connell

Acclimatise

Simon Connell

Standard Chartered

Craig Davies

European Bank for Reconstruction
and Development

John Firth

Accilimatise

Marenglen Gjonaj

UNFCCC

Marie-Lena Glass

Inter-American Development Bank

Munjurul Hannan Khan

Government of Bangladesh

Cinzia Losenno

European Investment Bank

Serina Ng

UK Department for International
Development

Pieter Pauw

Frankfurt School of Finance and
Management

Bertrand Reyssset

Agence Française de Développement

Hugo Robson

UK Department for Business, Energy
and Industrial Strategy

Madeleine Ronquest

First Rand

Namita Vikas

YES Bank

Project Management

The project was set up, managed, and coordinated by the UN Environment Finance Initiative, specifically:

Remco Fischer

Climate Lead
UNEP FI

Paul Smith

Climate Consultant
UNEP FI

Barney Dickson (GCA), **Carter Brandon** and **Nisha Krishnan** (World Resources Institute) provided input and direction on behalf of the GCA.

Yan Fan (Climate Finance Advisors) provided help and support during the preparation of this report.

Disclaimer

This paper is part of a series of background papers commissioned by the Global Commission on Adaptation to inform its 2019 flagship report. This paper reflects the views of the authors, and not necessarily those of UNEP FI, the Global Commission on Adaptation, nor those of the Review Panel participants or their organisations.

Copyright

Copyright ©

United Nations Environment Programme, July 2019

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

Contents

Acknowledgements.....	1
List of abbreviations	3
Commonly used terminology in this paper	4
Foreword.....	6
Executive summary.....	8
Background and Introduction.....	10
1. Context: The climate challenge for the financial system and its actors	12
What is Climate Risk in the Financial System?	14
Ongoing Work Integrating Climate Considerations into the Financial System.....	17
2. Considerations of climate risks in the financial sector	22
Climate Risk: A Potential for Capital Flight from Where it Is Most Needed.....	22
Who Owns the Risk?.....	24
Climate Risk Management Considerations.....	26
3. Barriers to scaling up finance for adaptation and resilience by the financial system.....	31
Barrier Type: Inadequate Support for Action on Adaptation/Resilient Investment ...	33
Barrier Type: Policy and Practice in the Financial Industry.....	35
Barrier Type: Market Barriers	37
Barrier Type: Nascent Application of Climate Risk Management Practices.....	38
Barrier Type: Low Capacity for Climate Risk Management.....	39
4. Examples of current approaches for increasing adaptation financing.....	41
Blended Finance for Adaptation: Using Public Funds to Catalyze Private Investment	42
Social, Green, or Resilience Bonds to Promote Investment in Adaptation	43
CAT Bonds and Other Innovative Insurance Products	43
Dedicated Investment Vehicles.....	45
Prizes and Competitions.....	46
5. Recommendations for GCA actions	47
Recommendation 1: Accelerate and Promote Climate-Relevant Financial policies ..	49
Recommendation 2: Develop, Adopt, and Employ Climate Risk Management Practices.....	51
Recommendation 3: Develop and Adopt Adaptation Metrics and Standards	53
Recommendation 4: Build Capacity Among All Financial Actors	55
Recommendation 5: Highlight and Promote Investment Opportunities.....	57
Recommendation 6: Use Public Institutions to Accelerate Adaptation Investment by Taking More Risks, Demonstrating New Markets	58
Linkages between Recommendations and Global Commission on Adaptation Action Tracks	60
Annex 1: Select Climate Risk Disclosure Frameworks	63
Endnotes.....	64

List of Abbreviations

ADB	Asian Development Bank	ILO	International Labour Organisation
AFD	Agence Française de Développement	IMF	International Monetary Fund
AfDB	African Development Bank	IPCC	Intergovernmental Panel on Climate Change
AIGCC	Asia Investor Group on Climate Change	IsDB	Islamic Development Bank
AODP	Asset Owners Disclosure Project	LDCs	Least Developed Countries
ARAF	Acumen Resilient Agriculture Fund	MDB	Multilateral Development Bank
ARC	African Risk Capacity	NAP	National Adaptation Plan
BEIS	Department for Business, Energy & Industrial Strategy	NBFI	Non-Bank Financial Institution
BFTF	Blended Finance Task Force	NDA	National Designated Authority
CBI	Climate Bonds Initiative	NDC	Nationally Determined Contributions
CCRIF	Caribbean Catastrophe Risk Insurance Facility	NGFS	Network for Greening the Financial System
CDSB	Climate Disclosure Standards Board	ODA	Official development assistance
CDP	Carbon Disclosure Project	OECD	Organisation for Economic Co-operation and Development
CIF	Climate Investment Fund	PPCR	Pilot Program for Climate Resilience
CPI	Climate Policy Initiative	PPIAF	Public Private Infrastructure Advisory Facility
CRAFT	Climate Resilience and Adaptation Finance & Technology Transfer Facility	PPP	Public-private partnership
CSRC	China Securities Regulatory Commission	PRI	Principles for Responsible Investment
DFID	Department for International Development	S&P	Standard and Poor's
DFI	Development Finance Institution	SASB	Sustainable Accounting Standards Board
EBRD	European Bank for Reconstruction and Development	SDGs	Sustainable Development Goals
EIB	European Investment Bank	SIB	Social Impact Bond
ESG	Environmental, Social, and Governance	TCFD	Task Force on Climate-Related Financial Disclosures
FI	Financial Institution	UN	United Nations
FSB	Financial Stability Board	UN Inquiry	United Nations Inquiry on Sustainable Financial Systems
GCA	Global Commission on Adaptation	UNEP	United Nations Environment Programme
GCF	Green Climate Fund	UNEP FI	United Nations Environment Programme Finance Initiative
GEF	Global Environment Facility	UNFCCC	United Nations Framework Convention on Climate Change
GIC	Global Investor Coalition on Climate Change	VaR	Value at Risk
IDB	Inter-American Development Bank	WBG	World Bank Group
IDFC	International Development Finance Club	WEF	World Economic Forum
IFC	International Finance Corporation	WRI	World Resources Institute
IIGCC	Institutional Investors Group on Climate Change		

Commonly used terminology in this paper

For the purposes of this paper, we provide the following commonly used climate risk terminology.

Adaptation

The process of adjustment to actual or expected climate conditions and their effects on human and natural systems to avoid or limit harmful consequences and/or realize benefits.¹

Climate resilience

The ability of social-ecological systems to absorb and recover from climatic shocks and stresses while positively adapting and transforming their structures and means for living in the face of long-term change and uncertainty.²

Climate risk

The potential for consequences (impacts) where something of value is at stake and where the outcome is uncertain due to impacts from climate change.³

Exposure

The presence of people, species, ecosystems, resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Financial actors

The paper uses this term to represent a collection of entities including: banks, investors, institutional investors, pension funds, and other providers of finance; insurance companies and other providers of financial “risk transfer” mechanisms; rating agencies and other neutral arbiters of credit risk assessment for investors.

Financial system constituents

The paper uses this term to broadly encompass financial governance bodies, financial institutions, and diverse additional influential actors, such as rating bodies.

Financial system governance bodies

The paper uses this term to represent a collection of entities that help to govern and guide the financial system and are responsible for the safety and soundness of financial markets and the economy at large. These include entities that promote and enforce regulations, but also entities that create standards and guidelines for the financial sector, and importantly those that play a key role in developing incentives that can promote, accelerate, and catalyze investment faster than the markets might otherwise act.

Hazards

The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.⁴ Hazards related to physical climate risk include events that are linked to gradual global warming and extreme weather events, such as intense storms, flooding (coastal and river), water scarcity, heat and temperature stress, drought, and wildfires, among others.

Investment in resilience

An investment whose primary objective or function is to increase resilience to protect against or create greater capacity to recover from the direct and indirect physical impacts of climate change.⁵

Liability

Financial liabilities, including insurance claims and legal damages, arising under the law of contract, tort, or negligence because of other climate-related risks.

Physical risk

Physical risks can be defined as “those risks that arise from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability of exposure of human and natural systems, including their ability to adapt” (Batten et al., 2016). Two main sources of physical risks can be identified: gradual global warming and an increase in extreme weather events.⁶ Physical risks resulting from climate change can be event-driven (acute) or longer-term shifts (chronic) in climate patterns. Physical risks may have financial implications for organizations, such as direct damage to assets and indirect impacts from supply chain disruption. Organizations’ financial performance may also be affected by changes in water availability, sourcing, and quality; food security; and extreme temperature changes affecting organizations’ property, operations, supply chains, transport needs, and employee safety.⁷

Acute physical risk

Those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.⁸

Chronic physical risk

Longer-term shifts in climate patterns, such as changes in precipitation patterns and sustained higher temperatures, that may cause sea-level rise or chronic heat waves.⁹

Resilient investment

An investment that is protected against or can recover from the impacts of climate change.¹⁰

Transition risk

Transitioning to a lower-carbon economy may entail extensive policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to organizations.¹¹

Value at risk

Quantifies the size of loss on a portfolio of assets over a given time horizon, at a given probability. Estimates of VaR from climate change can be seen as a measure of the potential for asset-price corrections due to climate change.

Vulnerability

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Foreword

Financial institutions are taking an increasing number of mitigation actions to prepare for a low-carbon future. These actions range from divesting from or engaging with firms that are highly dependent on the use of fossil fuel, to accelerating investment in green technologies, where, for example, solar build-out represented 38% of all new generating capacity added in 2017.¹²

However, even if we fully deliver on the mitigation objectives of the Paris Climate Agreement, we will end up with between +1.5°C and +2°C of warming, which is double the warming we see today. Even in that best-case scenario, the physical impacts of climate change will be significant and potentially disruptive. Climate change is already affecting our economy, our society and our environment and these material impacts will continue to increase even if we manage to hit mitigation targets. It is therefore of paramount importance that adaptation to climate change is considered as important as reducing carbon emissions. Yet the gap between the financing required for adaptation and the funds currently available continues to grow. According to the 2018 Adaptation Gap Report, the annual costs of adaptation could range from US\$140 billion to US\$300 billion by 2030 and from US\$280 billion to US\$500 billion by 2050. Furthermore, the physical impacts of climate change are likely to have a disproportionate impact on the poorest countries, regions and sectors of society. This is why the Global Commission on Adaptation was convened in 2018 to elevate the political visibility of climate adaptation and to encourage bold solutions such as smarter investments, new technologies and better planning. Financial institutions have a key role to play in unlocking investment for a climate-resilient economy.

An evolving landscape of adaptation investment opportunities are emerging, which will allow for both a societal impact and financial returns. For example, specific microfinance and microinsurance products could deliver investments in climate-resilient farms and businesses. Targeted savings products aimed at promoting climate resilience could be made available to vulnerable populations, while transfer and remittance facilities will help to facilitate emergency funding to communities affected by climate change-driven events. Financial service companies are also in a position to raise awareness and build capacity around climate risks. Governments could incentivize investment in adaptation through the use of blended finance instruments or other forms of public-private financing models that facilitate scale and pooling or diversifying of risks.

Furthermore, integrating climate resilience into project development makes investments both robust and long term, which is a clear advantage for private investors. Offshore wind farms in tropical regions that are able to survive hurricane or typhoons, for example, or investments in low-cost products to cool buildings, such as roofing materials or paint, would provide clear investment opportunities.

Finally, systemic changes, including physical risk disclosure and the integration of climate change assessments in investment decision-making will help to mainstream adaptation and build a more resilient financial sector.

This report provides a thorough analysis of the current situation, identifying the barriers that restrict the financial system's resilience and limit financial flows to adaptation-related investments, while underlining the potential opportunities that we highlight above. We are pleased to endorse this report's concrete and ambitious recommendations, which, if fully implemented, would make a real difference in unlocking financial flows for adaptation. We sincerely hope that the partnership between UNEP FI and the Global Commission on Adaptation will continue to develop over the coming years and help to deliver the actions and initiatives necessary to build a more resilient financial sector.



Peter Damgaard Jensen

CEO, PKA Ltd

Commissioner, Global
Commission on Adaptation
Chair, the Institutional Investors
Group on Climate Change



Eric Usher

Head, UNEP Finance Initiative

Executive summary

There is no doubt that the world is warming, and the consequences of this warming are and will increasingly be far-reaching. Addressing the adaptation needs that result from this warming and aligning those with the 2015 Paris Agreement is perhaps the biggest investment opportunity of this generation. In doing so it will be imperative to align the financial system to this challenge in order to truly “unlock” the necessary capital—both private and public—that can support investment in adaptation and resilience.

But efforts to date fail to reflect the urgency communicated in recent reports by the Intergovernmental Panel on Climate Change (IPCC) and other scientific bodies. With increasing evidence that climate impacts are already occurring and accelerating, further delay presents enormous, potentially catastrophic risks to the financial system—and, indeed, the global economy.

The financial sector is built around evaluating and managing risks of all kinds as the basis of making investment decisions. To date few in the financial sector are incorporating physical climate risks into investment decision making. Knowledge of how physical risks from climate change impacts risks and opportunities is rapidly evolving, but clear risk management practices are still nascent. Identifying the financial implications of climate risks will create enormous opportunities for profitable investment by all types of investors, including both public and private finance. However, the same understanding may also trigger potential capital shifts or flight from the poorest and most vulnerable communities and countries, those most in need of investment in adaptation and resilience. The absence of clear ownership of climate risk in many sectors has also led to expectations of publicly funded assistance following natural disasters, further discouraging investment in resilience.

This paper reviews barriers and opportunities for financing resilience and adaptation by all actors across the financial system but chiefly targets financial system constituents, including policymakers and financial actors, and the actions required of each.¹³ While the challenges and potential solutions are wide ranging, key needs fall into several categories:

- Climate risk management and climate risk disclosure;
- Harmonization of practices and terminology; and
- (re) Allocation of capital towards climate resilience, adaptation and overall sustainability.

Many efforts to bring about the changes in the financial system that are needed to integrate climate risks in decision making have been initiated, but the reality today is that the necessary rules, regulations, standards, and best practices remain nascent and weakly defined. While specific to different segments and actors within the financial system, five broad categories of barriers to scaling up financing for adaptation and resilience summarize the challenge:

- Inadequate support and/or incentives to act;
- Weak policies and conventions in the financial industry;
- Market barriers;
- Operational gaps at the institution level; and
- Low technical capacity for climate risk management.

The range of adaptation investment opportunities, while very large, faces additional barriers in the perceived lack of private benefits and the immaturity of business models.

Aggressive additional public and private commitments will be needed to address the growing adaptation financing gap. Closing the gap will require comprehensive policy reforms, enhanced incentives, and partnerships involving governments and policy makers, financial institutions, businesses of all forms, and communities at risk.

This paper was developed as part of a collection of background papers on the topic of finance to contribute to the Global Commission on Adaptation's "Action Tracks" to be presented in September 2019. This paper focuses specifically on two key constituents important for transforming financing flows towards adaptation and resilience:

- i. **Financial System Governance Bodies; and**
- ii. **Financial Actors. This paper presents six recommendations, supplemented by illustrative actions, which can facilitate and accelerate financing for adaptation and resilience.** Collectively, they offer a program that is ambitious, actionable, and can directly impact how finance can be unlocked for adaptation and resilience:
 - Accelerate and promote climate-relevant financial policies;
 - Develop, adopt, and employ climate risk management practices;
 - Develop and adopt adaptation metrics and standards;
 - Build capacity among all financial actors;
 - Highlight and promote investment opportunities; and
 - Use public institutions to accelerate adaptation investment.

Each of these are efforts which can be undertaken in parallel by both policy makers and financial institutions, and if implemented will result in the acceleration of financing flows and investment for adaptation and resilience.

Furthermore, the Global Commission on Adaptation can support the above efforts as part of its Action Tracks in the following ways:

- Establish, develop, and promote a network of excellence on climate risk and adaptation;
- Promote the integration of climate considerations into financial system governance;
- Promote the development of a climate analytics industry; and
- Innovate in financial instruments for climate adaptation and resilience

Given the far-reaching increased risks that a warming planet presents, there is an urgency required to focus efforts among all parts of the financial system—both financial system policy makers and financial institutions—to undertake efforts that can help to truly “unlock” the necessary capital—both private and public—that can support investment in adaptation and resilience.

Background and introduction

Across the globe, physical climate impacts resulting from a warmer planet have become more pronounced and damaging in recent years, with grave implications for vulnerable people and societies. The four-year period from 2015 to 2018 has been confirmed as the hottest on record, reflecting exceptional warming, both on land and in the ocean, a clear sign of continuing long-term climate change associated with record atmospheric concentrations of greenhouse gases¹⁴

But temperatures are only part of the story. Increasingly over the past five years, extreme weather triggered or exacerbated by climate change affected many countries and millions of people, with sometimes devastating repercussions for lives and livelihoods, as well as for economic growth and ecosystems. Both acute and chronic impacts from a changing climate are already manifesting in financial and economic losses around the globe, not only in emerging economies of the Global South, but also in more developed economies in Europe, Asia, and North America¹⁵ Climate change will transform the conditions under which ecosystems, economies, and societies operate, making it vital for all to adapt.¹⁶ Estimating the resources needed to adapt to a changing climate and the global benefits of adaptation is challenging. It is also difficult to precisely define what is meant by “adaptation” actions, which frequently also include steps to increase resilience to environmental and social shocks stemming from climate change.¹⁷ Given the amount of warming that has already been locked in by rising greenhouse gas concentrations, addressing adaptation needs will require significant financing across all countries, regions, and markets. And such financing for adaptation and resilience needs to be scaled up quickly.

Best available estimates are that the annual cost of adaptation will be between US\$140 billion and US\$300 billion by 2030.¹⁸ While understanding the costs and the benefits will be vitally important, the magnitude of these figures implies that in all circumstances public budgets will be insufficient alone to address the financing challenge for adaptation, and the full strength of the financial sector is needed, inclusive of both public and private finance. What is crucial now is to devise and implement practical measures to help policymakers and financial actors to facilitate, accelerate, and augment efforts that can enable this type of transformation the financial sector.

The question of how to scale up financing to address climate change is not new. In the context of the climate agenda over the last 25 years, significant effort—and action—has been taken to develop approaches that can “unlock” financial flows with the recognition that addressing

climate change will cost far more than public budgets alone can bear. Efforts to scale up financing have included the creation of special climate funds, such as the multilateral Global Environment Facility (GEF), Climate Investment Funds (CIF), and Green Climate Fund (GCF), as well as bilateral, national and local special climate funds, such as the Brazilian National Fund on Climate Change, South African Green Fund, Bangladesh Climate Change Trust Fund, European Regional Development Fund, and New York State Green Bank. These approaches effectively and efficiently utilize public and long-term capital to unlock private capital, as is the premise of most blended finance approaches. While these efforts, actions, and approaches have resulted in a significant shift in capital flowing toward climate-related investments over the last 25 years, the vast majority of investments go towards projects that help mitigate climate change (e.g., renewable energy investments).

Nonetheless, the scale of financing that addresses climate change continues to pale in comparison to both the mitigation and adaptation investment needs. This remains true even after the international community came together around the Paris Agreement in 2015 to move the global economy to a low-carbon and climate-resilient future.¹⁹ Nearly four years after Paris, international action has primarily focused on the low-carbon energy transition (mitigation measures), while action on adaptation has been slow, despite rising sea levels and warming trends that are on pace to exceed 3°C, and possibly 4°C by 2100, bringing almost certain catastrophic outcomes.

Accelerating the transition to low- or zero-carbon economies requires that all markets achieve parity between financing the low-carbon transition and addressing physical risks commensurate with the risks and challenges presented by a warming planet. This is not simply an accounting issue or an issue of mobilizing finance. It also is about understanding and addressing issues in the enabling environments in order to make aligning the financial system toward these twin goals a reality. Without these efforts, achieving a commensurate level of ambition will be challenging.

The GCA is working to address major roadblocks to adaptation action, including the failure to incorporate climate change risks and opportunities into planning and financial system governance and the challenge of mobilizing financing for adaptation investments. Scaling up financing is key to addressing this challenge. This background paper seeks to enhance the framing of the financing challenge for adaptation and resilience, as a financial “systemic”

challenge, focusing on issues related to climate risk in the financial system.

This background paper argues that it is time to fully align financial markets with the 2015 Paris Agreement and to recognize that this applies as much to the financial sector—inclusive of financial institutions and financial policymakers—as it does to the real sector and, of course, populations.

This paper highlights existing barriers and challenges preventing the full integration of climate change risks and opportunities within the financial system writ large, including for its institutions. **A “climate-informed” approach to both governing the financial system and investing is a necessary condition for achieving all adaptation financing goals, including those around mobilization.** Underpinning this will be a clear and comprehensive approach to climate risk management—the consequence of which will allow for greater potential for capturing opportunities to build a more resilient future society today, one that is more resilient to a warming planet.

This paper unpacks the barriers to financing adaptation and resilience and explores options and opportunities to address them. As one of more than two dozen background papers which will lead to “Action Tracks” of the GCA, this paper will focus on the challenges within the financial system writ large vis-à-vis financing adaptation and resilience investments, recognizing that the financial system is comprised of both:

1. Diverse **financial actors** that supply financing across economies, and
2. The **financial system governance bodies** that guide, regulate, and otherwise ensure that the financial “system” itself is sound.

As a background paper for the GCA, this paper primarily focuses on elements that need to be understood to promote systemic change in the economic and financial system to embed risk and resilience into decision making

as a necessary condition for mobilizing financing at scale for climate resilience and adaptation investment. The main audiences for this chapter of the GCA paper include (i) **financial system governance bodies**, regulators, and other government officials from emerging markets, as well as those in OECD and developed economies, and (ii) both **public and private financial institutions**, including banks, asset managers, asset owners, and insurance companies.

Though this paper focuses on the supply of capital for adaptation and resilience, equally important is the volume, quality, and maturity of the “demand side” necessary for financing adaptation and resilience—the pipeline of investible projects, companies, and financial vehicles—into which that capital can flow. Other technical inputs to the GCA’s report focus on the challenges and opportunities particular to developing high-impact and investible adaptation and resilience pipelines of projects in a range of sectors (e.g., agriculture, energy, transportation) and cities.

This paper is neither comprehensive of all issues related to financing adaptation and resilience, nor does it comprehensively showcase the numerous activities and initiatives which are currently being undertaken on the topic of financing adaptation and resilience. It should be noted that “finance” as a topic will also be touched upon in many of the other background papers, particularly with regard to the challenges and barriers for mobilizing finance for specific sectors, such as infrastructure or agriculture, and also for cross-cutting issues, such as financing adaptation for enabling resilient cities, or cross-cutting issues related to the support that international organizations can provide and facilitate as a result of their unique role in catalyzing development. As such, this paper does not cover all aspects of financing adaptation and resilience. For example, this paper does not examine issues that may be present in] sources of development finance focused on adaptation or climate change efforts, nor does this paper delve deeply into financial instruments or mechanisms that can be targeted to address or help scale up adaptation investment, although some may be touched upon.

Overview of Background Paper

This paper is organized as follows:

- **Chapter 1** of this paper presents an overview of the key **financial system constituents**, namely **financial system governance bodies** and **financial actors** that need to consider climate risk and resilience measures.
- **Chapter 2** lays out key considerations for addressing climate risk, including the question of who owns the risk and the potential for capital flight, and includes a practical overview of risk management processes that are needed to fully integrate climate considerations into investments.
- **Chapter 3** provides an overview of key barriers preventing or limiting finance for adaptation and resilience from scaling up, including specifically those focused on the two primary groups of **financial system constituents**.
- **Chapter 4** briefly reviews some examples of current approaches for increasing adaptation financing, including blended finance approaches and insurance-related instruments.
- **Chapter 5** outlines recommendations, along with illustrative actions that the **financial system constituents** and GCA can undertake. While not comprehensive, this paper makes recommendations that point to high-impact and high-priority actions that can (i) have systemic impacts, particularly on how financing flows for adaptation and resilience investments, and (ii) can facilitate action within the actors of the financial system itself.

