

A GUIDEBOOK FOR

National Development Banks on Climate Risk

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A Note on this Guidebook

The topic of climate-related financial risk management is fast evolving. Methods for identifying and measuring climate-related risks and translating them into financial metrics are still nascent. This guidebook intends to serve as a reference document on the resources available to date, with a view to helping national development banks (NDBs) fast track adopting good emerging practice while prompting them to contribute to filling outstanding gaps.

NDBs are encouraged to engage with their stakeholders and local financial and capital market actors, and to collaborate with peers regionally and globally to share knowledge and continue to improve climate-related risk assessments and management.

The guidebook uses forward-looking language when referring to climate change-related risks and their impacts. The text refers to projected changes, the *upcoming* transition to a low-carbon and climate-resilient economy, and the *likely* negative effects. This is because much of the economic effects of climate change are still largely unpriced and unaccounted for in the financial sector because some impacts have yet to materialize. The magnitude and nature of the future impacts will be determined by actions taken (or not taken) today to *orderly* move the world on a *well below 2°C* development pathway.

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List of Abbreviations and Acronyms

Bancoldex	Banco de Comercio Exterior de Colombia SA (Colombia)
Banobras	Banco Nacional de Obras y Servicios Públicos (Mexico)
BDMG	Banco de Desenvolvimento de Minas Gerais S.A. (Brazil)
BNDES	Banco Nacional de Desenvolvimento Econômico e Social (Brazil)
CDP	Carbon Disclosure Project
CFRF	Climate Financial Risk Forum
COFIDE	Corporación Financiera de Desarrollo (Peru)
CORFO	Corporación de Fomento de la Producción (Chile)
DNB	De Nederlandsche Bank or (the Central Bank of the Netherlands)
E&S	Environmental and Social
ECB	European Central Bank
ERM	Enterprise Risk Management
ESG	Environmental, Social, and Governance
ESMS	Environmental and Social Management Systems
ESRP	Environmental and Social Responsibility Policy
FCA	Financial Conduct Authority (United Kingdom)
FIRA	Fideicomisos Instituidos en Relación con la Agricultura(Mexico)
FSB	Financial Stability Board
GCF	Green Climate Fund
GHG	Greenhouse Gas
IDB	Inter-American Development Bank
IPACC II	Adapting Public Investment to Climate Change in Latin America
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ISAC	Integrated Sustainability Advisory Committee
KfW	Kreditanstalt für Wiederaufbau
KPI	Key Performance Indicators
LAC	Latin America and the Caribbean
MDB	Multilateral Development Bank
NAFIN	Nacional Financiera (Mexico)

List of Abbreviations and Acronyms

NDB	National Development Bank
NDC	Nationally Determined Contributions
NGFS	Network for Greening the Financial System
PRA	Prudential Regulation Authority (United Kingdom)
PRI	Principles for Responsible Investment
SASB	Sustainability Accounting Standards Board
SME	Small- and Medium-Sized Enterprise
TCFD	Task Force on Climate-Related Financial Disclosures
UNEP-FI	United Nations Environment Programme Finance Initiative