1 **Context:** The climate challenge for the financial system and its actors

In 2015, the Governor of the Bank of England, Mark Carney, asserted that climate change posed financial risks to all sectors and asset classes, and that a “tragedy of horizons”—meaning a general short-term and short-sighted focus—afflicted almost all actors within the financial system, including the financial actors themselves, the corporates they finance, and, importantly, the policymakers charged with managing risks to the financial system itself. Carney argued that too many perceived the potential impacts from climate change as an issue beyond typical time horizons (e.g., beyond the business cycle, beyond the investment cycle, and, indeed, beyond the political cycle). Carney further argued that both the transition away from fossil-based energy consumption and the acute and chronic physical impacts from climate change would bring about not only isolated losses, but also had the potential to pose a systemic threat to the financial system writ large if not managed and mitigated.²⁰

As a financial regulator, Mr. Carney’s message was primarily targeted toward two primary constituencies relevant for ensuring financial stability (collectively: “**financial system constituents**”):

- **Financial system governance bodies, including:**

- **Policymakers** (e.g., ministries of finance, treasuries, parliaments);
- **Rule-makers and standards bodies** (e.g., central banks, Bank for International Settlements);
- **Oversight and supervisory authorities/bodies** (e.g., European Banking Authority, U.S. Securities and Exchange Commission, European Securities and Markets Authority, Financial Regulatory Authority).

- **Financial actors and institutions, including:**

- Banks, investors, institutional investors, pension funds and other providers of finance;
- Insurance companies and other providers of financial “risk transfer” mechanisms; and
- Rating agencies and other neutral arbiters of credit risk assessment for investors.

These constituents, Mr. Carney argued, needed to fully address the potential risks that climate change might bring about, including for their returns and for the stability of the financial system as a whole. Mr. Carney’s remit extends to the **financial actors** the Bank of England regulates, although several other **financial system constituents** will bear risk from physical impacts from climate change, including financial institutions and investors which are not directly governed by the financial regulatory structures within countries, including a growing number of non-regulated financial institutions and providers of capital and other entities that engage in informal financing.²¹ Finally, and importantly, there are clear linkages between the real sector economy—through industry, corporations, enterprises, and consumers—and the financial system, which cannot be ignored given the direct manifestation of physical climate risks on the real sector.

This paper is primarily focused on the **financial system constituents**, inclusive of policymakers and **financial actors**. This is in part because of the **unprecedented challenge that climate change poses to the global economy, and the need to urgently catalyze a fundamental shift in both (i) the governance of the financial markets, and (ii) the behaviors of the financial actors within the financial system to orient and align all financial flows towards more resilient—and sustainable—investment.**

Role of Financial System Governance Bodies

The role of **financial system governance bodies** is two-fold. First, in terms of pure financial stability, financial regulators and others help ensure market efficiency and integrity. Liquidity, low costs, the presence of many buyers and sellers, the availability of information, and a lack of excessive volatility are examples of the characteristics of an efficient market. Regulators and other **financial system governance bodies** contribute to market integrity by ensuring that activities are transparent, contracts can be enforced, and their “rules of the game” are enforced.²² Integrity also leads to greater efficiency, particularly in capital allocation. Regulation can also address key market failures, such as asymmetric information, principal-agent problems, and moral hazards which would otherwise reduce market efficiency.

Box 1.1 Financial System Governance – Examples of Action in Practice to Date

The following illustrates four examples of how **financial system governance bodies** have used their regulatory and policy levers to orient capital toward climate-related investments. Notably, most of these are focused on directing capital toward mitigation investments:

Article 173 of the French Law on Energy Transition and Green Growth: France’s Article 173, adopted in 2016, was the world’s first mandatory climate change financial disclosure law. Article 173 applies only to publicly traded companies, banks and credit providers, asset managers, and institutional investors. It mandates climate change-related reporting, including a provision on physical climate risks, aligning with TCFD’s voluntary guidance on climate-related risk disclosure. The law provides flexibility in fulfilling these objectives, however, with a “comply or explain” approach; reporting companies must comply or are required to provide justification for why climate risks are immaterial.

Reserve Bank of India – Green Lending Targets: The Reserve Bank of India’s (RBI) Priority Sector Lending Program (PSL) is based on the Banking Regulations Act of 1949 and allows RBI to intervene in certain circumstances with commercial banks’ lending practices. In 2012, RBI included renewable energy as a category in the PSL, with a focus on off-grid solutions, and in 2015 this was expanded to include all renewable energy and social infrastructure projects (although with caps of US\$2.3 million per corporate borrower, and US\$15,600 per household borrower). Under the program, banks are required to maintain 40 percent of adjusted net bank credit or credit-equivalent amount of off-balance sheet exposure, whichever is higher, allocated to eight PSL categories.

Bangladesh Green Refinancing and Credit Allocation Policies: The central bank of Bangladesh has also undertaken an ambitious program for “greening” its financial sector. Perhaps the most innovative and successful of its policies are the refinancing lines at preferential terms for green loans, which today cover more than 47 “green” products, services, and investment types. Under this program, Bangladesh Bank refunds both commercial banks and NBFIs at reduced interest rates (e.g., “preferential rediscounting”) for loans extended to projects and sectors considered green, including solar energy, biogas, waste treatment, water, and energy efficiency. Up until June 2016, more than US\$33 million of investments have benefitted from the program.

California Department of Insurance and Climate-Related Risk Stress Tests: The California Department of Insurance engaged the 2° Investing Initiative to conduct a climate-related financial risk stress test in 2018. It was the first climate-related stress test of its kind in the U.S., with individual reports made available to all 672 insurance companies analyzed. The initial report only assessed transition risks, but a second report in 2019 assessed both transition and physical climate risks. The stress tests provide insurers with information on how investment plans align with different climate scenarios, and which securities are driving the climate risk exposure of their investment portfolios, all of which will help insurance companies implement the TCFD recommendations.

Sources: UNEP FI (2018), Reserve Bank of India (2015), Bangladesh Bank (2016), California Department of Insurance (2019)

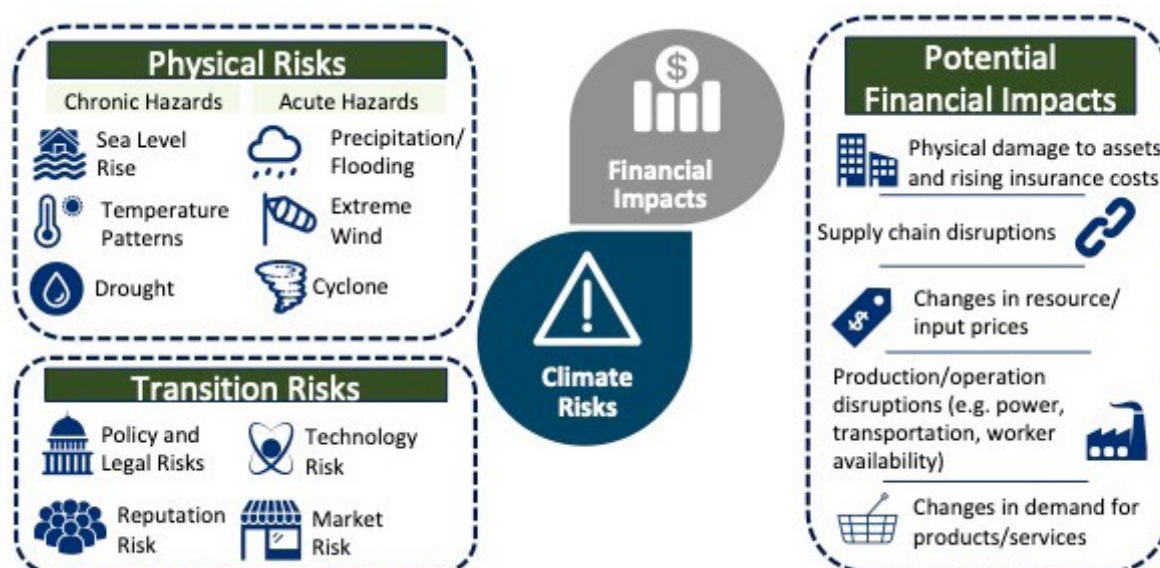
Second, there is a long history of **financial system governance bodies** undertaking and regulating efforts that support social goals and public goods, including: identifying priority sector lending targets, credit allocations, and other central banking activities such as setting guidelines or establishing new instruments. This has been true in most parts of the world and includes targeted governance around mortgage financing, agriculture lending programs, federally supported flood insurance programs, community (re)investment goals, and affordable housing. Notably, and as a direct result of targeted initiatives in recent years, some **financial system governance bodies** have new policies which support “greening” of financial systems (See Box 1.1: Financial System Governance – Examples of Action in Practice to Date), although many of these efforts have been focused on mitigation activities such as incentivizing investment in low-carbon or renewable energy. The types of interventions that **financial system governance bodies** can apply to **financial actors and institutions** are diverse and can vary by country and regulator, but they can be grouped into a few categories:

- **Prudential regulation:** The purpose of prudential regulation is to ensure an institutions’ safety and soundness, with a key focus on risk management and risk mitigation.
- **Disclosure and reporting:** Disclosure and reporting requirements are meant to ensure all relevant financial information is accurate and available to the public and regulators so well-informed financial decisions can be made. Disclosure is used to protect investors and consumers, and it supports market efficiency and integrity.
- **Standards setting:** Regulators often prescribe certain standards for products, markets, and professional conduct. These are used to help guide financial actors and institutions in executing their investments. Developing metrics and definitions for climate-related investment is part of standards setting.
- **Fiscal and monetary policy:** Monetary policy is the practice of identifying the nature, persistence, and magnitude of shocks to the economy, and typically includes setting interest rates, and, in some markets, setting maximum or minimum prices, fees, or premiums to support, for example, consumer protection or enforcement of usury laws.²³

What is Climate Risk in the Financial System?

The potential for climate change to have extreme consequences across the financial system is widely acknowledged, and thanks to the Task Force on Climate-Related Financial Disclosures (TCFD) and others, there are commonly agreed definitions about the types of climate risk (e.g., transition, physical, liability).²⁴

Figure 1: Climate-Related risks and Financial Impacts.



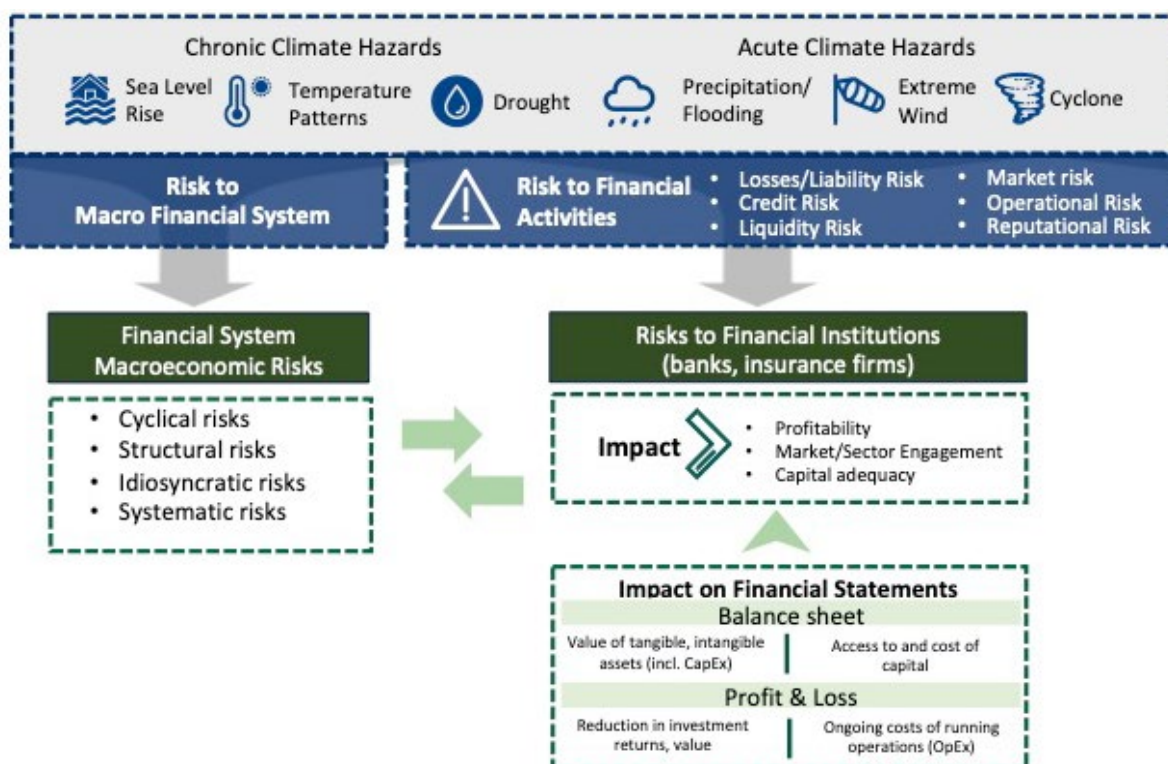
Source: Climate Finance Advisors (2019)

At a basic level, the physical impacts from climate change affect the financial system through the manifestation of both acute and chronic hazards, including those related to temperature, water stress, drought, extreme precipitation, sea level rise, precipitation, flooding, and extreme wind and storms. These risks can result in physical damage to assets (loss of asset value) and rising insurance costs, supply chain disruptions, changes in resource/input prices, production and operation disruptions, and potentially changes in demand for products and services, as shown in Figure 1.

These impacts are tangible and easily quantifiable in retrospect, but they are more difficult to translate into expected future risks. These hazards also translate into risk exposure of different types for both the **financial system governance bodies** and the **financial actors and institutions** in the system.

As an impact on the overall financial system, these hazards can affect both macro-financial risks and risks to financial activities, which are primarily undertaken by financial actors (e.g., financial institutions, investors) within the financial system.²⁵ As a systemic issue, climate risk factors are transverse in the sense that they have effects across different risk categories that banks and financial institutions face, such as credit risk, liability risk, and operational risk. Figure 2 illustrates links between climate change and impacts on the financial system. **Climate change and the related physical hazards can be a threat multiplier to key macro-financial risks, including cyclical risks, structural risks, idiosyncratic risks, and other systemic risks.** The challenge, of course, is that these risks are multifaceted and interdependent and are deeply intertwined with real-economy financing, including financing for major sectors, such as energy, agriculture, and transportation, as well as consumer lending, housing, and healthcare.²⁶

Figure 2: Climate-Related Risks, Macro-financial Risks, and Risks to Financial Institutions.



Source: Climate Finance Advisors (2019)

Linkages Between Financial Actors and the Financial System

The financial system is comprised of an array of discrete actors, each of whom is impacted by climate risk and driven by regulatory and policy mandates to different degrees and in different ways. They include financial institutions, institutional investors, pension fund managers, insurance providers (a financial mechanism for risk transfer), equity investors and venture capitalists, micro-finance and consumer financial institutions, and, of course, public **financial actors** such as public banks and multilateral, national, and other development finance institutions. **By ignoring or underestimating physical risks to assets, or underappreciating the future value of investments either positively, in the case of low-carbon investments, or negatively, in the case of value impaired by physical changes, many financial actors misprice climate risks and opportunities in their investments, strategies, and portfolios.**²⁷

Box 1.2: Role of Development Finance Institutions (DFIs) in Addressing Climate Change

Publicly capitalized development finance institutions have played an outsized role over the last two decades in the area of climate change, promoting many approaches that address barriers to scaling up climate-related investments, including: developing harmonized metrics and standards for mitigation investment, piloting and scaling up innovative financial mechanisms such as blended finance that enable risk sharing and crowding-in of private capital into climate-smart investments, and (currently) developing the tools necessary to integrate climate considerations into risk management approaches, such as climate risk rating systems. Furthermore, many of these institutions (e.g., IDB) work directly with emerging market/developing country financial sector policymakers and regulators to help build capacity with central banks, finance ministries, and others on topics related to climate change.

Source: Climate Finance Advisors (2019)

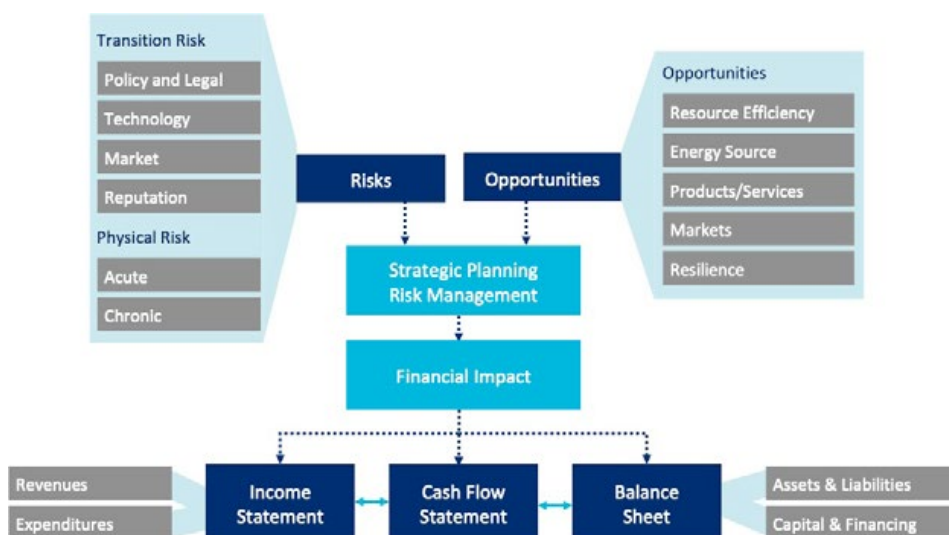
The TCFD 2018 Status Report²⁸ organized the financial sector into four major industries, largely based on activities performed: **banks** (lending), **insurance companies** (underwriting), **asset managers** and **asset owners**, which include public and private-sector pension plans, endowments, and foundations (investing). In addition, publicly directed financial mechanisms, such as public sector infrastructure banks, agriculture banks, and export credit agencies, and publicly capitalized development finance institutions—including multilateral, bilateral, regional and national development banks—play a significant role in the financial sector, in particular in emerging markets. Many of these publicly directed finance institutions play a key role in bridging and (increasingly) blending public and private capital to catalyze development that the markets do not automatically finance on their own (see Box 1.2: Role of Development Finance Institutions (DFIs) in Addressing Climate Change).

Importantly not all **financial actors** are directly governed by **financial system governance bodies**, although they all can bear and convey risks to the financial system through their linkages with other institutions, the real sector, and consumers. Some of these actors are directly influenced and governed by **financial system governance bodies** (e.g., central banks, finance ministries, standards institutions), others are driven by public policy mandates, including development objectives (e.g., development banks), and others are less directly guided by either financial system governance or public policy mandates (e.g., venture capital, impact investors, some equity investors). These actors have diverse institutional structures, investment priorities, risk/return thresholds, and decision-making processes, and the drivers of financial decision-making within them are varied. Whether directly influenced by **financial system governance bodies** or not, each type of financial actor will experience climate risks, including physical, transition, and potentially some liability risks.

For the **financial actors and institutions** within the financial system, climate impacts are not always clear or direct. Physical climate risk is (i) an institutional challenge, (ii) a market challenge, and (iii) a systemic challenge. On the risk side, physical climate risk has the potential

to directly affect investments an institution makes or exposure in its portfolio. Both acute and chronic physical risks can pose significant potential financial challenges to a financial actor's long-term—and likely short- to medium-term—returns, and can impact a financial institutions' portfolio of investments and operations in a number of ways (see Figure 3: Climate-Related Risks, Opportunities, and Financial Impact). Of course, opportunities also exist, including access to new markets, opportunities to employ new technologies or to improve efficiencies, and opportunities to build in physical resilience measures and measures to reduce vulnerabilities to physical impacts that may have a direct relationship with revenues or costs and, ultimately, overall profitability.

Figure 3: Climate-Related Risks, Opportunities, and Financial Impact.



Source: "Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures." Task Force on Climate-Related Financial Disclosure (2017)

Ongoing Work Integrating Climate Considerations into the Financial System

On the positive side, research that supports integrating climate considerations in the financial system has increased in volume and sophistication in recent years.²⁹ While there has been a number of efforts in the last decade that highlight the economic and financial costs of climate change, recent efforts have taken this concept further to focus on the real-world consequences to the financial sector, driven by a clear recognition that climate risk has the potential to be both a serious and potentially material threat and destabilizing for the financial system and its actors. In some cases, these efforts have focused on specific types of financial system governance, such as (i) prudential interventions, (ii) disclosure and reporting practices, (iii) standards setting, and, more recently, (iv) fiscal and monetary policy (See Box 1.3: Elements of Financial Governance Relevant for Financing Adaptation and Resilience).

That said, **almost all the efforts and initiatives to integrate climate considerations into the financial system have a disproportionate weight and focus on issues related to the low-carbon transition**, including carbon pricing and accelerating other mitigation activities. **Few have a deliberate and dedicated focus on issues arising from the expected—and now locked in—physical impacts from climate change and the ramifications of those impacts to the broader financial system.**

This section highlights several key initiatives that explore approaches for integrating climate considerations into financial system governance, and where adaptation and resilience to physical impacts from climate change are covered, including initiatives around (i) disclosure and reporting, and (ii) metrics and standards. Box 1.4: Influencing Global Stock Exchanges to Accelerate Climate Risk Management and Disclosure illustrates how these initiatives can have an outsize impact on the financial system.

Box 1.3: Elements of Financial Governance Relevant for Addressing Climate Risk and Financing Adaptation and Resilience

Integrating climate considerations into the main elements of financial governance (e.g., **prudential, disclosure, standards/metrics, and monetary policy**) can help transform the financial system in ways that catalyze financing for adaptation and resilience. It is important to note that countries vary in their approaches to financial governance, with some having clear and delineated agency roles and functions for prudential regulation, monetary policy, securities regulations, consumer protections and tax and budgetary policies. Nonetheless, each of these functions can be important to address climate risks through better assessment and management, and also through the development of financial policies which incentivize sustainable, climate-resilient investment.

Prudential regulation typically focuses on banking regulation, whereas securities regulation generally focuses on disclosure. Financial stability and taxpayer protection are central to banking because of taxpayer exposure and the potential for contagion when firms fail, but these are not primary goals of securities markets, in part because investors have little recourse in the event of losses and failures. Most securities regulations are not in place to prevent failures, but rather to ensure proper, clear, and relevant information is disclosed to investors. Monetary policy is the practice of identifying the nature, persistence and magnitude of shocks to the economy, achieve price stability, and help manage economic fluctuations. Standards and metrics are important across all of these aspects of financial regulation.

Source: Climate Finance Advisors (2019)

Broad Focus on Financial System Governance

Network of Central Banks and Regulators for Greening the Financial System: In December 2017, eight central banks and supervisors established the **Network of Central Banks and Supervisors for Greening the Financial System (NGFS)**, which now includes 34 members from around the world and six multinational organizations as observers. The NGFS considers climate risks as material, system-wide, and possibly destabilizing for the financial system, and it regards climate risks as falling within the supervisory and financial stability mandates of central banks and financial supervisors. The NGFS also is increasingly focusing on the preeminent risks created by physical climate risk, which is given equal if not greater attention in its first comprehensive report than transition risk. The NGFS is organized around three workstreams:

- **Workstream 1 (Micro-prudential and supervisory workstream):** reviewing practices for integrating climate risks into micro-prudential supervision, including climate information disclosure by banks and asset managers, as well as analyzing the risk differential that could exist between “green” and “brown” assets.
- **Workstream 2 (Macro-financial workstream):** assessing how climate change and the transition to a low-carbon economy affects the macroeconomy and financial stability, as well as identifying good practices and knowledge gaps in these areas.
- **Workstream 3 (“Scaling up green finance” workstream):** outlining the role that central banks and supervisors could play in promoting the scaling up of green finance by **greening the activities of central banks and supervisors**, understanding and monitoring the market dynamics of green finance, and serving as catalyst for greening the financial system.

As part of the work of the NGFS, some members—The Bank of England, De Nederlandsche Bank, and Banque de France—are currently conducting assessments of climate risks for financial institutions, which an initial NGFS progress report from fall 2018 documented.³⁰

The NGFS issued its first comprehensive report in April 2019, presenting six recommendations as non-binding best practices for central banks, regulators, policymakers and financial

institutions to better manage climate-related risks and support the financial sector's role in achieving the Paris Agreement goals:³¹

1. Integrating climate-related risks into financial stability monitoring and micro-supervision
2. Integrating sustainability factors into own-portfolio management
3. Bridging the data gaps
4. Building awareness and intellectual capacity and encouraging technical assistance and knowledge sharing
5. Achieving robust and internationally consistent climate and environment-related disclosure
6. Supporting the development of a taxonomy of economic activities

These recommendations emphasize practical steps for improved prudential and regulatory risk management, including knowledge sharing, improved data and disclosure, and improved harmonization of terminology and methodologies. In this report, the NGFS notes that it plans to issue a handbook on climate and environment-related risk management for supervisory authorities and financial institutions, voluntary guidelines on scenario-based risk analysis, and best practices for incorporating sustainability criteria into central banks' portfolio management.³²

Box 1.4: Influencing Global Stock Exchanges to Accelerate Climate Risk Management and Disclosure

In 2016, the 16 largest stock exchanges, comprising the "One Trillion Club" (each with US\$1 trillion or greater in aggregate capitalization), accounted for 87 percent of global market capitalization, implying that global capital stocks are heavily concentrated in a small number of countries and cities serving as financial centers. Among the largest stock exchanges are key developing country markets, such as the Shanghai and Bombay stock exchanges. These exchanges in turn have an outsized impact on global financial activity. Groups such as the G20's FSB, which includes 25 jurisdictions, and the NGFS, which has 30 members, are important focal points for coordination and consensus among highly influential **financial system governance bodies** on key actions that can lead to greater disclosure around climate risks and opportunities. There is a strong rationale for these focal points to promote mandatory physical climate risk management and disclosure among equities in those markets, thus enabling greater alignment and transition of global capital toward adaptation and resilience investments.

Source: "\$1 Trillion Club", Stock Market Clock website

Focus on Disclosure and Reporting

Among the issues that Mr. Carney highlighted was the need for more timely and relevant information about the risks and costs of climate change. Fundamentally, Mr. Carney's assertion was that **the right type of information, risk management and price signals can result in better capital allocation, both by businesses and investors, and better alignment of finance that is more sustainable in the long term.**

The TCFD was established by the Financial Stability Board (FSB) in 2015 and chaired by Michael Bloomberg as an industry-driven task force. In 2017, TCFD issued its guidance for voluntary disclosures by corporates and financial institutions on climate-related financial risks, focusing on four key elements of disclosure: (i) governance, (ii) strategy, (iii) risk management, and (iv) metrics and targets.³³ TCFD's work was groundbreaking in two ways: It focused on solving the information asymmetry barrier for investors by providing a voluntary disclosure framework on climate risk in terms that are relevant for investment decision-making, and the voluntary disclosure framework it developed was industry-driven. Although voluntary, the framework had public support from more than 500 organizations less than two years after its publication.

Focus on Metrics and Standards

Without sufficient, reliable, and comparable physical climate-related information from investee companies, the financial sector cannot efficiently direct capital to investments that drive solutions to the physical climate crises and cannot effectively identify and manage the risks to investments that will arise from those crises.³⁴ As noted in Box 1.5, developing metrics and standards also involves having a clear understanding of the “effectiveness” of those interventions, not simply whether and how to count interventions as adaptation or resilience finance. Several initiatives related to metrics and standards link with the work of **financial system governance bodies**, which are exploring ways to develop coherent and consistent definitions, standards and metrics. Development finance institutions are also deeply engaged in efforts to create common metrics and standards, in part because of the common interest by these stakeholders to promote sustainability.

Box 1.5: Developing Metrics and Standards Rests on Understanding Effectiveness of Adaptation (Finance)

Deciding what is effective adaptation relies on first defining what the long-term objectives of adaptation activities are, and then assessing to what extent the objectives have been reached. Much of the monitoring and evaluation (M&E) of adaptation focuses on whether or not activities have been completed or funds successfully dispersed. There is very little evidence as yet on whether or not adaptation activities have been effective in preparing households, communities, and governments for an uncertain climatic future and maintaining or sustaining development. The focus of adaptation efforts, and what is therefore effective adaptation, will vary widely depending on the socio-economic context of the party in question. Ongoing work around developing metrics for adaptation focus on the process of adaptation or the outcomes at different points in time. Measuring the “effectiveness” of adaptation often depends on measuring the potential for reducing vulnerability to climate shocks (and thus increasing the “adaptive capacity”) of households, communities, and countries. The approach taken to measure overall progress, therefore, needs to be flexible enough to take account of these very different contexts.

Source: Reviewing the Adequacy and Effectiveness of Adaptation and Support, International Institute for Environment and Development (IIED), 2017

European Commission Technical Expert Group on Sustainable Finance: In 2018, the European Commission (EC) set up a Technical expert group (TEG) on sustainable finance to assist it in developing, in line with the EC’s Action Plan on Sustainable Finance, (i) an EU classification system—the so-called taxonomy—to determine whether an economic activity is environmentally sustainable; (ii) an EU Green Bond Standard; (iii) benchmarks for low-carbon investment strategies; and (iv) guidance to improve corporate disclosure of climate-related information. The TEG is producing a taxonomy to, inter alia:

- Address and avoid further market fragmentation and barriers to cross-border capital flows, as currently some member states apply different taxonomies;
- Provide all market participants and consumers with a common understanding and a common language of which economic activities can unambiguously be considered environmentally sustainable/green;
- Provide appropriate signals and more certainty to economic actors by creating a common understanding and a single system of classification while avoiding market fragmentation;
- Protect private investors by mitigating risks of green-washing (i.e. preventing marketing from being used to promote the perception that an organization’s products, aims, or policies are environmentally friendly when they are, in fact, not); and
- Provide the basis for further policy action in the area of sustainable finance, including standards, labels, and any potential changes to prudential rules.

The EU TEG's approach to adaptation recognizes the context and location specificity of adaptation, and further notes that an adaptation activity can target an asset or an entire system. It utilizes a process-based approach to first assess the negative economic effects of climate change, then to demonstrate how the proposed economic activity or intervention will address these negative effects. It relies on four principles to assess potential adaptive contribution:

- Economic activity that contributes to adaptation to climate change addresses material physical climate risks;
- Economic activity that contributes to adaptation should avoid maladaptation;
- Economic activity that contributes to adaptation has a monitoring system in place aimed at measuring progress toward adaptation results; and
- Economic activity that contributes to adaptation to climate change is part of a wider strategy.³⁵

MDB Adaption and Climate Resilience Working Group: The MDB Adaptation and Climate Resilience Working Group is a sub-group of the joint MDB Working Group on Climate Finance Tracking. The joint MDB Working Group on Climate Finance Tracking is committed to working toward short- and long-term goals related to climate finance metrics in light of the Paris Agreement, and has tracked progress toward scaled-up climate change mitigation and financing adaptation and resilience in the portfolios of each of its member institutions since 2012.³⁶

The priorities of the Adaptation and Climate Resilience Working Group for the period 2017-2019 are to:³⁷

- Strengthen tracking of financing adaptation and resilience at MDBs and members of the International Development Finance Club (IDFC) and harmonize the application of the methodology based on the *Common Principles for Adaptation Finance Tracking*³⁸ to **ensure estimations for tracking financing adaptation and resilience are fully comparable**, particularly for co-financed projects;
- Engage with lead institutions to provide strategic and technical inputs to the international dialogue on **scaling up financing adaptation and resilience**, including, among others, the Standing Committee on Finance of the UNFCCC, the Organisation for Economic Co-operation and Development (OECD), and the International Organization for Standardization (ISO);
- Develop **adaptation outcome metrics** to capture the effects of activities with climate-resilient development objectives.

In line with these priorities, the Adaptation and Climate Resilience Working Group provides a platform for regular exchange between MDBs and IDFC members (e.g., to discuss case studies in challenging sectors). In 2018, the Adaptation and Climate Resilience Working Group published a paper on the "Lessons Learned from Three Years of Implementing the MDB-IDFC Common Principles for Climate Change Adaptation Financing,"³⁹ which was jointly presented at the 24th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP24). The Adaptation and Climate Resilience Working Group is currently working on a joint MDB-IDFC document on principles and elements of a climate resilience framework, as well as an analysis of reported adaptation shares in projects jointly financed by MDBs and/or IDFC members.

These and other initiatives are vitally important to chip away at specific barriers (e.g., definitions and metrics, disclosure) endemic to the challenge of transforming the financial system and aligning capital toward sustainable and climate-resilient investment, and yet they remain insufficient to fully unlock or re-orient the power of finance around the challenge of climate change. **What has garnered less attention is the topic of climate risk management**, and in particular how addressing climate risk can both limit exposure of the financial system and its actors and, importantly, highlight clear opportunities to invest in adaptation and resilience or make resilient investments.

The next section provides a brief overview of the topic of climate risk in the financial system, with an emphasis on how physical climate risk presents challenges for the **financial system governance bodies** and its financial actors, as well as a general synopsis of climate risk management processes.

2 Considerations of climate risks in the financial sector

Physical climate risk is inherent to all investments and financial asset classes. Understanding and internalizing that risk into financial decision-making is essential for both reducing exposure to investments from climate change and identifying opportunities to invest in resilience. This section reviews three key issues for **financial system governance bodies** and **financial actors** that arise from insufficient attention to the risks posed by physical impacts from climate change, including:

- Potential for shifts in capital from communities, markets, and sectors;
- Greater pressure on public budgets; and
- The urgent need for the **financial system constituents** to employ climate risk management practices.

Climate Risk: A Potential for Capital Flight from Where it Is Most Needed

In addition to identifying opportunities to scale up and invest in climate resilient and resilience opportunities, proper recognition of the financial risks from climate change has the potential to influence capital flows, both in terms of capital shifts—or in some cases capital flight—from areas where such investment is most needed, and for identifying and scaling up opportunities to invest in resilience.

Understanding the linkages between physical climate change and financial risk—which to date have not been well understood in terms of their direct and indirect impacts on finance, returns, and value—is an essential first step to understanding specific risks to **financial actors**, as well as larger financial system risks. Understanding these linkages can allow for finance to more efficiently price in these risks, and potentially incentivize both positive, more “resilient” investments that enhance climate-robustness, and “investments in resilience” that bring new solutions to market.⁴⁰ Ideally, a wider scale and more common understanding of physical climate risks will result in better pricing signals—not only from ratings agencies and insurance providers, but also in the supply of finance from banks, investors, and others. One challenge, however, is that physical climate risk assessment is contextual and specific to location and physical hazards, and thus integrating such measures of risk will require assessments relevant for the types of investments being made, including varying instruments (e.g., debt, equity, risk-transfer/sharing arrangements).

Unfortunately, a better understanding of such risks can also lead to financial “flight” from some types of investments, particularly of private capital. This could be important for investments in highly vulnerable communities and countries when the markets come to perceive them as too risky. This is of concern for development finance and economic development institutions, which have a primary mandate to accelerate development and, in many cases, catalyze private investment to reduce poverty, increase prosperity, and create jobs and economic growth.

The risk of capital flight is likely to vary not only due to certain locations which may be more or less vulnerable to climate-related hazards (both acute and chronic), but also depending on the type of investment and investors. For example, for some listed equities, the presence of climate risk may have little impact on their capacity to invest or (in the short term) attract capital. The availability of finance for listed equities and corporations once physical climate-related risks are fully priced in to asset valuations in the marketplace could vary by sector and market, may or may not be sudden, and could very well be quite negligible in the short term. In some cases, private capital may not flee, but rather will require greater returns (which could be attractive to some investors), and if capital flight occurs, it is likely that there

will be shifts or reallocations within asset classes and markets from climate-vulnerable to climate-resilient assets⁴¹ before there is a full retreat of those types of capital. In other cases, private capital may internalize climate risks into pricing for the short term, with an implicit objective of focusing on short-term returns.⁴² Furthermore, integrating climate risks into pricing assumes transparent information around climate risks is available. In some cases, this can have the positive benefit of reducing the volatility of asset prices.⁴³

Nevertheless, capital flight remains a serious potential risk for sectors and communities with high exposure to the impacts of climate change. Developing countries, many of which are already vulnerable due to poor infrastructure, poor economic systems, and poor governance, are at particular risk. Capital flight from those communities and countries influenced by climate risk has the potential to have not only major economic consequences but can also contribute to destabilization and migration.

These circumstances have the potential to put additional pressure on public balance sheets, including local governments and developing countries. Even in the best of circumstances, public balance sheets alone cannot bear all costs of climate risk (or all cost of transitioning to a low-carbon, climate-resilient economy), yet implicit assumptions that the public balance sheet will serve as a backstop leads to a lack of action by many stakeholders that can lead to market distortions and inadequate risk management.

Policy-level responses at all levels of government—and for the **financial system governance bodies**—should consider the potential for shifts in capital flows away from vulnerable communities and countries.

The issues of capital flight may become a major concern for financial actors that have a public or policy mandate, including development finance institutions and multi-lateral, bi-lateral, and national development banks, and, of course, domestic financing institutions in many countries (e.g., green banks, agriculture banks). These institutions have a dual mandate to promote economic development in domestic and/or international emerging markets, but more importantly, **they have played an outsized role in routinely using their balance sheets to leverage and “crowd in” private capital in countries and communities that are perceived risky by private finance.** As these physical climate risks become clearer, these institutions may need to leverage their balance sheets more to incentivize or “catalyze” private investment, placing more pressure on their own credit ratings and eventually on public budgets that are already stretched thin in some countries. Even where markets naturally form to provide resilience benefits, concessional support in financial markets may be justified from a policy standpoint to better align the private benefits of adaptation investment with their contribution to the public good.

Box 2.1: Understanding physical risks for profit

A better understanding of physical risks will also unveil new business models, opportunities for profitable investment, and approaches to safeguard and advance human development and economic growth. For example, improving climate risk data and transparency could allow a wider range of risk mitigation options, including insurance and other financial mechanisms, which can help highly exposed communities and countries attract needed investment capital from both the private and public sectors. As discussed in Chapter 4, new adaptation-oriented financial products and tools, drawing on innovation and best practices in governance and markets, are being developed and can be powerful engines to advance efforts to accelerate the transformation to a sustainable, climate-resilient financial system.

Finally, the uncertainty about the timing of mitigation efforts, and the imperfect understanding of whether those mitigation efforts can deliver temperature outcomes, suggests that we may also be underestimating the tail risks of the distribution of climate-related impacts to the financial system as a whole. Fat tail climate events could not only significantly damage growth and welfare in some sectors or communities, but could also upend whole economies. In this scenario, economic and financial mechanisms—such as the financial institutions we currently depend upon to catalyze positive, climate-smart investment—will find themselves facing abrupt adjustments which could be severely financially disruptive.⁴⁴

Who Owns the Risk?

It is relatively easy for all actors in the system—policymakers, financial institutions, investors, and others—to point to another constituency as the one primarily responsible for addressing or managing climate risks, or conversely for scaling up investment in adaptation and resilience. The issue of who “owns” the risk is important, and it is inextricably linked to finance for adaptation. This is because:

- The expected costs for adaptation and resilience investment far outweigh public balance sheets;
- Private capital of all types will need to be leveraged and directed toward adaptation and resilience; and
- Leveraging public balance sheets requires sharing risks.

At the moment, there is a widespread assumption (implicit, but sometimes explicit) that governments and public balance sheets will be the ultimate bearers of these risks. Yet, it is highly likely that physical impacts from climate change will involve risk of losses by a number of stakeholders, including not only vulnerable communities and countries, but also financial actors and private investors of all types across a range of asset classes. **In this sense, every financial actor “owns” climate risk directly and, in many cases, indirectly. Yet few are proactively addressing these risks, even for their own investments.**

One illustration of this comes from the development finance community, which has been focused on promoting and accelerating climate-smart investments for several decades, yet continues to have limited ex-ante active climate risk management for new investments. Few DFIs (if any) have undertaken extensive climate risk stress testing for physical risks of their portfolio. In most cases, DFIs employ little or no explicit incentives for recipient countries or projects to employ good climate risk management practices, undertake adaptation or resilience investment, or even adopt a “building back better” approach by recipient countries after disasters. There have been some innovative financing approaches, such as parametric insurance mechanisms (e.g., CCRIF, ARC) that have attempted to focus developing countries on this issue by providing insurance-based approaches to address certain risks (Chapter 4). At the moment, however, many developing countries operate on the assumption that, ultimately, disasters brought about by climate change will be addressed through aid provided post-disaster.

Box 2.2: Disaster Risk Management Alone is an Insufficient (and costly) Solution to Finance Adaptation and Resilience

Addressing the physical impacts from climate change solely as part of disaster risk management funding will not be sufficient to fully address adaptation and resilience needs or investments. Disaster risk reduction and management strategies tend to focus on funding the recovery from the impacts from acute and severe events, while addressing adaptation involves not only reducing vulnerability to shocks (e.g., acute events), but also stresses (e.g., chronic events). For many **financial system governance bodies**, fiscal funding directly related to disaster risk management and reduction is one of the few sources for funding adaptation and resilience investments. Using disaster risk management as the sole approach to address adaptation and resilience, however, will likely lead to more “costly” adaptive measures and investments by the government. For example, in 2016 a small community in Louisiana of 12 homes on the Isle de Jean Charles, received a first-of-its-kind “climate resilience” grant (from federal tax dollars) of US\$48 million to move its entire community because of risks posed by climate change. While the funding was an important contribution by the federal government toward that community’s resilience options, the cost-per-household to the government was significant. In Alaska, an Iñupiat village of about 600 people in 2016 voted to relocate from a barrier island disappearing due to erosion and flooding. After spending US\$27 million on coastal protection measures, the town estimated it needed US\$180 million for relocation. An estimated 31 villages similarly face “imminent threat of destruction,” according to the Arctic Council.

Source: “Resettling the First American Climate Refugees,” New York Times, 2016, and “Reeling from Effects of Climate Change, Alaskan Village Votes to Relocate,” NY Times, 2016.

Notwithstanding the potential for direct losses, the absence of any financial actor taking ownership of climate risk they are directly (or indirectly) exposed to reinforces the perception and implicit assumption that the back-stop for these risks are governments and the public balance sheet. This ultimately reinforces the perception that climate risk is “owned” or borne by public balance sheets (including international aid), especially as governments are typically the only source of funding for disaster risk relief and management (See Box 2.2: Disaster Risk Management as an Insufficient (and costly) Solution to Finance Adaptation and Resilience for further details). This may be true in some circumstances but doesn’t have to be true in all circumstances.⁴⁵

What is likely true is that, in the absence of proactive action to address climate risks, the costs of adaptation and resilience will increase over time for all **financial system constituents**. **Financial system governance bodies** and governments are likely to require the expansion of safety net programs for the poor and most vulnerable, putting additional pressure on public funding and potentially requiring governments to allocate additional capital to support these affected communities.

It is in the interests of both **financial system governance bodies** and **financial actors** to address climate risks collectively, yet there is nothing currently in the financial system which explicitly incentivizes good climate risk management, either by fully pricing in climate risks or by providing policy directives that require information disclosure or support investment in resilience/resilient investments. As a result, public budgets are likely to be under greater stress to assume the costs of climate risks, even though they may not be sufficiently able to absorb those costs. The challenge is to ensure that everyone—**financial system governance bodies** and **financial actors**—is incentivized in the right ways to undertake action now, versus waiting until climate risk fully manifests in unsustainable ways.⁴⁶

Climate Risk Management Considerations

Climate risk management practices which enable **financial system governance bodies** and **financial actors** to fully identify, quantify, assess, and manage climate risks (both physical and transition) are not yet widely employed by policymakers, financial actors or corporates, business or communities. Of the actions and initiatives to date to address climate risk, far more effort has been made around issues related to metrics and standards and disclosure, as well as efforts to address or invest in mitigation efforts. Yet far more needs to be done to employ risk management approaches for physical climate risks. Integrating climate risk management perspectives into all parts of the financial system will be a necessary component to fully aligning the financial system toward the Paris Agreement goals. As the financial sector improves its management of physical climate risk, these risk management practices will spill over into the rest of the economy.

However, assessing physical climate risks can be complicated. Physical climate risks typically have three characteristics which make the assessment of climate risk challenging:

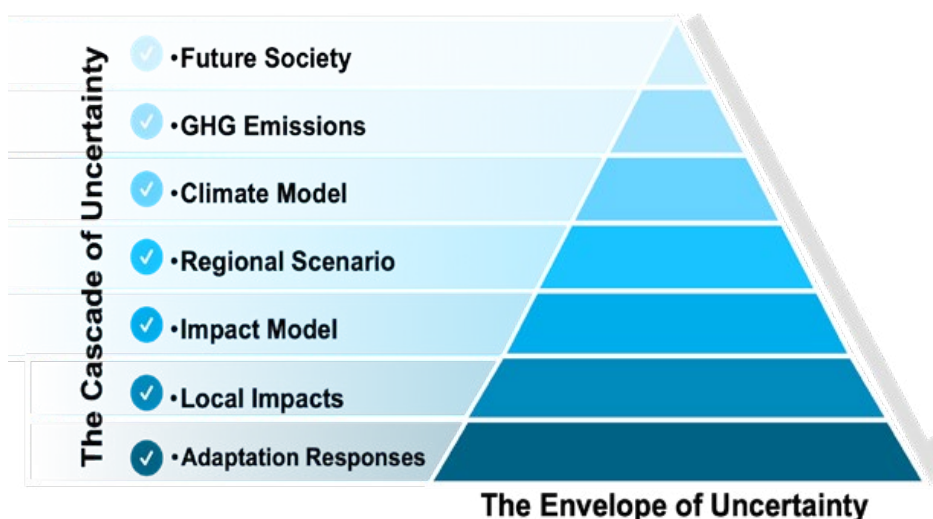
- They are linked to specific hazards—or a combination of hazards—which are present at the physical location of an asset, project, operations or supply chain(s);
- The various financial impacts of “hazards” that a project may encounter related to a changing climate depend on the circumstance of the project client, including its own financial health, its ability to withstand financial impacts from business interruption, and other factors; and
- Anticipating the timeframe that physical climate risks may become material is a function of evolving probabilities that those impacts will occur.⁴⁷

Importantly, for both transition and physical risk, understanding how these risks impact investment requires understanding the risks across a number of different time horizons, including (i) the time frame of an asset life, and (ii) the timeframe of the financial exposure, all of which are compounded when there remains a general lack of understanding of climate change and its associated risks.

Assessing and Managing Climate Risks: Decision Making under Uncertainty?

Significant work has been undertaken by economists around the topic of decision-making under uncertainty as it relates to the topic of climate change. Early research on this topic acknowledged that projections and timing of future climate conditions were “uncertain” due to the inability to precisely predict the factors that will drive future greenhouse gas emission levels and their corresponding effects on the climate system, societies, and economies, sometimes referred to as the “cascade of uncertainty” (see Figure 4: Cascade and Envelope of Physical Climate Risk Uncertainty).⁴⁸ Furthermore, climate and economic models and conventional risk management tools may not fully capture extreme, “fat tail” scenarios entailing geophysical or economic tipping points and feedback effects.⁴⁹ Many researchers call this “deep uncertainty”⁵⁰ in an effort to distinguish from common risks that are routinely considered in the context of investment decision making. Given the already observable impacts of a warmer planet, uncertainty about future climate conditions or impacts should not block action, as new approaches—particularly for infrastructure investors—are available to characterize and address this uncertainty, including through robust decision-making processes (RDM), probabilistic risk management, real option analysis, and adaptation pathways that are appropriate for adaptive design in the face of uncertainty.^{51,52}

Figure 4: Cascade and Envelope of Physical Climate Risk Uncertainty.



Source: R.L. Wilby and S. Dessai (2010)

Investors and banks deal with uncertainty all the time, and given the already observable impacts, climate change risks are far more certain—due to their basis in physics—than many other market risks.⁵³ What is uncertain is the timing and severity of and vulnerability to those impacts. Identifying and evaluating risks is one of the core competencies of the financial system, whether lending to consumers, businesses, or even countries on the basis of creditworthiness; providing working capital to start-ups on the basis of business viability (and possibly collateral); or investing (for example) in infrastructure.⁵⁴ For example, financiers of infrastructure projects (including commercial banks, infrastructure investors, and DFIs) routinely assess key project and commercial risks, such as commercial viability, completion risks, environmental risks, operating risks, revenue risks, input supply risks, and contracting risks (e.g., mismatch, sponsor risk) as part of their investment process.⁵⁵ Climate change can impact any of these risks in a number of ways, and such impacts can be measured in terms of overall financial value at risk for the project. Viewing climate risks as an integral part of the overall financial assessment for investments in infrastructure has the potential to enhance not only the physical resilience of infrastructure but also the financial resilience of the investment or project. Climate risk and disaster risk management, for example, are already being fully integrated to address acute physical climate impacts at development finance institutions such as IDB⁵⁶ and the World Bank.⁵⁷

Integrating Climate into Risk Management Process and Practices

Integrating climate risks into financial decision-making has several interlocking components. The TCFD and other efforts have focused on disclosure to address the information asymmetry between investors and investees.⁵⁸ Robust requirements, detailed guidelines, and harmonized best practices for disclosure are all vital to giving investors comparable, material, decision-relevant information. Climate risk disclosure, however, is necessary but not sufficient to ensure full integration of climate risks. First, pro forma or heterogeneous disclosures may not overcome information barriers that investors face alone. Second, good climate risk management is a necessary condition for good disclosure, which provides information for investors and **financial system governance bodies** to make well-informed decisions, whether on the policy level or at the transaction level (and all the layers of the system in between). That is to say, without strong risk management, disclosure will necessarily be weak and incomplete.⁵⁹

Figure 5: Strategies for Risk Management

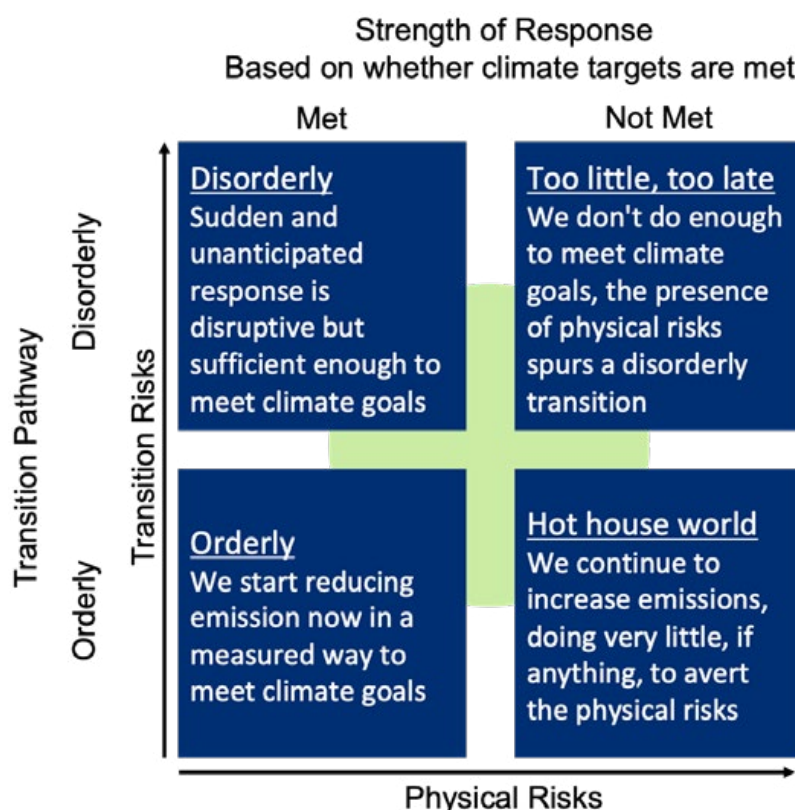


Source: Adapted from the TCFD Recommendations Report (2017) by Climate Finance Advisors

For most risks assessed by **financial actors**, the risk management process includes three phases:

- **Identify and assess risks:** At the asset level, this process typically involves (i) the identification of climate hazards that may be present (identification), and (ii) the potential “vulnerability” of the assets. Fundamentally this involves an attempt to understand how those hazards may impact operations, performance, supply chains, markets, or other aspects that might impact the value of an investment. Key to identification and assessment of climate risks is understanding meaningful time horizons that are relevant for risk management purposes. This is not simply understanding time horizons for climate-related hazards to manifest (in either chronic or acute ways, both directly and indirectly), but also the period of investment exposure and the asset life. Also vital for risk identification and assessment is scenario analysis that takes into account various realistic potential futures based upon society’s political-economic responses to climate change, and the efficacy of those responses (see Figure 6). Ideally the scenarios examined should be harmonized across financial institutions and industries to allow apples-to-apples comparisons of risk exposure and vulnerability.⁶⁰
- **Quantify risks:** Perhaps the most underdeveloped part of climate risk management practices to date, this part of climate risk management involves identifying and analyzing the financial value of those risks in terms of their impacts on returns (e.g., revenues, assets, costs), and across time horizons that are meaningful for understanding value at risk for the investment.
- **Manage risks:** From the basis of understanding, financial institutions and **financial system governance bodies** can develop a strategy for managing risk, including by employing a combination of risk-transfer (e.g., insurance), mitigation, accept, or control risks as illustrated in Figure 5: Strategies for Risk Management.

Figure 6: NGFS Scenario Analysis Framework



Source: NGFS, 2019

Not unlike risk management of other forms of risks (e.g., credit risk, market risk, political risk), climate risks need to be assessed at the (i) transaction level, (ii) institution-wide level, (iii) market level, and (iv) system level in several important aspects (represented by Figure 6: Risk Management Levels):

- **Transaction level:** Climate risks need to be assessed at both the investment (pipeline) stage and in portfolio management, and they need to be contextual to the investment itself, meaning these risks need to be understood and quantified based on the time horizon of the investment period, the exposure and vulnerability the investment may experience, and the value at risk over the investment and asset life.⁶¹
- **Institution level:** Climate risks can be aggregated based on an institutions' portfolio of transactions, and evaluations of the overall portfolio's exposure to climate risks can be monitored and managed. When portfolio assessments identify areas or transactions that hold the potential for higher-than-acceptable impacts from hazards, undertaking portfolio-level stress tests can be useful to inform and guide strategic management decisions.
- **Market level:** Financial system governing bodies can regularly monitor and assess the exposure of certain market segments (e.g., housing, agriculture) to physical impacts from climate change, and can ascertain the potential for these market-level impacts to affect other parts of the economy and financial system.
- **System level:** Climate risks need to be assessed not just for financial institutions in the system, but also for their overall economic impact on sectors and markets, cyclical risks, and other structural risks.

Figure 7: Risk Management Levels



Source: Climate Finance Advisors (2019)

Ongoing assessments are required, just as they are for other risks. Climate risk is not static, and good risk management practices would employ approaches that monitor these risks on an ongoing basis, for time-horizons which are meaningful (short-term, medium-term, and long-term).

The next section provides an overview of key barriers preventing or limiting finance for adaptation and resilience from scaling up, including specifically those focused on the two primary groups of **financial system constituents**.

3 Barriers to scaling up finance for adaptation and resilience by the financial system

A dramatic increase in investment in adaptation and resilience is necessary across the public and private sectors. Debates over the size of the finance gap for addressing resilience in the context of climate change and the proper scope of the public sector's responsibilities for adaptation should not obscure the urgent need for increased investment from both the public and the private sectors. Many steps can be taken to reorient and reallocate both public and private capital flows to adaptation and resilience.

Investment in adaptation to date has achieved limited success and faced many barriers. Most investment decisions today do not consider climate change threats and risk management at the transaction or systemic level. Notwithstanding the gravity of large-scale and long-term systemic threats, most investors still treat these risks as temporally remote, limited, uncertain, and/or unquantifiable at the level of an individual project or asset, and thus discount them. The continued reliance on short time horizons as the basis for financial decisions remains a significant contributor to the failure of policymakers, investors, corporations, and project developers to fully consider and respond to climate risk.⁶²

Even for policymakers, it is challenging to estimate whether proactively addressing adaptation will be more "costly" (ex-ante) given the number of barriers, including the lack of quantifiable (in financial terms) exposure climate change poses to investments, difficulty fusing and interpreting climate data, lack of awareness of the complexity of adaptation, and the absence of measures and standards. This results in inefficient allocation of public capital, and the existence in many places of policies that directly contradict each other (e.g., incentives for fossil production, incentives for renewables).

This section catalogs a wide range of barriers that prevent scaling up of financing for adaptation and resilience, grouped into five types (see Figure 8: Barriers to Scaling Up Financing for Adaptation and Resilience, Separated into Categories): (i) inadequate support for action on adaptation/resilient investment, (ii) policy and practice in the financial industry, (iii) market barriers, (iv) nascent application of climate risk management practices, and (v) low capacity for climate risk management. This taxonomy is meant to facilitate the prioritization and grouping of response measures, many of which are addressed in Section 5, "Recommendations for GCA Actions."

Figure 8: Barriers to Scaling up Financing for Adaptation and Resilience, Separated into Categories.

Barrier Categories	Barriers
Inadequate Support for Action on Adaptation/ Resilient Investment	1 Insufficient public financial support
	2 Insufficient incentives for private finance to act
	3 Moral hazard surrounding physical climate risks
Policy and Practice in the Financial Industry	4 Weak legal/regulatory frameworks and guidance
	5 Lack of meaningful disclosure of climate risks
	6 Absence of harmonized and robust metrics and standards
Market Barriers	7 Perceived lack of profitable investments
	8 Perceived low commercial readiness of adaptation and resilient solutions
Nascent Application of Climate Risk Management Practices	9 Weak management of physical climate risks
	10 Insufficient availability and adoption of climate risks data and tools
Low Capacity for Climate Risk Management	11 Low capacity within Financial System Governance Bodies
	12 Low capacity within financial actors

Source: Climate Finance Advisors (2019)

These barriers are applicable to both **financial system governance bodies** and **financial actors** and align with the six recommendations in this section, as illustrated in Figure 9: Barrier Categories Aligned with Recommendations.

Figure 9: Barrier Categories Aligned with Recommendations

Barrier Categories	Recommendations & Actions					
	1  Accelerate and Promote Climate-Relevant Financial Regulation	2  Develop and Adopt Climate Risk Management Practices	3  Develop and Adopt Adaptation Metrics and Standards	4  Build Capacity Among All Financial Actors	5  Highlight and Promote Investment Opportunities	6  Use Public Institutions to Accelerate Adaptation Investment
Inadequate Support for Action on Adaptation/Resilient Investment						
Policy and Practice in the Financial Industry						
Market Barriers						
Nascent Application of Climate Risk Management Practices						
Low Capacity for Climate Risk Management						

Source: Climate Finance Advisors (2019)

These barriers exist to a greater or lesser extent among countries, financiers, and the wider business community, and their nature is evolving as climate impacts and awareness increase. In some cases, their influence already appears to be declining as impacts from a warmer planet become more obvious. These barriers are nevertheless still significant obstacles to large-scale deployment of financial resources to address adaptation and resilience. Options for addressing these barriers are discussed at the end of this paper.

Barrier Type: Inadequate Support for Action on Adaptation/Resilient Investment

Despite widespread recognition of the urgent need for action on climate change by political leaders in most countries, as well as from various civil society and private sector actors, both the public and private sectors have been reticent to translate this message into a call for investment in adaptation and resilience. One manifestation of this is the omission of adaptation investment in action pledges and letters to political leaders issued by recent coalitions of values-based investors (see Box 3.1: Low Priority of Adaptation and Resilience by Climate Change Investor Coalitions and Activists).

Barrier 1: Insufficient Public Financial Support

Despite the enormous climate-resilient investment need, progress has been slow, not least due to low awareness and prioritization until very recently. As of 2018, only six of the G20 countries had submitted long-term climate change plans to the UNFCCC,⁶³ and the G20 only created a climate adaptation working group for the first time in 2018.⁶⁴ An expansive 2016 study on the state of climate adaptation in U.S. cities found that “practices are piecemeal and fail to comprehensively address climate change and its associated uncertainties. ...[M]uch more work is needed for communities to holistically reduce their vulnerability to climate variability, extreme events, and climate change.”⁶⁵

Box 3.1: Low Priority of Adaptation and Resilience by Climate Change Investor Coalitions and Activists

Investor activism and demands can drive the behavior of asset managers, project developers, corporate executives and boards, and other actors in the financial community. However, as recently as last spring, explicit calls for investment in adaptation and resilience were not as prevalent or widely promoted by investor coalitions demanding action on climate change as their calls for greater acceleration of mitigation investments and the need to transition to a low-carbon economy. Groups such as the Institutional Investors Group on Climate Change (IIGCC), representing around US\$23.5 trillion in assets under management, the Ceres Investor Network on Climate Risk and Sustainability, representing 163 institutional investors with US\$25 trillion in assets under management, and the Global Investor Coalition on Climate Change (GIC) each have strong platforms around the low- or zero-carbon economic transition but give little attention to climate adaptation and resilience. These groups have grown and become more active in recent years, often directly applying pressure to policymakers. In June 2018, at least 319 investors with US\$28 trillion in assets under management called upon the G7 to uphold the Paris Agreement.

Sources: IIGCC website, Ceres Investor Network website, and GIC website

Development finance for climate change is similarly lagging in the mobilization of resources for adaptation. In 2015-2016, only 27 percent of climate finance flows from major OECD donors to developing countries targeted adaptation,⁶⁶ a proportion largely unchanged as of 2016. Even today, despite aiming to deliver a 50:50 balance, pure adaptation projects represent only 23 percent of the Green Climate Fund's project portfolio (compared to 44 percent for mitigation and 33 percent for "cross-cutting").⁶⁷ And while the GCF has sought to assist developing countries with National Adaptation Plans (NAPs) and support for institutional capacity and strategic planning frameworks for adaptation investment projects, this work has proceeded slowly. To be fair, this slow progress partly reflects the need to establish and approve new procedures and financial systems for the management of large amounts of donor funds and should become more rapid and efficient over time.⁶⁸ More broadly, systems for tracking adaptation finance are not well developed: In 2018, the UNFCCC Standing Committee on Finance recommended improved efforts to track adaptation finance and to balance adaptation and mitigation funding flows, though the institutions to execute this mandate are weak or absent.⁶⁹

Public authorities have also neglected to spur private investment by emphasizing opportunities for lending by mandating quotas and carveouts for adaptation within financial institutions. This inaction stands in contrast to proactive efforts by financial authorities to promote investment in clean energy. For example, the Reserve Bank of India and Bangladesh Bank (both central banks) mandate other banks in those countries to invest in renewable energy.^{70,71} Green and infrastructure banks are a growing phenomenon worldwide, focusing heavily on renewable energy and green (low-carbon) infrastructure: the seven-member Green Bank Network, for example, since 2015 "connects leaders in clean energy finance".⁷² While some banks, like the Rhode Island Infrastructure Bank, have a strong resilience orientation⁷³ and many international donors supported the Bangladesh Climate Change Resilience Fund (BCCRF) in the early 2010s,⁷⁴ there are few dedicated green banking institutions for financing adaptation and resilience.

Barrier 2: Insufficient Incentives for Private Finance to Act

Among financial sector actors, investment in adaptation has been hampered by two discrete components of investor inattention: (i) low awareness of the opportunities to invest in adaptation and/or low awareness of the impacts of climate change on investment returns, and (ii) a lack of commitment to direct resources and financial capital into adaptation and resilience, both for the pure business case and as a values issue. Due to the increasing frequency and severity of extreme weather events, awareness of the links between climate change and natural disasters is increasing.⁷⁵ However, awareness of financial risks arising from chronic,

longer-term climate risks and transition risks surrounding emissions-intensive business models remains low. Even where awareness of the risk management imperative is present (the need for negative screening or downside risk protection) there has not been a similar commitment to “positive” investment as there has been for renewable energy by groups such as the RE100,⁷⁶ for the Sustainable Development Goals by many corporates,⁷⁷ and for other environmental and social priorities by responsible investors and public institutions. National and subnational governments with strong credit ratings and the ability to issue general obligation bonds at low cost, and large corporations with long time horizons and balance sheet depth, are well situated to consider adaptation investments. Yet the Climate Bonds Initiative reported in March 2019 that only 10% of sovereign green bonds and 3% of emerging market green bonds go into adaptation and resilience.⁷⁸

Barrier 3: Moral Hazard Surrounding Physical Climate Risks

Moral hazard results from the perception that risks are reduced in part because of financial mechanisms such as insurance or government subsidies. In the context of climate adaptation, moral hazard has two primary manifestations: (i) the principal/agent problem of insurance, and (ii) the expectation that government will rescue those who do not invest in their own protection. The principal/agent problem refers to the split incentive issue inherent to most forms of insurance: Once insurance has been purchased, the incentive to safeguard against hazards within the policy’s scope is weakened. While co-insurance and deductibles (i.e., limitations on the transfer of risk) in theory serve to deter poor asset stewardship by insured entities, in practice, many insurance holders erroneously presume that risk transferred is tantamount to risk mitigated. Some innovative insurance products manage to address these issues (such as the RE.bound Program),⁷⁹ but they have yet to gain widespread use (see Section 4 for further discussion).

The presumption of a government backstop in the case of damaging climate impacts is also a source of moral hazard. One significant barrier to investment in climate adaptation and resilience, not only in OECD countries but also developing countries, is the presumption that the government or aid will provide financial support after disasters, such as extreme storms, floods, and droughts. Government-subsidized insurance in the United States protecting residences from flood damage costs⁸⁰ and farms from crop losses⁸¹ are two well-documented examples of suboptimal outcomes resulting from moral hazard, in some cases amplified by principal/agent problems—those most exposed to the risks have little incentive to address them. These conditions make addressing climate risk—even at the transactional level—more challenging. Taking the example of crop insurance, experts find that moral hazard, together with speculation and unaffordability inherent in the current U.S. marketplace, makes crop insurance an impediment to rather than an enabler of risk mitigation and adaptation.⁸²

Barrier Type: Policy and Practice in the Financial Industry

Formal legal frameworks, informal industry practices and conventions, and the quasi-official voluntary frameworks and standards in between together form an interlocking latticework of guidelines that dictate mores, priorities, practices, terminology, and customs applied in practice. These social and legal structures are also mutually reinforcing, as regulated entities inform and influence the decisions of regulators and rule-makers, while financial actors often take their cues from policymakers and formal rules even for actions extending beyond the letter of the law. At both ends of the spectrum (legal and informal), the guidelines surrounding climate risk and resilience in the financial sector have been weakly established and have achieved limited adoption into practice.

Barrier 4: Weak Legal/Regulatory Frameworks and Guidance

At the system level, financial regulation on climate disclosure and climate risk management has lagged. Even where there is existing regulation, enforcement is often an issue. Financial regulators establish the rules and set the agenda for systemic risk management and compliance, but with few exceptions, they have not made adaptation and resilience investment, physical climate risk management, or risk disclosure central issues of financial management. Financial stability discussions, such as in the Basel Committee on Banking Supervision and among national regulators of major financial economies, have focused heavily on

capital reserve and leverage ratios, derivatives trading, size of financial institutions, and market cycle-related financial stress tests—but not climate risks as yet. Regulatory efforts have been halting and limited in scope or effectively non-binding, though TCFD and NGFS document that this is beginning to change.^{83,84} An example is the 2010 U.S. Securities and Exchange Commission (SEC) guidance for reporting materiality related to climate change. A 2018 review of its implementation noted that weak SEC guidance has led to U.S. corporate disclosures of climate risks that are often generic and dispersed across various filings.⁸⁵ Even France's Article 173, the world's first mandatory disclosure law (see Box 1.1: Financial System Governance—Examples of Action in Practice to Date), has not radically transformed corporate practice. Heralding a step forward, in 2018, the Bank of England's Prudential Regulatory Authority published a consultation paper to begin to shape practices and rules around banks' management and disclosure of climate risk.⁸⁶ Ratings agencies have by and large neglected physical climate risk as a material factor in ratings, though this is changing. The integration of climate resilience into environmental, social, and governance (ESG) disclosures and scores—and thence into corporate filings—is in its early stages, though as investor demand for ESG information continues to rise, increasing numbers of companies are responding even if regulations are still patchy.

Barrier 5: Lack of Meaningful Disclosure of Climate Risks

Companies and other investees are inadequately disclosing the risks they face, both due to information asymmetry and corporate and investor neglect. The lack of disclosure of climate risk to investors is a two-fold problem: the weak impetus for corporations to address climate risk and the absence of regulatory or investor demand to adequately disclose, even when corporations are aware of such risks. In the former case, corporations are shirking their duty to manage a material business risk; in the latter, they are declining to fully disclose material information to shareholders or lenders, leading to information asymmetry between securities issuers and their investors.⁸⁷ These issues are gradually being addressed at the international level by influential but non-binding consensus-building processes with high-level participation from the financial community. Beginning in 2012, the Sustainability Accounting Standards Board (SASB) undertook a process of analyses and consultations on climate risks from an accounting perspective resulting in a 2016 publication.⁸⁸ Subsequently, the G20 Financial Stability Board created the Task Force on Climate-Related Financial Disclosures (TCFD).⁸⁹ In June 2017, the TCFD issued recommendations in four thematic areas: governance, strategy, risk management, and metrics and targets. Status reports issued by the TCFD in September 2018 and June 2019 reviewed business implementation of the disclosure recommendations. TCFD identified enough good examples to conclude that “it is both possible and practical for companies to disclose certain baseline climate-related information today,” and yet such efforts are “still in early stages.” The recent announcement by the UN's Principles for Responsible Investing (UN PRI) that TCFD-compliant disclosures will be required of signatories underscores the essential nature of such disclosures.

Barrier 6: Absence of Harmonized and Robust Metrics and Standards

Standardized climate resilience metrics are necessary to measure the effectiveness of financed activities in building climate resilience and to be formally recognized as such, yet the context-specificity of adaptation brings further challenges to such standardization, not to mention extra costs. Part of the problem is inadequate methodologies and evaluative techniques for all types of investments and asset classes. For example, in 2016, the green bond market was observed to be plagued by a proliferation of taxonomies and lack of standard definitions for both mitigation and adaptation.⁹⁰ This too is changing as methodologies advance for resilience bonds and for climate-proofing of infrastructure, but slowly.⁹¹ Though efforts to create, aggregate, and harmonize metrics and standards have begun, the field is marked by the absence of common terminology, definitions, evaluative metrics, and categories (See earlier sections “Work to Date on Climate Risk in the Financial System” and “Work on Metrics and Standards”).

Barrier Type: Market Barriers

Even when there is an appreciation and awareness of risks, market barriers often present additional barriers to investments in resilience and adaptation. The market perception will often be that because projects to address water management, coastal flooding, and other climate risks respond to public problems, they lack market returns. In reality, public benefits can be combined with private profits, as is the case in many public-private partnerships for infrastructure. Early stage and innovative resilience and adaptation technologies and services also often take time to achieve market acceptance, a problem in the context of the urgency for adaptation measures.

Barrier 7: Perceived Lack of Profitable Investments

Though many adaptation measures are ripe for private investment, some investments in adaptation and resilience are perceived as public goods since the positive externalities (such as revenue, avoided losses, and other social benefits) they generate do not accrue to investors, explaining why so many are left to governments to fund. Governments often struggle to internalize these benefits or align them with private incentives sufficiently to attract investors. Furthermore, many of the most vulnerable countries and markets which are most in need of adaptation and resilience are also the markets perceived to be the riskiest to investors.

Investors and corporates often do not properly capture private benefits from investments in adaptation and resilience due to deficient accounting methodologies, short investor time horizons, and insufficient information about the benefits.⁹² For example, it is usually difficult to incorporate and measure the context-specific and time frame-dependent economic benefits from avoided losses into cost-benefit analyses and discounted cash flow models.⁹³ Benefits of the different types of implemented adaptation projects can be difficult to compare (e.g., nature-based infrastructure or a managed retreat). The general lack of certainty of future climate pathways and model predictions coupled with financial actors' weak understanding of climate models has stymied efforts to express climate change risks in financial terms. While adaptation investment in certain infrastructure projects (such as irrigation and wastewater management) can generate sufficient revenue or savings to make private investment profitable, other projects with weak or absent cash flows, such as sea walls and water utility networks, are unattractive to private enterprise and necessitate general obligation bond finance and budgetary outlays rather than revenue bond finance or privately financed public-private partnerships to establish and operate services in natural monopolies.⁹⁴ There is also a paucity of publicly traded equities and debt for the asset owner or manager seeking adaptation investments as a market segment, such as recognized climate-resilient companies and projects and resilience-oriented green bonds.

Barrier 8: Perceived Low Commercial Readiness of Adaptation and Resilient Solutions

Many adaptation and resilience technologies offer the promise of revenue generation, cost reduction, and efficiency, but often the capital investment required is hard to justify against the marginal increases in profitability. Even as some sectors, such as climate risk data and analytics and climate-smart agriculture, are rapidly evolving into viable markets, other sectors and market niches may lag. In some cases, the risk/reward profile of investments is prohibitive for investors; investment opportunities are too capital-intensive; or the potential to reduce expected losses or value at risk serves as an insufficient impetus to drive investment. In other instances, the lack of awareness of products and services in the marketplace and the lack of capital, human resources, and know-how to reach target markets serve as barriers to market formation and investment. Some of this is attributable to the normal process of market evolution to changing needs and offerings, a process that in the context of adaptation needs to be accelerated.⁹⁵

Barrier Type: Nascent Application of Climate Risk Management Practices

A growing general awareness of climate risks in corporate boardrooms and among asset managers has yet to be translated into operational risk management practices. This is due to several factors, including the need for better decision-relevant tools that are still mostly at an early stage.

Barrier 9: Weak Management of Physical Climate Risks

Insofar as entities have been managing and planning around weather and climate variability—including planning for chronic patterns such as drought or heat—businesses and corporations have been dealing with physical risks for some time. However, it is unclear how much proactive management of potential climate risks is occurring, and consequently how much of those efforts are factoring into investor decisions. For example, a 2018 report based on a survey of publicly owned companies conducted by CDP and the Climate Disclosure Standards Board (CDSB) found that 83 percent of surveyed companies “recognize physical risks” but fail to act on this awareness in operations.⁹⁶ Progress is similarly slow among investors of all types, even the largest institutional investors. Further, a 2018 study in *Nature* has shown that many corporates’ adaptation strategies have “significant blind spots,” not only in their assessments of the potential for climate-related impacts, but also their proposed strategies to manage such risks.⁹⁷ Climate adaptation and resilience is seen as a loss avoidance issue rather than a business or investment opportunity.

Barrier 10: Insufficient Availability and Adoption of Climate Risk Data and Tools

Investors and asset managers need quantitative data and tools to help them make informed decisions on climate risk. While there is a fledgling climate data industry (see Box 3.2: Emerging industry of Climate Data and Analytics), an important driver of investor inaction is the general lack of quantitative and decision-relevant tools to incorporate climate risk into investment selection and portfolio management, particularly for future risks not yet manifest in the present. The NGFS noted in October 2018 that climate risk tools, methodologies, taxonomies, and definitions are all in a nascent state.⁹⁸ Despite the profusion of climate change-related scientific data available both in the public domain and for purchase, much of it is not organized, quantified, analyzed, or presented in a manner that is readily interpreted and made decision-relevant to financial institutions. Data on risk and resilience needs to be consistent and available in terms that are relevant for financial decision making, including in terms of financial costs and opportunities. As a result, many investors and financial decision makers fail to incorporate climate risk as a component of overall risk management practices, notwithstanding that climate risks is beginning to be considered as part of overall sustainability practices.

Box 3.2: Emerging Industry of Climate Data and Analytics

Notwithstanding the lack of widespread adoption of climate risk data and tools, there is a lot of activity in this emerging sector. Entities are emerging that track hazard-specific climate risks (e.g., Coastal Risk Consulting), track macro-economic impacts from climate change (e.g., NDGain, Carbone 4), provide tools that translate climate risks into financial indicators for different types of investors (e.g., Four Twenty Seven, Acclimatise, Jupiter, The Climate Service, Ortec Finance, Carbon Delta), and provide rating systems for climate risk related to development and infrastructure (e.g., the World Bank Climate Risk Rating Tool - still under development).

Source: Climate Finance Advisors (2019)

This problem is further compounded by an absence of common metrics and standards, which results in inconsistent practices in the choice of scenarios and other key assumptions.⁹⁹ These issues are exemplified in two reports published by UNEP FI (“Extending Our Horizons” and “Navigating a New Climate”) on transition and physical climate risk: almost every bank case study incorporating transition climate risk into its operations utilized different methodologies, and sector-specific physical risk methodologies were developed by the participating banks to reflect the differences in vulnerability to climate change impacts across sectors. A 2016 EY survey of leading asset managers found a distinct paucity of in-house expertise to integrate climate risk in financial strategies.¹⁰⁰ The lack of tools is rapidly shifting from a problem of fact to a problem of perception: Increasingly sophisticated climate risk tools are emerging in the marketplace, though their uptake remains slow.¹⁰¹ As noted above, a growing number of data analytics, engineering, and risk assessment consultancies and firms are now offering sophisticated risk assessment services for corporations, investors, asset managers, and project developers. Published guides have emerged in the past two years on mitigating climate risk in finance¹⁰², including specifically for institutional investors¹⁰³ and for infrastructure investors¹⁰⁴, and on TCFD disclosures of physical risks for both public companies in general¹⁰⁵ and financial institutions in particular.¹⁰⁶

Barrier Type: Low Capacity for Climate Risk Management

Institutional and human capacity to engage in climate risk management across the spectrum of financial actors acts as a headwind, stymieing progress and delaying the vigorous and effective adoption of solutions to all the aforementioned barriers.

Barrier 11: Low Capacity within Financial System Governance Bodies

Understanding climate risks at the level necessary for financial decision making requires expertise typically lacking in financial regulatory agencies and financial institutions, both because the issue is relatively new, but also because—as already discussed—the issues involve a complex mix of science, economics, management, and policy. Even within advanced economies, this capacity has come only recently, is not fully developed, and often has yet to be fully integrated with more established risk management functions. Agencies have sometimes expressed awareness and even announced initial steps, only to stop at the point when more detailed action toward risk management is required.¹⁰⁷ Some developing countries facing the greatest and most imminent climate risks may be leaders in this respect, having already adopted policies to provide concessional terms for climate-related lending and consideration of climate change in the management of their pension funds.

Barrier 12: Low Capacity within Financial Actors

Full, robust integration of climate risk into financial institutions and prioritization of adaptation investment is difficult. One response is the Climate Action in Financial Institutions Initiative, founded in 2015, which seeks to mainstream both climate risk and investment opportunities within financial institutions “to make climate change considerations a core component of how financial institutions conduct business.”¹⁰⁸ The initiative emphasizes the fundamental shift required in how capital is deployed. This shift is a transformation of business models and requires new staff and management capabilities for climate risk management, including expertise in sectoral and domain-specific issues, deal sourcing, portfolio management, and monitoring and evaluation. The World Bank Group’s Action Plan on Climate Change Adaptation and Resilience, released in December 2018, illustrates the scale of management commitment and resource mobilization required to seize the opportunity (see Box 3.3: The World Bank Group’s Action Plan on Climate Change Adaptation and Resilience: Managing Risks for a more Resilient Future (2019))¹⁰⁹. Even the most sophisticated development finance institutions and multinational banks lack sufficient capacity to address these issues, which in turn exacerbates the other barriers; other institutions lag far behind.

Box 3.3: The World Bank Group's Action Plan on Climate Change Adaptation and Resilience: Managing Risks for a more Resilient Future (2019)

The Action Plan is designed to increase the World Bank Group's level of ambition and commitments on climate change adaptation and resilience. It has three core objectives:

1. **Boost adaptation financing.** The WBG will ramp up its direct adaptation climate finance to reach US\$50 billion over FY21-25. This financing level—an average of US\$10 billion a year—is more than double what was achieved during FY15-18. The WBG will also pilot new approaches to scale up private finance for adaptation and resilience.
2. **Drive a mainstreamed, whole-of-government programmatic approach.** The WBG intends to help countries shift from addressing adaptation as an incremental cost and isolated investment to systematically managing and incorporating climate risks and opportunities at every phase of policy planning, investment design, implementation, and evaluation.
3. **Develop a new rating system to create incentives for, and improve the tracking of, global progress on adaptation and resilience:** A new rating system will be developed to promote public and private sector investments in adaptation. It will be designed to create incentives for donors and countries to engage in more and better adaptation; more effectively report on what the WBG and clients are doing; and aims to establish a global standard for financial markets and public procurement. The new system will be piloted over FY19-20 with an anticipated rollout to projects in relevant sectors by FY21.

Source: World Bank Group (2019)

4 Examples of current approaches for increasing adaptation financing

Before concluding with recommendations for addressing the identified barriers, this paper will briefly review the range of instruments for adaptation financing, including some that are relatively new and innovative. While far from comprehensive, this section highlights the potential for financial instruments to become part of the solution to the adaptation financing gap while also generating sizable investment opportunities, and also provides the basis for one of the recommendations. Notwithstanding the barriers reviewed in the last section, **investing in adaptation, resilience and in making investments resilient is perhaps the biggest investment opportunity for this generation.** As previous sections have discussed, addressing physical climate risks by both the **financial sector governance bodies** and **financial actors** is challenging but imperative. Yet, far more emphasis has so far been given to investment opportunities related to mitigation and low-carbon investments.

The adaptation financing gap is large and increasing as climate impacts grow and barriers persist, particularly in markets and communities that are highly vulnerable and which have weaker investment climates and governments. Fully aligning financial markets with the 2015 Paris Agreement will require that **financial system governance bodies** and financial actors—including all private investors—give climate resilience the same level of ambition as emissions reductions. The active engagement of all **financial system constituents** is necessary, not simply donors or specialized climate finance vehicles (which are important but not in themselves enough). Consideration of the impacts of climate change must be mainstreamed into the financial system, including into the supply of both public and private sources. Private investment in adaptation is growing, but not nearly rapidly enough due to multiple barriers, including lack of awareness, difficulty quantifying impacts in financial terms, weak governance and policy frameworks, and lack of capacity.

The “adaptation financing gap” is a challenge. However, it is also an opportunity for innovation around financial products, sharing and managing risks, and becoming more efficient in leveraging public balance sheets and capital to accelerate investments in all asset classes, sectors, and countries, regions and communities, particularly those that are highly vulnerable to impacts from climate change.

To fully address the financing adaptation and resilience gap, discrete and innovative financial mechanisms are necessary to accelerate the pace of investment in adaptation and resilience. However, even if substantially expanded, it is doubtful that innovative financial instruments and dedicated initiatives for financing adaptation and resilience alone can fully address the enormity of the adaptation funding gap. Some of the broader requirements for **financial system governance bodies** and financial actors to fully engage in addressing adaptation needs (or “mainstream climate considerations”)—such as employing climate risk management practices, improving analytical methods for evaluating the financial implications of climate risks, removing policy barriers, and enhancing inadequate human and institutional capacity—are addressed in the final section, “Recommendations for GCA Actions.” The following provides an overview of a select number of innovative approaches that are emerging for catalyzing and mobilizing finance for adaptation.

Blended Finance for Adaptation: Using Public Funds to Catalyze Private Investment

The development finance community has recognized that to meet the investment needs related to climate change and other Sustainable Development Goals, the discussion needs to evolve from “billions” for development to “trillions” in investments of all kinds—public and private, national and international—and to building capacity across all institutions.¹¹⁰ Blended finance is the use of catalytic capital from public or philanthropic sources to increase private sector investment in developing countries and sustainable development. **Blended finance is a structuring approach** that allows different types of capital (whether public, impact, or commercially oriented), to invest alongside each other while each achieves its own objectives (financial, development, or social impacts, or a blend).¹¹¹ Blended finance structures are observed across a broad range of transaction types, including funds, facilities, bonds, notes, projects, and companies. Public or patient capital in blended finance applications is primarily used to take higher risks in projects (e.g., through “first loss” or repayment guarantees), which helps to “crowd-in” private capital. Blended finance structures are typically used in circumstances where there are perceived or real risks by private investors, and where public capital can take more risk (without the commensurate return expectations) to catalyze investments faster than would otherwise happen.

Box 4.1: Using Blended Finance for Adaptation: the Nepal Hydropower Project

Most discussion of blended finance has focused on its use for mitigation. However, there is a long history of blending public and private finance for large infrastructure projects and increasing recognition that incorporating climate resilience features in the design and construction stage is both more effective and cheaper over the life of the project (versus incurring the costs of impacts not adequately planned or designed for), despite the requirement for some additional up-front analysis and climate modeling. There have also been a few examples demonstrating the potential for using concessional climate funds to enable finance on commercial terms. One such project focused on strengthening vulnerable hydropower facilities in Nepal, one component in the program “Building Climate Resilient Communities through Private Sector Participation” funded by the Pilot Program for Climate Resilience (PPCR). A US\$2.1 million PPCR grant enabled a US\$6.6 million loan from the IFC. This work was the foundation for the IFC Hydropower Environmental Impact Assessment Manual, prepared in cooperation with the Government of Nepal and released in September 2018.

Sources: International Finance Corporation (2018), Climate Policy Initiative (2013), Acclimatise (2016)

Early examples of blended finance approaches were primarily for climate-related investments, including efforts by IFC and others to use climate finance sources (e.g., Global Environment Facility, Climate Investment Funds) to provide concessions (through price, structure, tenor, rank, or a combination) to entice private investments in renewable energy, energy efficiency, and other mitigation investments in emerging markets.¹¹² Today, all the MDBs employ blended finance approaches, and numerous blended finance funds, facilities, and instruments exist for climate-related investment across all markets and regions, including green banks/banking approaches and guarantee and first loss mechanisms for financial institutions to move into climate-related investments (See Box 4.1: Using Blended Finance for Adaptation: The Nepal Hydropower Project for an example). The ultimate goal of the blended finance approach is to increase the amount of capital directed toward socially important investments. Adaptation is one such area where blended finance approaches are critical.

Development banks are central contributors to scaling up the blended finance market through their risk capital, capacity for due diligence, and relationships with the investment community. Public funds available on concessional terms will always be limited and a relatively small fraction of total investment (although much more important in poor countries). Consequently, to have a meaningful impact at scale, public finance must be deployed strategically to leverage private investment and to unlock those markets perceived as immature or risky for mainstream and commercial investors.

The MDBs are also cognizant of the importance of their role in leveraging private sector finance to meet the objectives of the Paris Agreement. In 2018, the MDBs crowded in US\$28.2 billion in private financing for climate change, up 29 percent from 2017.¹¹³ In December 2018, the MDBs collectively announced ambitious targets for increasing their climate change financing, the share of climate financing going to adaptation, and the resultant leverage from their climate lending.¹¹⁴

Social, Green, or Resilience Bonds to Promote Investment in Adaptation

Another approach to mobilizing greater private capital for adaptation projects is through new financial instruments. A plethora of new instruments have emerged, of which we cite only a few prominent examples here:

- **Social impact bonds (SIBs)** and other sustainability-linked debt products can provide a lower lending rate or pricing reward for sustainability or ESG performance. This category of debt finance could be a basis for promoting investments in resilience and adaptation.
- **Green bonds:** The market for green bonds has been growing and in 2018 topped US\$167 billion from 44 countries, over half from corporate issuers led by the U.S. and China.¹¹⁵ To date, such bonds have typically not offered a lower cost benefit, but this may come as climate risks come to be better known and quantified. A few central banks, regulators, and local authorities have introduced incentives for banks to increase green lending and for lenders to issue green bonds.¹¹⁶
- **Resilience bonds:** Resilience bonds quantify and protect against climate risks and in the process can lower the cost of financing infrastructure potentially at risk.¹¹⁷ Some bonds are already addressing adaptation needs. For example, the District of Columbia Water Environmental Impact Bond, issued in 2017, was developed not only to fund an innovative system for managing stormwater runoff that mimics natural processes, but also to integrate novel performance-based terms that reduce interest paid to bondholders if stormwater management attains certain thresholds of success. The issue has become more urgent with the increased frequency of heavy rainfall events due to climate change, which exacerbates stormwater runoff.¹¹⁸

CAT Bonds and Other Innovative Insurance Products

Growing awareness of the magnitude of climate risks has led to efforts to create innovative insurance products to reduce financial vulnerability and enhance resilience post-disaster recovery.¹¹⁹ It is important to emphasize that insurance products transfer risk to parties willing to bear it rather than reduce risk, thus they do not constitute a freestanding, comprehensive solution to physical climate vulnerability. Such initiatives are indicative of a growing level of awareness around risks resulting from climate change, and the ability to provide financial risk transfer as one (financial) option for managing the downsides of climate-related risks. Some examples include:

- **Catastrophe bonds:** Global issuance of catastrophe or “cat” bonds now exceeds US\$11 billion annually, and the demand for such bonds has continued to be robust despite record losses in 2017, suggesting that, at least for now, this product can be a useful risk transfer mechanism for investments exposed to some measure of climate risks.¹²⁰
- **Index insurance:** Index insurance schemes linking payments to extreme weather events were initially conceived as a means to provide more efficient and effective disaster relief, but the reduction in risks can also improve credit ratings and the credit worthiness of the insured and thus serve to support private investment.¹²¹ The CCRIF and ARC programs

(Box 4.2: CCRIF & ARC: Examples of Risk Transfer Mechanisms) are prime examples.¹²² Payments are triggered by weather-related disasters such as droughts or floods. At a smaller scale, index insurance programs for small farmers also trigger payment based on weather parameters.¹²³ The farmers become more credit worthy when less subject to losses from weather events, facilitating borrowing for improved seeds, fertilizers, and other measures to increase productivity and enhance resilience to climate change.¹²⁴

Box 4.2: CCRIF & ARC: Examples of Risk Transfer Mechanisms

In 2007, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) was formed as the first multi-country risk pool and the first insurance instrument to successfully develop parametric policies backed by both traditional and capital markets. It was designed as a regional catastrophe fund for Caribbean governments to limit the financial impact of devastating hurricanes and earthquakes by quickly providing financial liquidity when a policy is triggered. CCRIF has successfully provided Caribbean and Central American governments short-term liquidity following natural disasters, easing the financial losses during extreme events. However, it does not incentivize fully good climate-risk management ex ante and does not currently link to a country's efforts to build resilience prior to disasters or risks manifesting.

The African Risk Capacity (ARC) is a specialized agency of the African Union established to help African governments improve their capacities to better plan, prepare, and respond to extreme weather events and natural disasters. Through collaboration and innovative finance, ARC enables countries to strengthen their disaster risk management systems and access rapid and predictable financing when disaster strikes to protect the food security and livelihoods of their vulnerable populations. Like CCRIF, ARC provides a parametric insurance product, but also provides ARC member states with capacity-building services and access to state-of-the-art early warning technology and contingency planning to help enable ex-ante risk management. Payments are made for pre-approved disaster relief measures implemented by participating governments.

Sources: ARC website and CCRIF website

There is increasing interest in the design of insurance instruments that contribute to climate resilience. For example, a recent collaboration between Swiss Re, the Nature Conservancy, and a state government in Mexico includes a parametric insurance policy that encourages conservation and helps cover the cost of restoring a coral reef after hurricanes, in turn safeguarding the reef's capacity to protect the coast from future storms and beach erosion.¹²⁵ Funds to pay for conservation activities, as well as insurance premiums, will be collected by the government through several sources, including taxes on tourism. By combining private capital with public resources in a trust to fund premiums, vulnerable communities are assisted to proactively protect important natural resources indispensable to the resilience of both the assets and the local economy. Such insurance instruments can provide both public and private benefits: reducing and transferring risk away from vulnerable local parties, as well as providing environmental benefits.¹²⁶

Much as credit rating agencies' incorporation of climate risk will align borrowers' and lenders' incentives, as insurance companies and insurers come to better understand physical risks and effective resilience measures, opportunities will emerge for win-win resilience measures to reduce both residual climate risk (to the insurer) and premiums (to the insured). Proactive insurance companies could begin to offer premium discounts for resilience, such as reduced premiums for elevated buildings in flood-prone areas. Ancillary advisory services to assist borrowers and insurers to lower their borrowing costs and insurance premiums could complement the issuance of insurance policies or loans to expand access to credit and insurance into new markets and market niches, or maintain its affordability where it is currently subsidized by governments or becoming prohibitively expensive (e.g., mortgages and flood insurance in coastal areas vulnerable to sea level rise and storm surge).

Dedicated Investment Vehicles

As discussed above, the analysis of climate risks is generating interest in products and services that can enhance resilience and reduce risks. This presents a new set of business and investment opportunities. Recognition that this new market has the potential for good commercial returns is the basis for some emerging funds and financing vehicles dedicated to adaptation investment, including:

- **CRAFT:** The Climate Resilience and Adaptation Finance & Technology Transfer Facility (CRAFT) is envisioned to be a US\$500 million private equity fund with a complementary US\$20 million technical assistance facility. The fund will invest in growth capital in private companies that offer climate resilience solutions, while the TA facility will provide technical support to enable market entry, initial application, and capacity building for use of climate resilience solutions in developing countries. Initial funding for CRAFT was provided by donors with an interest in promoting products that serve the poorest countries.¹²⁷ CRAFT aims to invest in 10 to 20 companies, located in both developed and developing countries, which have proven technologies and solutions for climate resilience and are expected to be profitable. Potential businesses include weather analytics, catastrophe risk modeling services, and drought resilient seed companies.¹²⁸
- **ARAF:** The Acumen Africa Resilient Agriculture Fund (ARAF), a project approved by the GCF in March 2018, aims to improve climate resilience and ensure long-term sustainable increases in agricultural productivity and incomes. ARAF will support investments in micro, small, and medium enterprises (MSMEs) by financing aggregator and digital platform services. ARAF also will provide innovative financial services to smallholder farmers to improve their resilience to climate impacts by shifting investment in climate adaptation from grants to long-term capital. The GCF is providing US\$26 million (US\$23 million as equity, US\$3 million as a grant) out of a total US\$56 million investment.¹²⁹

Box 4.3: Adaptation Opportunities: Not All Depend on Large Investments

The identification of risks can be a pathway to adaptation opportunities, and while investment will often be necessary, the major barriers are not always financial. A good example is the critical need for modernization of weather and climate information services in many developing countries, without which effective emergency warnings are impossible, farmers cannot be informed of climate changes critical for their planting and harvesting, and many weather-sensitive businesses will operate inefficiently. Substantial donor funding has supported improving these services but with mixed results due to a combination of low capacity, inadequate institutions, and an inability to maintain systems over time. The World Meteorological Organization and other international organizations increasingly see a promising response to this challenge in the form of public-private partnerships and new business models based on revenue sharing between public agencies and private weather vendors. While this approach is designed to attract investment and achieve financial sustainability for resilience-enhancing activities, the initial challenge is primarily to build capacity, introduce new business models, and support pilots with the expectation that successful demonstrations will bring about the necessary commercial interest and financing.

Sources:

IPCC, 2018. Special Report: Global Warming of 1.5oC

UNDP, 2016. A New Vision for Weather and Climate Services in Africa

Usher J., Phiri C., Linacre N, O’Sullivan R, & Qadir U., 2018. Climate Information Services Market Assessment and Business Model Review, USAID-supported Assessing Sustainability

WMO, 2018. World Meteorological Organization, 2018b: Resolution 12.2/1 (EC-70) Public-Private Engagement, with Annex 1: Policy Framework for Public-Private Engagement and Effectiveness of Climate Information Services in Africa project

Prizes and Competitions

Another potential innovative financing approach is funding for prizes and competitions to attract interest in new approaches to addressing adaptation challenges. Prizes have been used to attract interest in many environmental endeavors, including one for removal of greenhouse gases from the atmosphere,¹³⁰ and there may be similar opportunities to encourage innovative approaches to enhancing resilience and promoting adaptation. One example is the Global Cooling Prize, a competition to develop a climate-friendly residential cooling solution that can provide access to cooling to people around the world without warming the planet.¹³¹

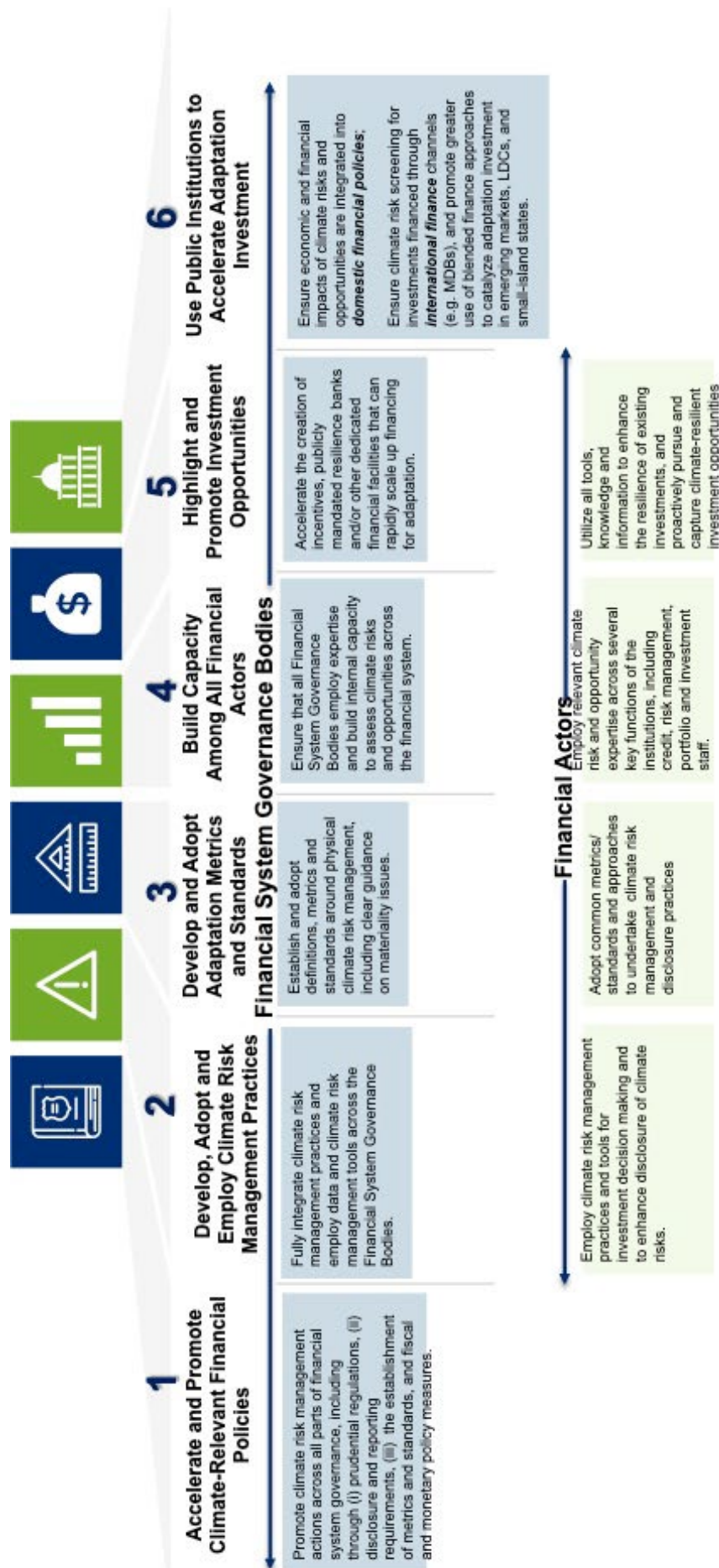
5 Recommendations for GCA actions¹³²

This paper has taken a primary look at the key question: **How can we adjust financial flows so that community, country, and global adaptation goals are met.** In unpacking this question, this paper has primarily focused on elements that need to be understood to promote systemic change in the economic and financial system to embed risk and resilience into decision making as a necessary condition for mobilizing financing at scale for climate resilience and adaptation investment.

In this section, we outline **six recommendations that collectively would promote systemic change in the financial system, with a primary focus on actions and activities that can give sufficient balance to adaptation and resilience investment to complement ongoing efforts to scale up mitigation investments.** Each recommendation includes specific examples to illustrate how it can be accomplished. Each also includes actions applicable to the **financial system governance bodies**, and four include actions also applicable to **financial actors** themselves, including financial institutions of all types. Figure 9 illustrates the recommendations and applicable actions to the **financial system constituents.**

These recommendations are meant to be both actionable and ambitious and can directly impact how finance can be unlocked for adaptation and resilience. In addition, all recommendations can be implemented and scaled up quickly with sufficient leadership, coordination and political will within the next [one to two] years, although the process of developing and implementing capacity building will require continuing and ongoing efforts over time. **Given the increasing urgency associated with climate risks, and the potential that climate changes will occur more rapidly and with greater impact than was thought only a few years ago, there is no time to lose.**

Figure 10: Illustrative Actions for Financial System Constituents Broken Down by Recommendation.



Source: Climate Finance Advisors (2019)

RECOMMENDATION 1:

Accelerate and Promote Climate-Relevant Financial Policies

The GCA should highlight the need for central banks and financial regulators to recognize and respond to climate risks by using their authorities to enact smart financial policy, regulations, guidance, and enabling measures.

Policies

Given the systemic nature of climate risks, central banks and financial regulators need to be actively involved in the identification and management of climate risks. Financial system governance bodies¹³³ can each play a key role in ensuring that climate considerations—including risks posed by physical impacts from climate change—are addressed in policies, regulations, and enabling measures that guide financial actors across the financial system. To date, some **financial system governance bodies** have shown leadership through early efforts to identify and better understand climate risks to financial systems, although a preponderance of these efforts focus on carbon emissions reductions or transition risks arising from transitioning to a low-carbon or net-zero-carbon economy. Few have focused on risks posed by already-locked-in warming and the physical impacts of climate change, much less the potential for capital flight or shifts away from vulnerable communities and countries, which will result in greater pressures on public capital and balance sheets.

Progress is beginning, though. Through both the NGFS and the EU Technical Expert Group on Sustainable Finance, detailed technical work is ongoing to develop taxonomies and provide frameworks for financial policy and regulation (e.g., assessing climate risk in micro-supervision, integrating sustainability and climate risks into momentary policy frameworks, endorsing mandatory disclosure).¹³⁴ Further, some central banks in developing countries have already gone further toward “greening” their financial systems through green finance guidelines with potential for application to climate risks.¹³⁵ The measures, policies, and regulations developed by these initiatives will need to be implemented in order to drive change in the financial system in meaningful ways. Such measures will vary across nations, reflecting differences in the structure of financial oversight and regulation.

The following actions illustrate efforts that **financial system governance bodies** (consistent with differing authorities and responsibilities) can make to integrate climate considerations into the financial system:¹³⁶

Financial System Governance Area	Illustrative Actions
Prudential and financial policy	To enhance the role of risk management and risk mitigation in the financial system, financial system governance bodies can: ■ Develop and adopt climate risk integration frameworks and action plans, as recommended by the NGFS, including setting supervisory expectations and promoting transparency among both supervisors and supervised institutions; ■ Integrate physical climate risk considerations more thoroughly into stress-testing approaches for regulated financial institutions, grounding those approaches on scenarios that build off expected warming and not off international commitments. ■ For micro-supervision, undertake a comprehensive mapping of transition and physical climate risk transmission channels in order to more fully assess and understand the impacts of climate risk on the financial system. ■ Monitor and analyze NBFIs and identify those institutions which have concentrated portfolios with potentially high exposure to climate risks and which may pose contagion risks to other parts of the financial system. ■ Undertake climate risk screening of public investment programs and integrate into procurement standards for publicly financed projects (both purely publicly financed and PPPs). ■ Ensure the costs of climate risks are integrated into disaster risk management funding approaches, and develop approaches for fiscal risk management and contingency finance.
Disclosure and reporting	To enhance the transparency of information about climate risks for investors, financial system governance bodies should: ■ Make climate-related financial disclosures a mandatory requirement, including those related to potential risks from physical impacts (both acute and chronic) to assets (both financial and real) that financial actors have a stake in. ■ Ensure robust and internationally consistent climate-related disclosure frameworks are in place, establishing TCFD frameworks as the initial basis for mandatory disclosure. ■ Designate climate risk as a material risk. ■ Require disclosures be presented in terms of financial value at risk over several time horizons, including the holding life of the investment for the firm and asset life. Firms should also be required to disclose actions taken to enhance their resilience, invest in adaptation, or make resilient investments.
Standard setting	To provide guidance for entities disclosing or assessing climate risks for investors, financial system governance bodies should: ■ Adopt and promote coherent and consistent climate risk guidelines for disclosure of both physical risks and transition risks, and require disclosing entities to report on these metrics. ■ Require rating agencies—a key provider of risk information for investors—to employ climate risk ratings aligned with best available assessments, ensuring assessments are grounded in methodologies that account for expected warming based on current trends, not international commitments.
Fiscal and monetary policy	Monetary policy is the practice of identifying the nature, persistence, and magnitude of shocks to the economy. In this regard, financial system governance bodies can: ■ Undertake economy-wide, sector-wide, and/or regional assessments of the impacts of physical climate risks—both acute and chronic—to overall economic growth and stability. ■ Promote safety nets and financial support mechanisms for communities most vulnerable to physical climate risks, where the potential for capital flight may become an issue exacerbated by climate change. ■ Where feasible, incorporate findings from economy-wide, sector-wide, and/or regional assessments of the impacts of physical climate risks into long-term economic strategies: □ Promote initiatives, programs, or financial policy approaches that can incentivize climate-resilience and/or adaptation investments particularly for key sectors such as infrastructure; □ Develop contingency funding plans to prepare for the increased frequency of climate-related shocks to the economy, and □ Actively remove regulations which incentivize maladaptation investments.

RECOMMENDATION 2:

Develop, Adopt, and Employ Climate Risk Management Practices

GCA should highlight, promote, and incentivize the development and wide-scale application of climate risk management practices and tools, including robust scenario analysis for all financial system constituents.

Practices

Understanding and internalizing climate risk into financial decision-making is essential for both (i) reducing exposure of investments to adverse climate impacts, and (ii) identifying opportunities to invest in resilience and align the financial system toward climate-resilient investments. While the work of the TCFD and others on disclosure, metrics, standards, and governance has created significant momentum, additional parallel efforts are urgently needed to begin to fully develop and integrate climate risk management practices throughout the financial system, including with **financial system governance bodies** and **financial actors** of all types (e.g., commercial banks, development finance institutions, infrastructure banks, asset managers, asset owners, insurance companies).

Data on risk and resilience needs to be consistent and available in terms that are relevant for financial decision making, including in terms of financial costs and opportunities. Effective integration of climate risk management practices will require the adoption of standard definitions, metrics, and methodologies, particularly regarding the use of scenarios and stress-testing approaches. In order to fully understand adaptation and resilience requirements, climate risk management practices for all **financial system constituents** must be grounded in existing warming trends, as opposed to expectations based only on international agreements yet to be realized. A climate risk scenario based on the Paris Agreement ambition to limit warming to less than 2°C could significantly underprepare an institution or the financial system for climate change impacts.

The policies, processes, and procedures of climate risk management are critical for both **financial system governance bodies** and financial actors. Integrating climate change considerations into risk management practices will likely require employing data tools and/or analytics to help assess and quantify risks, as well as employing scenario planning and stress-testing approaches to understand the full range of management options and strategies. The following actions illustrate efforts that **financial system governance bodies** and financial actors can make to develop, adopt, and employ climate risk management practices at the transaction and portfolio levels:

Financial System Constituents	Illustrative Actions
Financial system governance bodies	Financial system governance bodies need to develop, adopt, and employ their own climate risk management practices. Financial system governance bodies should: ■ Employ and adopt a climate risk management approach at the level of governance of the financial system. ■ Identify and employ the tools, data, and analytics appropriate to understand and assess information presented by financial actors (through stress tests, disclosure, market insights, and other means). Ensure stress tests for physical climate risks are grounded in scenarios based on expected warming trends, not international agreements, to ensure accurate and timely understanding of climate risks ■ Engage insurance companies to integrate into products incentives for ex-ante resiliency measures and investments. ■ Integrate climate considerations fully informed by climate risk analyses (both physical and transition) into relevant areas of financial governance, including regulation, standards setting, incentives, and monetary policy.
Financial actors	Financial actors of all types need to accelerate the adoptions and employment of climate risk management practices. Financial actors should: ■ Fully integrate climate considerations into existing risk and/or credit management practices, including:¹³⁷ □ Identifying climate-related hazards to investments, □ Assessing the vulnerability (including financial) of those assets, and □ Quantifying that vulnerability into meaningful financial value at risk over relevant time horizons. ■ Employ tools, data, and analytics to fully understand the financial impacts of climate risk at the transaction and portfolio levels for the institution. Undertake stress tests as part of overall risk management practices, and ensure stress tests are grounded in scenarios based on expected warming trends, not international agreements. ■ Integrate climate considerations fully informed by climate risk disclosure and analyses into the institutions' strategies and governance, addressing both climate risks and opportunities to become more resilient.

RECOMMENDATION 3:

Develop and Adopt Adaptation Metrics and Standards

The GCA should urge accelerated efforts by all financial system constituents to adopt an initial set of climate adaptation metrics and standards no later than January 2020.

Metrics and standards for adaptation, physical climate risks, and resilience are actively being developed and created by several important initiatives including for example EBRD's work to develop common adaptation metrics and methodologies,¹³⁸ the metrics for assessing transition risk of Banks by Portfolio Carbon Initiative,¹³⁹ and work by the Climate Bonds Initiative to develop adaptation definition for green bonds.¹⁴⁰ As noted in the 2018 TCFD Status Report,¹⁴¹ there was significant confusion around even basic terms for disclosure (e.g., what constitutes an "adaptation investment" or an "investment in resilience or an investment which is climate resilient"), as well as more complex systems for hazard classification, ratings, and scoring. Such standardization of metrics remains a challenge, according to the 2019 TCFD Status Report.¹⁴² Pilot programs and other early experiences should allow for the continued development of guidelines and ultimately lead to standardization of terms and methodologies.

The creation of commonly agreed standards for defining an adaptation or resilience investment is complicated by several questions that are critically important for market adoption. These concerns include:

- **A need for clarity around hazards linked to physical climate risk exposure**, including a taxonomy that users can employ as relevant for specific assets, given that climate-related hazards vary by location, assets, level of vulnerability, and exposure.
- **A need for clarifications around the magnitude or robustness of a "resilience/resilient" or "adaptation" investment**, including how extensive "resilience" or "adaptation" needs to be for investments to qualify as resilience or as a resilient investment.
- **Maladaptation spillover effects and tradeoffs**, including whether and how some adaptation or resilience/resilient investments may lead to increased risk of adverse climate-related outcomes, or even potentially increase vulnerability in other areas (e.g., coastal barriers which shift flooding risk to other locations).¹⁴³

The absence of commonly accepted and applied metrics, standards, and methodologies for identifying and evaluating climate risks remains a significant barrier to investor awareness and response, and, of course, to the ability of **financial system governance bodies** to adequately assess the overall risks and opportunities for the financial system at large. In the short term, because climate risk assessments of physical hazards are very localized and context specific, it may only be possible to produce standardized guidelines or principles. However, risk screening tools are evolving rapidly which can be useful not only for climate risk assessments, but also for bringing some standardization to definitions, metrics, and standards. Several of these initiatives link with the work of **financial system governance bodies** and development finance institutions, consistent with the common interest of these stakeholders in promoting sustainability. Speed is also a necessity. Prior efforts to build consensus around mitigation metrics and standards for investments evolved over a decade or more, a time frame that is unacceptably long given the urgency needed for financing adaptation and resilience. The following actions illustrate efforts that **financial system governance bodies** and financial actors can make to develop and adopt adaptation metrics and standards:

Financial System Constituents	Illustrative Actions
Financial system governance bodies	Financial system governance bodies need to promote the development and adoption of adaptation metrics and standards, including: ■ Developing and employing resilience rating systems which can provide important market signals about climate risks. ■ Building off the TCFD industry-developed guidance, adopting and continuously improving common language, definitions, and classifications of hazards for physical climate risk assessment, management, and disclosure requirements. ■ Employing classification of hazards for physical climate risks into climate risk analyses (both physical and transition) into relevant areas of financial governance, including regulation, standards setting, incentives, and monetary policy. ■ Supporting ongoing efforts by international actors (MDBs, NGFS, and others) to define and describe measures of climate resilience in investments, particularly based on evolving understanding of warming trends and resulting adaptation/resilience investments needs. ■ Regularly integrating enhanced understanding of climate resilience in all investments via the employment of climate scenarios used for stress testing at the level of the financial system and regulated entities.¹⁴⁴
Financial actors	Financial actors need to develop and adopt adaptation metrics and standards, including: ■ Adopting the common language, definitions, and classifications of hazards for physical climate risk assessment provided by TCFD and SASB, and employing such definitions, classifications, and metrics in the management (and disclosure) of climate-related risks, with regular updates as these standards improve. ■ Utilizing the TCFD framework to undertake increasingly rigorous climate risk assessments, and employing climate risk management practices across transactions and portfolios. ■ Engaging in ongoing efforts to define and describe measures for scoring climate resilience in all investments, particularly based on evolving understanding of warming trends and resulting adaptation/resilience investments needs.

RECOMMENDATION 4:

Build Capacity Among All Financial Actors

The GCA should highlight the fundamental need to build human and institutional capacity in climate resilience (risk management and investment) across all financial system constituents.

The importance of raising the level of awareness and understanding of climate change and building capacity to address climate change cannot be underestimated. While the communities that focus on climate change and sustainability are not insignificant, the mainstream financial sector community continues to perceive these issues and challenges (and indeed the opportunities) as bespoke, marginal, and not core to their own mandates or objectives. The community of practitioners in this space remains small, and more needs to be done to ensure that the capacity, skills, and tools are adopted to make and implement better investments decisions in the face of climate change. The general lack of climate awareness among financial Institutions in these countries has been a key finding of recent efforts to support climate finance readiness.¹⁴⁵

Addressing climate risk and pursuing investment opportunities in resilience will require new skills and abilities in a diversity of fields bridging an understanding of the physical sciences with knowledge of risk management and financial valuation. The knowledge required will vary within the financial sector, among risk managers within those institutions, and within financial policymaking and regulatory institutions. Such capacity and skills include practitioners who can help policymakers and financial institutions assess, quantify, and manage climate risks, and, most importantly, pursue climate adaptation and resilience investment opportunities. These skills and expertise will be important among economists (macro and micro), policy experts, financial experts, chartered financial analysts (CFA), actuaries, and data modelers, as well as those engaged in financial structuring, business development, strategy, management, and international development. Over the longer term, business schools and other institutions engaged in financial training need to be engaged in developing curricula supporting a new set of specialized skills. Furthermore, vulnerable communities and developing countries may need dedicated assistance to build and acquire this type of capacity. The challenges in developing countries, particularly the poorest and most vulnerable, are particularly great.

The following actions illustrate efforts that **financial system governance bodies** and financial actors can make to help ensure that the right internal capacity exists to enable them to undertake proper analysis of climate risks and opportunities:

Financial System Constituents	Illustrative Actions
Financial system governance bodies	Financial system governance bodies need to build awareness and enhance internal technical and financial expertise and capacity to enable proper analysis of climate risks and opportunities, including: ■ Ensuring that governance bodies gain awareness, build capacity, and employ expertise relevant for integrating climate considerations throughout governance, regulations, standards setting, and other activities important for financial system governance.
Financial actors	Financial actors of all types need to build awareness and enhance internal technical and financial expertise and capacity to enable proper analysis of climate risks and opportunities, including: ■ Employing relevant expertise across several key functions of the institution, including credit, risk management, portfolio, and investment staff. ■ Building internal capacity through training and other means of raising awareness, and ensuring existing staff have sufficient understanding of the risks and opportunities resulting from climate change. ■ Building financial structuring capacity and expertise across asset classes to accelerate the development of innovative financial instruments that can catalyze adaptation and resilient investment. ■ Deploying expertise by adopting or procuring climate risk management tools and continuing to build internal capacity for the use of those systems, data, and analytic tools.

RECOMMENDATION 5:

Highlight and Promote Investment Opportunities¹⁴⁶

The GCA should highlight and promote the very large investment and market development opportunities for financial system constituents associated with responding to climate risks.

This paper has repeatedly noted that recognition of risks often results in the identification of investment opportunities (e.g., projections of water shortages may lead to agreement on the need for water management projects). Indeed, the required level of investments across all sectors and segments of society presents likely the larger investment opportunity of this generation. **Financial system governance bodies** need to incentivize opportunities to invest in adaptation and resilience. The recommendations and actions outlined will provide some of the necessary information that can help highlight those opportunities. By incorporating climate risk assessments in routine operations and business development, financial actors can also take advantage of new opportunities to invest in adaptation and resilience. The following actions illustrate efforts that **financial system governance bodies** and financial actors can make to help ensure an equal focus on adaptation and resilience investment opportunities:

Financial System Constituents	Illustrative Actions
Financial system governance bodies	Financial system governance bodies need to incentivize opportunities to invest in adaptation and resilience, including: ■ Utilizing information and analysis on climate risk to incentivize adaptation and resilience investment, such as creating linkages between highly vulnerable communities and locations with the establishment of innovative financial mechanisms and approaches (e.g., resilience banks, resilience bonds). ■ Requiring disclosure of climate-related financial risks in the real economy, in particular, infrastructure assets.
Financial actors	Financial actors of all types should seek out opportunities and scale up investments in adaptation, including: ■ Utilizing climate risk assessment practices to develop climate-resilient investment opportunities, thereby enhancing investment pipelines and bankability of proposed projects. ■ Utilizing climate risk management practices to develop and deploy new financial asset classes, instruments, and products, including such innovations as resilience bonds and expanded use of catastrophe bonds and contingency finance. ■ Participating in partnerships that serve the investment community, such as in technical best practice, design standards, procurement approaches, and shared modeling of climate scenarios.

RECOMMENDATION 6:

Use Public Institutions to Accelerate Adaptation

The GCA should advocate that financial system governance bodies provide support for or create financial institutions with a public/development mandate to incentivize financing for adaptation, particularly to benefit vulnerable communities and countries.

Investment by Taking More Risks, Demonstrating New Markets

There are limitations on public balance sheets to finance the level of investment needed to meet adaptation and resilience needs. Furthermore, as climate risks become better known and knowable, there will be limitations on the potential of public balance sheets to bear the rising costs of a failure to adapt or build resilience in investments. As poor and vulnerable communities encounter climate risks (perhaps more quickly given their existing vulnerabilities), it also will be necessary for governments and public balance sheets to potentially expand safety nets to avoid significantly undermining development gains. In those circumstances, hard choices will be required by all **financial system constituents**. This means that public funds will need to be used more creatively and effectively to bring about policy frameworks conducive to incentivizing, catalyzing, and mobilizing all sources of finance toward adaptation and resilience investments, including greater employment of blended finance approaches.

Addressing adaption investment needs will require both the public and private sectors—including international organizations, think tanks, and NGOs—to work together on a number of fronts, including:

- Creating tools, investment screening criteria, standard climate adaptation definitions, metrics and standards; and
- Developing ways to share public and private costs and benefits.

It also will require the public sector to play its essential role in creating robust financial sectors and capital markets, and require the public sector to back-stop social risks, optimize concessional finance, protect the most vulnerable, and promote local solutions.

Publicly mandated financing institutions (e.g., development finance institutions, community investment organizations) should play an expanded role in bridging public policy objectives and investment. Public finance institutions have a strong track record of supporting—where private investors will not—socially valuable investments that accelerate public policy objectives, such as investment in pre-commercial and marginally commercial technologies, geographies, and market segments. This holds equally, if not more so, for adaptation and resilience investments, many of which do not yet generate sufficient private benefits for purely market-based solutions.

Blended finance approaches that leverage public finance to crowd in private investment may be critically important to accelerate adaptation and resilience investment, particularly for investments in emerging markets, and new technologies or business models that deliver adaptation and resilience solutions. In many countries, finance ministries and **financial system governance bodies** work together across a number of public policy objectives, both domestic and international, and can play important roles in developing efforts to employ blended finance approaches.

This recommendation is primarily focused on efforts that governments, their finance ministries and, by extension, their **financial system governance bodies** can promote, in particular around the ability to most effectively and efficiently use public institutions to

accelerate adaptation and investment taking more risks and demonstrating to investors the value of new markets. The following actions illustrate efforts the **financial system governance bodies** can make to use public institutions to accelerate adaptation and investment by **financial actors**. Illustrative actions are divided by those that can be undertaken at the domestic level and at the international level:

Financial system governance bodies and Ministries	Illustrative Actions
Domestic	To enhance investment in adaptation and resilience domestically, financial ministries and their related financial system governing bodies can promote the use of domestic public institutions to accelerate adaptation investment, including: ■ Ensuring the economic and financial impacts of climate risks are integrated into financial policy. Undertaking climate risk screening of domestic public investment programs and integrating into procurement standards. Addressing any existing regulations which promote maladaptation investments or increase the vulnerability of communities more at risk from physical climate impacts. ■ Enhancing the role of public financing mechanisms/institutions to incentivize adaptation and resilience investment, including by allowing public financial institutions to more actively employ blended finance approaches to “crowd in” private capital through de-risking and risk-sharing approaches. ■ Where none exist, considering creating specialized financing mechanisms (e.g. resilience banks, aggregation funds/vehicles) to catalyze and accelerate adaptation investment, particularly for highly vulnerable communities. ■ Supporting the development of a robust resilience bond market, including by incentivizing with credit enhancement issuances by municipalities, PPP projects related to key resilience/resilient infrastructure investments, and others. ■ Supporting the expanded use of catastrophe bonds and contingency funds to increase resilience and reduce vulnerability to the impacts and costs of physical impacts from climate change.
International	To enhance investment in adaptation and resilience domestically, financial ministries and their related financial system governance bodies can promote the use of international public institutions to accelerate adaptation investment, including: ■ Promoting greater use of blended finance approaches among DFIs and MDBs to accelerate and catalyze adaptation investment in emerging markets, LDCs, and small island states. ■ Ensuring climate risk screening assessments are undertaken for international public investment channels (e.g., DFIs, MDBs), and monitoring such risks. ■ To help catalyze private adaptation investment in emerging markets, promoting efforts to develop aggregation models or funds, as well as public-private financing models that facilitate scale and pooling/diversifying risks from emerging markets. ■ Where there are gaps in the financial ecosystem in emerging markets, supporting the creation of financial mechanisms (e.g., aggregation vehicles/funds for adaptation, resilience banks, infrastructure banks, SME finance, micro-finance) in partnership with DFIs/MDBs specifically designed to invest in adaptation/resilience, and “crowd in” private investment at the local level. ■ Supporting efforts to address challenges limiting access to adaptation funding at the local level by addressing barriers to funding models, transparency, monitoring progress, and improving capacity of local institutions.

LINKAGES BETWEEN RECOMMENDATIONS AND GLOBAL COMMISSION ON ADAPTATION ACTION TRACKS

The GCA is working to address major roadblocks to adaptation action, including the failure to incorporate climate change risks and opportunities into planning and financial system governance, and the challenge of mobilizing financing for adaptation investments. The GCA should strongly advocate for the recommendations above and should work with other initiatives to secure commitments from governments, policymakers, and **financial actors** to implement the actions identified to support the recommendations.

To most effectively promote and advocate these measures with the relevant stakeholders (e.g., financial governance bodies, financial institutions), the GCA will need to¹⁴⁷:

- i. Build the internal technical capacity and expertise, both in climate adaptation and in finance and financial system governance; and
- ii. Garner credibility by leveraging this internal expertise and its high-level commission to promote and advocate with relevant stakeholders.

These two features will be necessary for GCA to work effectively with central banks, financial policymakers, financial actors, and other financial system constituents. Below are four categories of concrete actions that should form a critical component of a transformative summit resilience package and can be included in the GCA's Action Tracks:

1. Establish, Develop, and Promote a Network of Excellence on Climate Risk and Adaptation

For the GCA to make the greatest impact, the most immediately actionable step is to take on the role of a convening body for a network of climate adaptation excellence. Given its influential and diverse high-level group of commissioners, the GCA is well positioned to bring together leading actors across a wide range of financial constituents and stakeholders around relevant climate risk and adaptation topics, potentially serving as a repository of information on climate risk management and adaptation investment for the benefit of all **financial system constituents**. An effective network on financing adaptation and resilience needs to include governments, **financial system governance bodies**, financial actors, and academia. With the right staff and governance, GCA could be well placed to be a focal point for promoting and advocating for the alignment of the financial system around low-carbon and climate-resilient investment.

2. Promote the Integration of Climate Considerations into Financial System Governance

Integrating climate considerations—both risks and opportunities—will be fundamentally important for aligning the financial system toward low-carbon, climate-resilient investments, and ensuring there is at least as much attention given to investment in adaptation and resilience as to mitigation. Climate risk assessment, management, and disclosure are important components of this alignment, as are the creation of taxonomies and definitions to enable entities to identify climate risks and opportunities. The following key actions can be supported by the GCA:

Disclosure: GCA should leverage its high-level commission to promote mandatory climate risk disclosure policies. Enhanced disclosure is required both in terms of depth of disclosed information and in breadth of reporting constituents. Scaling up climate risk disclosure practices by both the real economy and the financial sector will be important for addressing information asymmetry challenges, and can provide sufficient and transparent information on which to base investment decisions to investors of all types.

Taxonomies and protocols: GCA should support the ongoing efforts by the European Commission Technical Expert Group on Sustainable Finance to develop climate-related taxonomies and protocols. A clear taxonomy is critical to determine whether activities are environmentally sustainable and include climate mitigation/adaptation benefits.

The GCA can facilitate the development of the climate data analytics industry through a number of concrete actions, including:

Engagement: The GCA should engage with ongoing initiatives, such as the NGFS, on a number of key financial policy recommendations, including:

- i. **Mandatory disclosure.** GCA should promote the rapid adoption of the existing TCFD disclosure framework and guidelines by the real sector, corporates, and the financial sector;
- ii. **Development of taxonomies** to facilitate financial institutions' assessment of physical climate-related risks; and
- iii. Financial policy recommendations related to **climate risk management practices** (e.g., stress tests, scenario planning).

3. Promote the Development of a Climate Analytics Industry

For the continued efficiency of the future financial sector, the application of climate data and analytics is critical. Without such tools in place, meaningful disclosure is impossible, as is good climate risk management. The demand for such services is emerging as corporates and financial institutions are seeking to integrate climate considerations into already existing risk management practices. There have been developments in this emerging industry in recent years, particularly in the insurance sector, but the climate analytics industry itself is still nascent, notwithstanding the potential for a number of distinct uses for climate risk analytics.

The GCA can facilitate the development of the climate data analytics industry through a number of concrete actions, including:

Convening: GCA can play a convening role for all the industry actors (e.g., academics, technology startups, the financial industry) to collaborate and share best practices around climate risk modeling, translating climate and weather data into usable information for different types of investment decision making, portfolio analysis, and stress testing.

Catalyzing: GCA may consider facilitating and funding, through competitions or competitive prizes, the development of climate data risk management solutions for specific types of climate risk assessment needs, including for various types of investors (e.g., infrastructure, institutional investors, bond underwriting), various sectors (e.g., agriculture, water, health), or for cross-cutting systems-based solutions (e.g., supply chain, city-level investments).

4. Innovation in Financial Instruments for Climate Adaptation and Resilience

Financial instruments are crucial for scaling up investment in climate. A number of new and innovative financial instruments have been developed which help catalyze investment in climate adaptation and resilience. While it is not realistic for the GCA itself to develop innovative financial instruments for climate adaptation and resilience, it can facilitate the development of new innovative financial instruments for climate adaptation and resilience through a number of concrete actions, including:

Convening: GCA can act as the convening platform for various actors in the climate finance space to engage and share their expertise around investing in adaptation and resilience, and can serve as a repository of best practices on innovative financial approaches, such as blended finance applications for adaptation and integration of climate risk elements into financial structuring approaches. As part of this, GCA can directly engage with various initiatives, such as the Adaptation and Resilience Expert Group (AREG) of the Climate Bonds Initiative and others that are actively addressing approaches which will lead to innovative financial instruments.

Catalyzing: GCA may consider facilitating and funding the creation of dedicated funds/ facilities or institutions that can catalyze and accelerate investments in adaptation and resilience, particularly promoting local solutions for the most vulnerable countries and communities. One option is for the GCA to promote the creation of a climate adaptation blended finance fund (likely as a facility under an existing multilateral climate fund) for the world's poorest and most vulnerable countries¹⁴⁸ which can effectively help to de-risk adaption and resilience investments at both the country and transaction levels, thereby attracting and mobilizing private capital for high-impact adaptation projects where it may be most needed.

ANNEX 1: Select Climate Risk Disclosure Frameworks

Organization	Purpose	Members / Target Audience	Funders	Reporting Framework Description	Latest Update of Framework
TCFD	Develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers, and other stakeholders	Investors, lenders, corporates, insurers, and other stakeholders	Financial Stability Board	Public recommendations for voluntary climate-related financial reporting	2017
SASB	Develop and disseminate sustainability accounting standards that help public corporations disclose material, decision-useful information to investors	Public corporations in 79 industries	SASB Foundation	Public reporting on sustainability, revisions being done internally in coordination with CDSB to align with TCFD recommendations on climate disclosures	2018
CDSB	Develop a global mainstream corporate reporting model to equate climate change and natural capital information with information about financial capital	Investors, companies	Consortium of nine business and environmental non-governmental organizations	Public standards and guidance designed for the disclosure of material sustainability information, including climate change risks	2018
CDP	Global disclosure system that helps businesses and cities submit data to investors and customers	Investors, companies, cities		Public reporting on climate change, forests and water; revisions being done internally with private consultation to align with TCFD recommendations	2019
UN PRI	Support international network of investor signatories in incorporating ESG factors into their investment and ownership decisions	Asset owners, investment managers	PRI signatories	Public guidance and ESG reporting framework, including specific climate indicators	2018
GRI	Modular reporting standards that can be used by any organization to report about its impacts on the economy, environment, and society	Companies	Government agencies, foundations, and other organizations	ESG reporting standards that include climate-specific disclosures	2018
ISO	Bring together experts to share knowledge and develop voluntary, consensus-based, market-relevant international standards that support innovation and provide solutions to global challenges	Companies	Non-governmental international organization with a membership of 162 national standards bodies	Public ESG reporting standards, currently developing standards related to climate change risks	2018

Endnotes

- 1 "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." IPCC, 2014; An effective adaptation process should contribute to enhancing transformative change, and accelerate/shift investments toward climate resilient development.
- 2 OECD (2014) Guidelines for resilience systems analysis, Andrew Mitchel and Astrid de Valon;
- 3 "Climate-Related Risks and Extreme Events." United Nations Framework Convention on Climate Change, unfccc.int/topics/resilience/resources/climate-related-risks-and-extreme-events.
- 4 "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." IPCC, 2014
- 5 Global Adaptation & Resilience Investment Working Group (GARI), November 2016
- 6 Bank of England, Climate Change and the Macro Economy: A Critical Review, January 2018;
- 7 Final Report: Recommendations of The Task Force on Climate-Related Financial Disclosures (TCFD), June 2017
- 8 TCFD, ibid
- 9 TCFD, ibid
- 10 GARI, ibid
- 11 TCFD, ibid
- 12 p.12, Frankfurt School-UNEP Centre, BNEF (2018), "Global Trends in Renewable Energy Investment 2018", <http://www.fs-unep-centre.org> (Frankfurt am Main)
- 13 Note: Additional background papers for the GCA focus on other areas specifically related to topic of finance, including: (i) Blended Finance; (ii) Insurance; and (iii) gaps in adaptation financing flows relative to the overall investment needs
- 14 "WMO Confirms Past 4 Years Were Warmest on Record." World Meteorological Organization, 7 Feb. 2019, public.wmo.int/en/media/press-release/wmo-confirms-past-4-years-were-warmest-record.
- 15 "Climate Change Could Depress Living Standards in India, Says New World Bank Report." World Bank, 2018, www.worldbank.org/en/news/press-release/2018/06/28/climate-change-depress-living-standards-india-says-new-world-bank-report. and Ciscar, J.C., et al. "Climate Impacts in Europe: Final Report of the JRC PESETA III Project." Publications Office of the European Union, 2018, ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/climate-impacts-europe.
- 16 Hallegatte, S., et al. 2018. "The Economics of (and Obstacles to) Aligning Development and Climate Change Adaptation: A World Bank Group Contribution to the Global Commission on Adaptation." Rotterdam and Washington, DC. Available online at www.gca.org.
- 17 "Resilience" refers to hardiness in the face of shocks and stresses; to prevent, withstand, respond to, and recover from a disruption, the enhancement of which is not necessarily within the commonly-understood definition of adaptation, i.e. altering physical, societal, or economic structures to increase fitness for a dynamic environment. Source: Nelson, Donald R., et al. "Adaptation to Environmental Change: Contributions of a Resilience Framework." Annual Review of Environment and Resources, vol. 32, no. 1, 2007, pp. 395–419.
- 18 "The Adaptation Finance Gap Report 2016." United Nations Environment Programme (UNEP), 2016, www.unepdtu.org/newsbase/2016/05/uneps-adaptation-finance-gap-report-released?id=377aa3d4-32c1-4100-8bee-ae65390b60ba

- 19 Other important milestones in international climate finance include: (i) The Marrakesh Accords, adopted at COP 7 in 2001, established several important components of climate finance, including the basis for what became the Kyoto Protocol, the International Emissions Trading Scheme and the Clean Development Mechanisms, and (ii) The Copenhagen Accord, adopted at COP 15 in 2009 where developed countries pledged up to US\$30M in “new and additional” financing with an equal balance between mitigation and adaptation, and developed countries agreed to a goal of mobilizing at least \$100M per year in funding to support and address climate change challenges in developing countries. www.unfccc.int
- 20 Carney, Mark. “Breaking the Tragedy of the Horizon – climate change and financial stability” speech. Lloyd’s of London, 2015.
- 21 Financial Stability Board, Global Shadow Banking Monitoring Report, 2017; published May 2018. www.fsb.org/2018/03/global-shadow-banking-monitoring-report-2017/; The report found that non-bank financial assets were approximately \$99 trillion in 2016, and that **approximately \$45.2 trillion indicated shadow banking activity that may give rise to financial stability risks**. Approximately 70% of shadow banking activity centers around collective investment vehicles (e.g., open-ended fixed income funds, hedge funds and money market funds), as well as short-term lending activity between non-bank institutions and broker-dealers.
- 22 Labonte, Marc, “Who Regulates Whom? An Overview of the US Financial Regulatory Framework.” August 2017, Congressional Research Service, 7-5700; www.crs.gov
- 23 Ibid; and Speech by Benoit Coeur, Member of the Executive Board of the European Central Bank, at a conference on “Scaling Up Green Finance: The Role of Central Banks”, November 2018, Berlin.
- 24 This paper does not explore in depth issues related to climate risk in the financial system related to either (i) transition risk, or (ii) liability risk.
- 25 Knight, Zoë, and Gaurav Ganguly. “Managing Financial System Stability and Climate Change - A Preliminary Guide.” HSBC Centre of Sustainable Finance, 2018, Macroeconomic and macro-financial risks include four main categories each of which are monitored, including: **cyclical risks**: such as shocks that die out with economic changes/growth, e.g., temporary oil shortages and low-carbon energy transitions; **structural risks**: such as events that fundamentally alter established economic structures, including interrelationships between economic agents, locations of industry, quality of economic and political institutions, which exert permanent effects on rates of growth, the performance of industries, the level of savings and investment in an economy **idiosyncratic risks**: such as risks with narrow effects that are confined to a specific sector, or entity; e.g., company profit warnings, and **systemic risks**: such as broad sector risks, cross-border risks/contagion and political instability;
- 26 Ibid.
- 27 Pasay, Julius. “Getting Climate Risk Right in Investment Portfolios.” The Climate Trust, 2018, climatetrust.org/getting-climate-risk-right-in-investment-portfolios/.
- 28 “Task Force on Climate-Related Financial Disclosures: 2018 Status Report.” The Task Force on Climate-Related Financial Disclosures, 2018, www.fsb-tcfd.org/wp-content/uploads/2018/08/FINAL-2018-TCFD-Status-Report-092518.pdf.
- 29 Most of the volume of work around SDGs to accelerate sustainable finance has significant grounding around climate change and addressing climate-related risks.
- 30 “NGFS First Progress Report”, Network for Greening the Financial System, October 2018; and Dikau, Simon, and Ulrich Volz. “Central Bank Mandates, Sustainability Objectives and the Promotion of Green Finance.” Council on Economic Policies, 2019, www.cepweb.org/wp-content/uploads/2019/02/Volz_paper.pdf.
- 31 “A Call for Action: Climate change as a source of financial risk.” Network for Greening the Financial System, April 2019. www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf.
- 32 NGFS, April 2019. Ibid.
- 33 “Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures.” Task Force on Climate-Related Financial Disclosure, 2017, www.fsb-tcfd.org/publications/final-recommendations-report/.

- 34 "Consultation Document on the Update of the Non-Binding Guidelines on Non-Financial Reporting." European Commission, 2019, ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/2019-non-financial-reporting-guidelines-consultation-document_en.pdf.
- 35 "Technical Expert Group on Sustainable Finance: Taxonomy Pack for Feedback and Workshops Invitations." European Commission, 2018, ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/sustainable-finance-taxonomy-feedback-and-workshops_en.pdf.
- 36 AfDB, ADB, EBRD, EIB, the Inter-American Development Bank Group (IDBG, Inter-American Development Bank (IDB) and IDB Invest), the World Bank Group (International Bank for Reconstruction and Development, Multilateral Investment Guarantee Agency and International Finance Corporation) as well as the IsDB since January 2018
- 37 For the period 2017-2019, the MDB Working Group on Climate Finance Tracking has agreed on leadership for three key tasks: The EBRD leads the core business and annual report production, the EIB leads the work on **Mitigation Finance** metrics, and the IDB leads the work on **Adaptation and Climate Resilience**.
- 38 The Common Principles build on and are consistent with the MDB methodology for tracking climate change adaptation finance. The methodology was developed in 2011 by the AfDB, the ADB, the EBRD, the EIB, the IDBG, and the World Bank Group. This group of MDBs has applied and further developed the MDB methodology over the years, as illustrated in the annual joint reports on MDB climate finance. The MDB methodology requires a high level of disaggregation to separate the cost of adaptation from the cost of other project activities, resulting in a more granular climate finance reporting than the Common Principles.
- 39 "Lessons Learned from Three Years of Implementing the MDB-IDFC Common Principles for Climate Change Adaptation Finance Tracking." Multilateral Development Banks (MDBs) Climate Finance Tracking Working Group and the International Development Finance Club (IDFC) Climate Finance Working Group, 2018, www.idfc.org/wp-content/uploads/2018/12/mdb_idfc_lessonslearned-full-report.pdf.
- 40 For greater discussion of "resilient investments" and "investment in resilience, see "Bridging the Adaptation Gap: Approaches to Measurement of Physical Climate Risk and Examples of Investment in Climate Adaptation and Resilience", pp. 34–35, Global Adaptation and Resilience Investment Working Group, 2016. 427mt.com/wp-content/uploads/2016/11/GARI-2016-Bridging-the-Adaptation-Gap.pdf.
- 41 Keenan, Jesse M, et al. "Climate Gentrification: from Theory to Empiricism in Miami-Dade County, Florida." *Environmental Research Letters*, vol. 13, no. 5, 2018, p. 054001.
- 42 Levin, Jonathan. "Big Money Is Buying Up Puerto Rico's Risky Real Estate." *Bloomberg*, 2017, www.bloomberg.com/news/articles/2017-07-14/puerto-rican-mortgages-deeply-distressed-and-suddenly-in-demand.
- 43 Kirk, Stuart, "Transparency Vital as Climate Change Takes Hold", DWS Research Institute, July 2018.
- 44 Knight, Zoë, and Gaurav Ganguly. "Managing Financial System Stability and Climate Change - A Preliminary Guide." HSBC Centre of Sustainable Finance, 2018, www.sustainablefinance.hsbc.com/reports/managing-financial-system-stability-and-climate-change.
- 45 For vulnerable communities and many developing countries, managing these types of risk ex ante may be necessary but the ability of these communities to do so is [severely limited], as is their ability to attract private capital, even with government/public support. There are public-policy linkages between this issue and the "just transition" and the government/policy role in supporting communities where climate risks are so significant that the benefits of investing in adaptation/resilience are [too] short lived.
- 46 One could argue this has been the challenge with scaling up financing for mitigation, but unlike the clear winners/losers of the low-carbon energy transition among industry and some economies (many of which are under development and where energy is a cornerstone of economic growth), the physical implications and risks from climate change transverse all sectors of all economies, including the financial sector.

- 47 While anticipating the timing of climate-related impacts is challenging, the probability that those risks will materialize is changing, and for the most part is resulting in an increase in risk, not a decrease in risk.
- 48 Wilby, Robert L., and Suraje Dessai. "Robust Adaptation to Climate Change." *Weather*, vol. 65, no. 7, 2010, pp. 180–185.
- 49 For greater consideration of this issue, see "Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change", Martin Weitzman, 2011. *Review of Environmental Economics and Policy*, volume 5, issue 2, summer 2011, pp. 275–292. scholar.harvard.edu/files/weitzman/files/fattaileduncertaintyeconomics.pdf
- 50 Some experts refer to this type of uncertainty as "deep uncertainty" which is defined by (Lempert, 2003) as the condition in which analysts do not know or the parties to a decision cannot agree upon (1) to describe interactions among a systems variables, (2) to determine the probability distributions to represent key parameters in the models, and/or (3) how to value the desirability of alternative outcomes.
- 51 Francis, Royce, and Nii Attoh-Okine. "Special Collection on Uncertainty Analysis and Decision-Making in Infrastructure Systems Under Climate Change." *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, vol. 4, no. 1, 2018.
- 52 "Paying It Forward: The Path Toward Climate-Safe Infrastructure in California - The Climate-Safe Infrastructure Working Group." California Natural Resources Agency, 2018, resources.ca.gov/climate/climate-safe-infrastructure-working-group/.
- 53 Investors make decisions all the time in the face of uncertainty, and it can be argued that many market-related trends (such as demand for products, interest rates, inflation) are far more uncertain than climate change, particularly the farther out in the time horizon. One is based on physics, and others are based on human behavior.
- 54 Miller, Alan, and Stacy Swann. "Climate Change and the Financial Sector: A Time of Risk and Opportunity." *Georgetown Environmental Law Review*, 2016. gielr.files.wordpress.com/2017/04/zsk00117000069.pdf.
- 55 "Emerging Trends in Mainstreaming Climate Resilience in Large-Scale, Multi-Sector Infrastructure PPPs." World Bank Group, PPIAF, 2016, ppiaf.org/documents/2874?otp=b3RwIzE1NTA5NzlyNDU=&ref_site=ppiaf.
- 56 "Delivering Climate Agenda for LAC: IDB Group Actions to 2020." Inter-American Development Bank (IDB), 2017, publications.iadb.org/en/publication/12926/delivering-climate-agenda-lac-idb-group-actions-2020; and Melissa Barandiaran, Maricarmen Esquivel, Sergio Lacambra, Gines Suarez, Daniela Zuloaga. "Executive Summary of the Disaster and Climate Risk Assessment Methodology for IDB Projects: A Technical Reference for IDB Project Teams", Inter-American Development Bank, December 2018
- 57 "Building Resilience: Integrating Climate and Disaster Risk into Development." World Bank, 2013. openknowledge.worldbank.org/handle/10986/16639.
- 58 "Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures." Task Force on Climate-Related Financial Disclosure, 2017, www.fsb-tcfd.org/publications/final-recommendations-report/.
- 59 TCFD guidance to actors in the Financial Sector includes three ways to disclose an entity's climate risk management: 1) Describe the organization's **processes for identifying and assessing** climate-related risks; 2) Describe the organization's **processes for managing climate-related** risks; and 3) Disclose the **metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management processes**. Implementing the Recommendations of the Task Force on Climate-Related Financial Disclosures, TCFD, June 2017
- 60 In April 2019, the NGFS issued guidance in its first comprehensive report on scenario analysis frameworks for central banks financial supervisors, inclusive of successful and unsuccessful emissions mitigation pathways and orderly and disorderly response scenarios. The NGFS promised in the future to issue more detailed guidance on data-driven scenario development. www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf.

- 61 Monitoring value-at-risk is important not only for risk management of investments currently in an institution's portfolio, but also for future expectations of selling those investments to other investors (who may be interested in understanding the risk they are "buying" or assuming).
- 62 "Transition in Thinking: The Impact of Climate Change on the UK Banking Sector." Bank of England Prudential Regulation Authority, 2018, www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/report/transition-in-thinking-the-impact-of-climate-change-on-the-uk-banking-sector.pdf.
- 63 Higgins, Hayden. "5 Ways the G20 Can Support Climate Action and Sustainable Development." World Resources Institute, 2018, www.wri.org/blog/2018/11/5-ways-g20-can-support-climate-action-and-sustainable-development. In the words of WRI's climate specialist Katherine Ross, "Any G20 country that hasn't studied for its LTS yet is lagging behind. Releasing these would show the world that the biggest economies realize their development and economic aspirations are tied to climate action."
- 64 "G20 Climate Sustainability Working Group: Adaptation Work Program (2018–2019)." G20 Climate Sustainability Working Group, 2018, www.argentina.gob.ar/sites/default/files/g20_adaptation_work_program_adopted_version.pdf.
- 65 Vogel, Jason et al. 2016. "Climate Adaptation: The State of Practice in U.S. Communities." Kresge Foundation and Abt Associates, November 2016. kresge.org/sites/default/files/library/climate-adaptation-the-state-of-practice-in-us-communities-full-report.pdf. Anecdotal evidence from journalistic reporting in late 2018 suggests that this state of affairs has not substantively changed; Brad Plumer, "Five Big Ways the United States Will Need to Adapt to Climate Change," New York Times, November 26, 2018. www.nytimes.com/2018/11/26/climate/adaptation-us-climate-change.html.
- 66 "Climate-Related Development Finance Data." OECD Development Assistance Committee, 2018, www.oecd.org/dac/financing-sustainable-development/development-finance-topics/Climate-related-development-finance-in-2018.pdf.
- 67 Green Climate Fund website. "Portfolio Dashboard." www.greenclimate.fund/what-we-do/portfolio-dashboard. Accessed February 11, 2019.
- 68 The challenges in operating donor supported climate funds efficiently is receiving much needed attention, e.g., N. Amerasinghe et al, 2017. Future of the Funds: Exploring the Architecture of Multilateral Climate Finance (WRI), www.wri.org/publication/future-of-the-funds
- 69 See UNFCCC 2018, IV. Recommendations. "Summary and recommendations by the Standing Committee on Finance on the 2018 Biennial Assessment and Overview of Climate Finance Flows." unfccc.int/sites/default/files/resource/51904%20-%20UNFCCC%20BA%202018%20-%20Summary%20Final.pdf.
- 70 "Report of the Internal Working Group (IWG) to Revisit the Existing Priority Sector Lending Guidelines." Reserve Bank of India, 2015, rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/PSGRE020315.pdf.
- 71 "Annual Report 2017-2018." Bangladesh Bank, 2018, www.bb.org.bd/pub/annual/an-report/ar1718/full_2017_2018.pdf.
- 72 Green Bank Network. greenbanknetwork.org/members/. Accessed March 15, 2019.
- 73 Rhode Island Infrastructure Bank. "Rhode Island Infrastructure Bank Hires Director of Stormwater and Resiliency." July 10, 2017. www.riib.org/node/226.
- 74 World Bank. "Bangladesh Climate Change Resilience Fund." May 22, 2012. www.worldbank.org/en/news/feature/2012/05/22/bangladesh-climate-change-resilience-fund-bccrf.
- 75 Since 2015, climate change has been one of the top five global risks identified the World Economic Forum Global Risk Report in terms of both likelihood and impact. Climate risks as a whole overshadowed other risks in the results of the WEF's Global Risk Perception Survey 2018-2019 – accounting for three of the top five risks by likelihood for the second year in a row, and four by impact for the third year in a row (including water crises as a climate risk). Collins, Aengus. "The Global Risks Report 2019." World Economic Forum, 2019, www.weforum.org/reports/the-global-risks-report-2019.
- 76 "Companies." *RE100*, there100.org/companies. Accessed February 20 2019

- 77 A UN study found, "82% of 100 analyzed blue chips disclosed their commitment to the SDG in their 2016 annual reports." Source: "Sustainable Development Goals Commitment Report." UN Global Sustainability Index Institute (UNGSII), 2017, www.cbd.int/financial/2017docs/un2017-scr100.pdf.
- 78 "Why Making Infrastructure Climate-Adapted and Resilient Will Help Meet the SDGs." Climate Bonds Initiative, 2018, www.climatebonds.net/files/reports/cbi_briefing-climate-adaptated_investment_helps_achieve_sdgs_final.pdf.
- 79 "A Guide for Public-Sector Resilience Bond Sponsorship." Re:Focus Partners, The Rockefeller Foundation, 2017, www.refocuspartners.com/wp-content/uploads/pdf/RE.bound-Program-Report-September-2017.pdf.
- 80 Starbuck, Kevin. 2016. "Moral Hazard: How the National Flood Insurance Program is Preventing Risk Mitigation." Homeland Security Affairs, December 2016. www.hsaj.org/articles/13755.
- 81 "Covering Crops: How Federal Crop Insurance Program Reforms can Reduce Costs, Empower Farmers, and Protect Natural Resources." NRDC, December 2017. www.nrdc.org/sites/default/files/federal-crop-insurance-program-reforms-ip.pdf.
- 82 Dolan, Ed. "The Strange Economics of Crop Insurance." The Niskanen Center, May 15, 2018. niskanencenter.org/blog/the-strange-economics-of-crop-insurance/.
- 83 The TCFD June 2019 status report notes, "Today, the TCFD has 785 supporters, including 671 companies and 114 other organizations (e.g., industry associations, governments). The companies represent a broad range of sectors with a combined market capitalization of over \$9.2 trillion. This includes over 374 financial firms, responsible for assets of nearly \$118 trillion. The TCFD has also received support from governments—Belgium, Canada, France, Sweden, and the United Kingdom—as well as financial regulators around the world, including in Australia, Belgium, France, Hong Kong, Japan, the Netherlands, Singapore, South Africa, Sweden, and the United Kingdom." "Task Force on Climate-Related Financial Disclosures: 2019 Status Report." The Task Force on Climate-Related Financial Disclosures, 2019, <https://www.fsb-tcfd.org/wp-content/uploads/2019/06/2019-TCFD-Status-Report-FINAL-053119.pdf>.
- 84 Underscoring how new these efforts are, NGFS wrote in its initial status report in October 2018, "Supervisors have started to actively assess the impact of climate and environment-related risks on prudential risks and are beginning to set expectations to enhance the financial risk management of supervised firms." "NGFS First Progress Report", Network for Greening the Financial System, October 2018. www.banque-france.fr/sites/default/files/media/2018/10/11/818366-ngfs-first-progress-report-20181011.pdf.
- 85 The U.S. GAO (United States Government Accountability Office) found that "companies may report similar climate-related disclosures in different sections of the filings, and climate-related disclosures in some filings contain disclosures using generic language, not tailored to the company, and do not include quantitative metrics." U.S. GAO, 2018. "Climate-Related Risks: SEC Has Taken Steps to Clarify Disclosure Requirements." February 2018. www.gao.gov/assets/700/690197.pdf.

- 86 "The PRA's desired outcome is that firms take a strategic approach to managing the financial risks from climate change, taking into account current risks, those that can plausibly arise in the future, and identifying the actions required today to mitigate current and future financial risks. The draft [supervisory statement] sets out the PRA's proposed expectations concerning how firms:
- (a) embed the consideration of the financial risks from climate change in their governance arrangements;
 - (b) incorporate the financial risks from climate change into existing risk management practice;
 - (c) use (long-term) scenario analysis to inform strategy setting and risk assessment and identification; and
 - (d) develop an approach to disclosure on the financial risks from climate change."
- Cited in BoE PRA 2018, "Consultation Paper | 23/18 Enhancing banks' and insurers' approaches to managing the financial risks from climate change."
www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/consultation-paper/2018/cp2318.pdf?la=en&hash=8663D2D47A725C395F71F-D5688E5667399C48E08.
- 87 In February 2019, Michael Bloomberg wrote in the Los Angeles Times, "We are flying blind" and called the lack of transparency a "market failure." The NY-Exxon lawsuit referenced in endnote xxxv may be an indication that this is beginning to change. Bloomberg, Michael R. "Michael Bloomberg: PG&E bankruptcy is a wake-up call on financial risks of climate change." Los Angeles Times. February 8, 2019. www.latimes.com/opinion/op-ed/la-oe-bloomberg-climate-change-risk-disclosure-20190208-story.html.
- 88 "Standards Setting Process." Sustainability Accounting Standards Board, www.sasb.org/standards-setting-process/.
- 89 TCFD website. www.fsb-tcfd.org/.
- 90 Forsgren, Kurt. 2016. "What's Next for U.S. Municipal Green Bonds?" S&P Global, September 7, 2016. www.spglobal.com/en/research-insights/articles/Whats-Next-For-US-Municipal-Green-Bonds.
- 91 The Adaptation and Resilience Expert Group formed by the Climate Bonds Initiative "to discuss and develop the A&R Principles, which will provide high-level guidance for determining when projects and assets are compatible with a climate resilient economy, and therefore should be certified under the Climate Bonds Standard" is one such effort. www.climatebonds.net/adaptation-and-resilience
- 92 For further treatment of market barriers to adaptation finance, please see UNEP FI, 2016, "Demystifying Adaptation Finance for the Private Sector", www.unepfi.org/wordpress/wp-content/uploads/2016/11/DEMYSITIFYING-ADAPTATION-FI-NANCE-FOR-THE-PRIVATE-SECTOR-AW-FULL-REPORT.pdf.
- 93 IPCC. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014. 1132 pp.
- 94 Public private partnerships are another response to financing such projects when revenue streams are available, e.g., in building toll roads. To date such projects also typically fail to consider climate risks or simply transfer such risks to public sponsors as part of the terms seen as necessary to attract private investment. S. Sundarajan and N. Suriyagoda, "Climate Risks and Resilience in Infrastructure PPPs: Issues to be Considered," World Bank PPIAF, March 2016, ppiaf.org/documents/2870/download
- 95 It should be noted that some risk management companies with effective products and services have been in the marketplace for many years. See, e.g., H. Tabuchi, "When a Projectile Two-By-Four Is All in a Day's Work," The New York Times, Dec. 11, 2017, www.nytimes.com/2017/12/11/insider/disaster-lab-research.html
- 96 "New Research Shows Clear Gap between Companies' Awareness of Climate Risks and Actions for Tackling Them." CDP, 2018, www.cdp.net/en/articles/media/new-research-shows-clear-gap-between-companies-awareness-of-climate-risks-and-actions-for-tackling-them.
- 97 Goldstein, Allie, et al. "The Private Sector's Climate Change Risk and Adaptation Blind Spots." Nature Climate Change, vol. 9, no. 1, 2018, pp. 18–25.
- 98 Network for Greening the Financial System, 2018. [NGFS First Progress Report: October 2018](http://www.ngfs.net/first-progress-report).

- 99 "Measuring Physical Climate Risk in Equity Portfolios." Deutsche Asset Management, 2017. dws.com/insights/global-research-institute/physical-climate-risk/
- 100 "Climate Change: The Investment Perspective." EY, 2016, [www.ey.com/Publication/vwLUAssets/EY-climate-change-and-investment/\\$FILE/EY-climate-change-and-investment.pdf](https://www.ey.com/Publication/vwLUAssets/EY-climate-change-and-investment/$FILE/EY-climate-change-and-investment.pdf).
- 101 For example, in October 2018, Four Twenty Seven and GeoPhy released the first global dataset on real estate investment trusts' (REITs') climate change exposure, including flood, wind, and heat and water stress. Four Twenty Seven combined its asset level climate risk exposure with GeoPhy's REIT holdings database of over 73,500 properties owned by 321 listed REITs to categorize REITs as either exposed or not exposed to various climate hazards. "Climate Risk, Real Estate, and the Bottom Line." Four Twenty Seven and Geophy, 2018, 427mt.com/wp-content/uploads/2018/10/ClimateRiskRealEstateBottomLine_427GeoPhy_Oct2018-6.pdf.
- 102 Hubert, Romain, et al. "Getting Started on Physical Climate Risk Analysis in Finance - Available Approaches and the Way Forward." I4CE – Institute for Climate Economics, 2018, www.preventionweb.net/files/63004_i4cecliminvest2018gettingstartedonp.pdf.
- 103 "Addressing Climate Risks and Opportunities in the Investment Process." The Institutional Investors Group on Climate Change (IIGCC), 2018, www.iigcc.org/files/publication-files/Addressing_climate_risks_-_web_version.pdf.
- 104 "Lenders' Guide for Considering Climate Risk in Infrastructure Investments." Acclimatise, Four Twenty Seven and Climate Finance Advisors. 2018. climatefinanceadvisors.com/wp-content/uploads/2018/01/Investment-Guide_1.8-single-hi-q_17012018.pdf.
- 105 European Bank for Reconstruction & Development (EBRD) and Global Centre on Adaptation (GCA). "Advancing TCFD Guidance on Physical Climate Risk and Opportunities". 2018. s3.eu-west-2.amazonaws.com/ebird-gceca/EBRD-GCECA_draft_final_report_full_2.pdf.
- 106 "Navigating a New Climate: Assessing credit risk and opportunity in a changing climate: Outputs of a working group of 16 banks piloting the TCFD Recommendations. PART 2: Physical risks and opportunities." UNEP FI and Acclimatise. 2018. www.unep-fi.org/wordpress/wp-content/uploads/2018/07/NAVIGATING-A-NEW-CLIMATE.pdf.
- 107 Such criticism has been made regarding the U.S. Securities and Exchange Commission, which in 2010 issued guidance indicating climate risk could be "material" for purposes of reporting requirements by publicly traded companies but has done little since to advance the requirement. U.S. General Accounting Office, "Climate-Related Risks: SEC Has Taken Steps to Clarify Disclosure Requirements," Feb. 20, 2018, www.gao.gov/products/GAO-18-188
- 108 Climate Action in Financial Institutions Initiative website: www.mainstreamingclimate.org/initiative/
- 109 "The World Bank Group's Action Plan on Climate Change Adaptation and Resilience: Managing Risks for a more Resilient Future." World Bank Group. 2019. pubdocs.worldbank.org/en/519821547481031999/WBG-Action-Plan-on-Climate-Change-Adaptation-and-Resilience-FINAL.pdf.
- 110 World Bank and IMF Joint Development Committee, "From Billions to Trillions: Transforming Development Finance Post-2015 Financing for Development: Multilateral Development Finance", April 2, 2015 [siteresources.worldbank.org/DEVCOMMINT/Documentation/23659446/DC2015-0002\(E\)FinancingforDevelopment.pdf](https://siteresources.worldbank.org/DEVCOMMINT/Documentation/23659446/DC2015-0002(E)FinancingforDevelopment.pdf). See also "Better Finance, Better World." Blended Finance Taskforce, 2018. s3.amazonaws.com/aws-bsdc/BFT_BetterFinance_final_01192018.pdf
- 111 "Blended Finance." Convergence, www.convergence.finance/blended-finance.
- 112 "Blended Finance." International Finance Corporation (IFC), www.ifc.org/wps/wcm/connect/CORP_EXT_Content/IFC_External_Corporate_Site/Solutions/Products+and+Services/Blended-Finance. See also "Selling Solar: Lessons from More Than a Decade of IFC's Experiences", IFC (2007), www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_loe_sellingsolar_wci_1319577385747
- 113 "2018 Joint Report on Multilateral Development Banks' Climate Finance." IDB - Publications, Inter-American Development Bank, 2019.

- 114 "2025 Targets to Step Up Climate Action." World Bank Group, 2018. pubdocs.worldbank.org/en/368601543772742074/2025-Targets-to-Step-Up-Climate-Action.pdf; "World Bank to put support for adaptation 'on a par' with mitigation for first time," Climate Centre, Jan. 16, 2019, www.climatecentre.org/news/1094/world-bank-to-put-support-for-adaptation-a-on-a-para-with-mitigation-for-first-time
- 115 "2018 Green Bond Highlights." Climate Bonds Initiative, 2019. www.climatebonds.net/resources/reports/2018-green-bond-market-highlights
- 116 Network for Greening the Financial System website, www.banque-france.fr/en/financial-stability/international-role/network-greening-financial-system. Accessed Feb 18 2018
- 117 "Swiss Re & Nature Conservancy Partner for Parametric Coral Reef Insurance." Artemis, 21 Mar. 2018, www.artemis.bm/news/swiss-re-nature-conservancy-partner-for-parametric-coral-reef-insurance/.
- 118 "Fact Sheet: DC Water Environmental Impact Bond." Goldman Sachs, 2016. www.goldmansachs.com/media-relations/press-releases/current/dc-water-environmental-impact-bond-fact-sheet.pdf
- 119 "Willis Towers Watson Launches Global Insurance Facility for Resilience." Artemis, 21 Mar. 2018, www.artemis.bm/news/willis-towers-watson-launches-global-insurance-facility-for-resilience/; "Swiss Re & Nature Conservancy Partner for Parametric Coral Reef Insurance." Artemis, 21 Mar. 2018, www.artemis.bm/news/swiss-re-nature-conservancy-partner-for-parametric-coral-reef-insurance/
- 120 Chappatta, Brian. "The Catastrophe Bond Business Is Booming." Bloomberg, Bloomberg, 2018, www.bloomberg.com/opinion/articles/2018-09-11/catastrophe-bonds-are-anything-but-a-disaster
- 121 T. Talbot, S. Dercon, and O. Barder, "Payouts for Perils: How Insurance Radically Improve Emergency Aid." Center for Global Development, 2017. www.cgdev.org/publication/payouts-for-perils-how-insurance-can-radically-improve-emergency-aid-report
- 122 African Risk Capacity website: www.africanriskcapacity.org/
- 123 Popescu, Alexandra. "Index Insurance for Small Farmers: a Primer." CCAFS: CGIAR Research Program on Climate Change, Agriculture and Food Security, 11 May 2018, ccafs.cgiar.org/blog/index-insurance-small-farmers-primer#XG7o76iU-Uk.
- 124 M. Miranda et al, "Using Index Insurance to Enhance the Agricultural Credit System in Ghana," Feed the Future Innovation Lab for Assets and Market Access at UC Davis, 2014, basis.ucdavis.edu/sites/g/files/dgvnsk466/files/2017-02/Miranda-brief-2014-05.pdf
- 125 "Designing a new type of insurance to protect the coral reefs, economies and the planet." Swiss Re, March 5, 2018, www.swissre.com/our-business/global-partnerships/solutions/governments/Designing-a-new-type-of-insurance-to-protect-the-coral-reefs-economies-and-the-planet.html
- 126 "Swiss Re & Nature Conservancy Partner for Parametric Coral Reef Insurance." Artemis, 21 Mar. 2018, www.artemis.bm/news/swiss-re-nature-conservancy-partner-for-parametric-coral-reef-insurance/
- 127 "GEF Joins Forces with Partners to Promote New Fund for Resilience in the Poorest Countries." Global Environment Facility, 16 Nov. 2017, www.thegef.org/news/gef-joins-forces-partners-promote-new-fund-resilience-poorest-countries.
- 128 The Global Innovation Lab for Climate Finance. 2017. "Climate Resilience and Adaptation Finance and Technology Transfer Facility (CRAFT): Instrument Analysis." September 2017. www.climatefinancelab.org/wp-content/uploads/2017/09/Global-Lab-Instrument-Analysis-CRAFT-2.pdf
- 129 "Acumen Resilient Agriculture Fund (ARAF)." Green Climate Fund, 2018, www.greenclimate.fund/projects/fp078.
- 130 The Virgin Earth Challenge website: www.virginearth.com/
- 131 The Global Cooling Prize website: Globalcoolingprize.org

132 As noted previously, this paper does not explore the potential for new financial mechanisms in depth, although recognizing that dedicated financing platforms, instruments (such as resilience bonds), funds or institutions that solely focus on providing financing for adaptation and [resilience/investment in resilience] would bring substantial short-term benefit to scale up financing. GCA should support all efforts to continue to develop and deploy instruments that can catalyze financing for adaptation, help share and/or transfer climate risks, and otherwise enable the “crowding-in” of private capital (e.g., blended finance). These types of approaches are incremental, and useful, although limited insofar as they don’t directly address the system-wide challenges that necessary to transform the financial system and help reorient capital around sustainability and resilience.

133 As discussed above, in “financial system governance bodies” we include policymakers, financial system rule-makers and standards bodies, and agencies with oversight and supervisory authorities

134 The NGFS will issue an initial set of six recommendations in April 2019 which reflect [34] Central Banks’ views on how best to integrate climate considerations across financial system policies and regulations [footnote to be updated prior to publication]. “Technical Expert Group on Sustainable Finance Subgroup: Disclosures - Progress Report.” European Commission, 2019, ec.europa.eu/info/files/sustainable-finance-teg-subgroup-disclosures-progress-report_en.

135 Dikau, Simon, and Josh Ryan-Collins. “Green Central Banking in Emerging Market and Developing Country Economies.” New Economics Foundation (NEF), 2017, neweconomics.org/uploads/files/Green-Central-Banking.pdf.

136 Note: some of the actions within this section are also covered in other Recommendations, although these are specific for financial system governance bodies.

137 The ESG practices of firms frequently do currently address issues related to climate change. However, ESG approaches primarily focus on an asset’s impact on the environment, not the environment (or climate) impact on the asset. Further, most ESG approaches do not undertake a financial value-at-risk assessment over relevant time horizons for investors, rather when financial or economic assessment are undertaken for an ESG risk, these are often based on asset life.

138 European Bank for Reconstruction & Development (EBRD) and Global Centre on Adaptation (GCA). “Advancing TCFD Guidance on Physical Climate Risk and Opportunities”. 2018. s3.eu-west-2.amazonaws.com/ebird-gceca/EBRD-GCECA_draft_final_report_full_2.pdf.

139 Weber, Chris, et al. “Exploring Metrics to Measure the Climate Progress of Banks.” 2 Degrees Investing Initiative, United Nations Environment Programme Finance Initiative, World Resources Institute, 2018, [wrong.s3.amazonaws.com/s3fs-public/exploring-metrics-to-measure-the-climate-progress-of-banks.pdf](https://s3.amazonaws.com/s3fs-public/exploring-metrics-to-measure-the-climate-progress-of-banks.pdf).

140 “Adaptation and Resilience.” Climate Bonds Initiative, Nov. 2018, www.climatebonds.net/adaptation-and-resilience.

141 “Task Force on Climate-Related Financial Disclosures: 2018 Status Report.” The Task Force on Climate-Related Financial Disclosures, 2018, www.fsb-tcfd.org/wp-content/uploads/2018/08/FINAL-2018-TCFD-Status-Report-092518.pdf.

142 “Task Force on Climate-Related Financial Disclosures: 2019 Status Report.” The Task Force on Climate-Related Financial Disclosures, 2019, www.fsb-tcfd.org/wp-content/uploads/2019/06/2019-TCFD-Status-Report-FINAL-053119.pdf.

143 “Technical Expert Group on Sustainable Finance: Taxonomy Pack for Feedback and Workshops Invitations.” European Commission, 2018, ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/sustainable-finance-taxonomy-feedback-and-workshops_en.pdf

144 Risk assessments are undertaken based on information at a point in time. Depending on actual and anticipated warming, concepts of what constitutes “resilience” may evolve as GHG emissions occur and scientific understanding of risks and the magnitude of resulting financial stress improves.

145 “Engaging the Green Climate Fund—GCF Readiness Programme Report.” United Nations Development Programme, 2018, www.gcfreadinessprogramme.org/sites/default/files/Lessons%20learnt-%20October10.pdf

- 146 While highlighting the importance of identifying business and financial opportunities associated with addressing climate risks, this paper does not cover the topic in detail. Other reports and more recently investment funds have begun to do so focusing on financially attractive adaptation and resilience investments across all industries, including (i) infrastructure, (ii) energy, (iii) agriculture and food security/rural livelihoods, (iv) cities, (v) supply chains, and other parts of the economy (e.g., IFC, 2017).
- 147 Regardless of whether GCA will itself undertake any specific actions, or will leverage the influencing capability of the Commission, it would be important for the GCA itself to build a minimum level of internal technical and subject matter expertise in order to most effectively promote issues raised in this background paper with financial system constituents.
- 148 The Least Developed Countries Fund administered by the Global Environment Facility has a mandate that encompasses many of these countries.



United Nations Environment Programme – Finance Initiative (UNEP FI) is a partnership between United Nations Environment and the global financial sector created in the wake of the 1992 Earth Summit with a mission to promote sustainable finance. More than 200 financial institutions, including banks, insurers, and investors, work with UN Environment to understand today's environmental, social and governance challenges, why they matter to finance, and how to actively participate in addressing them.

www.unepfi.org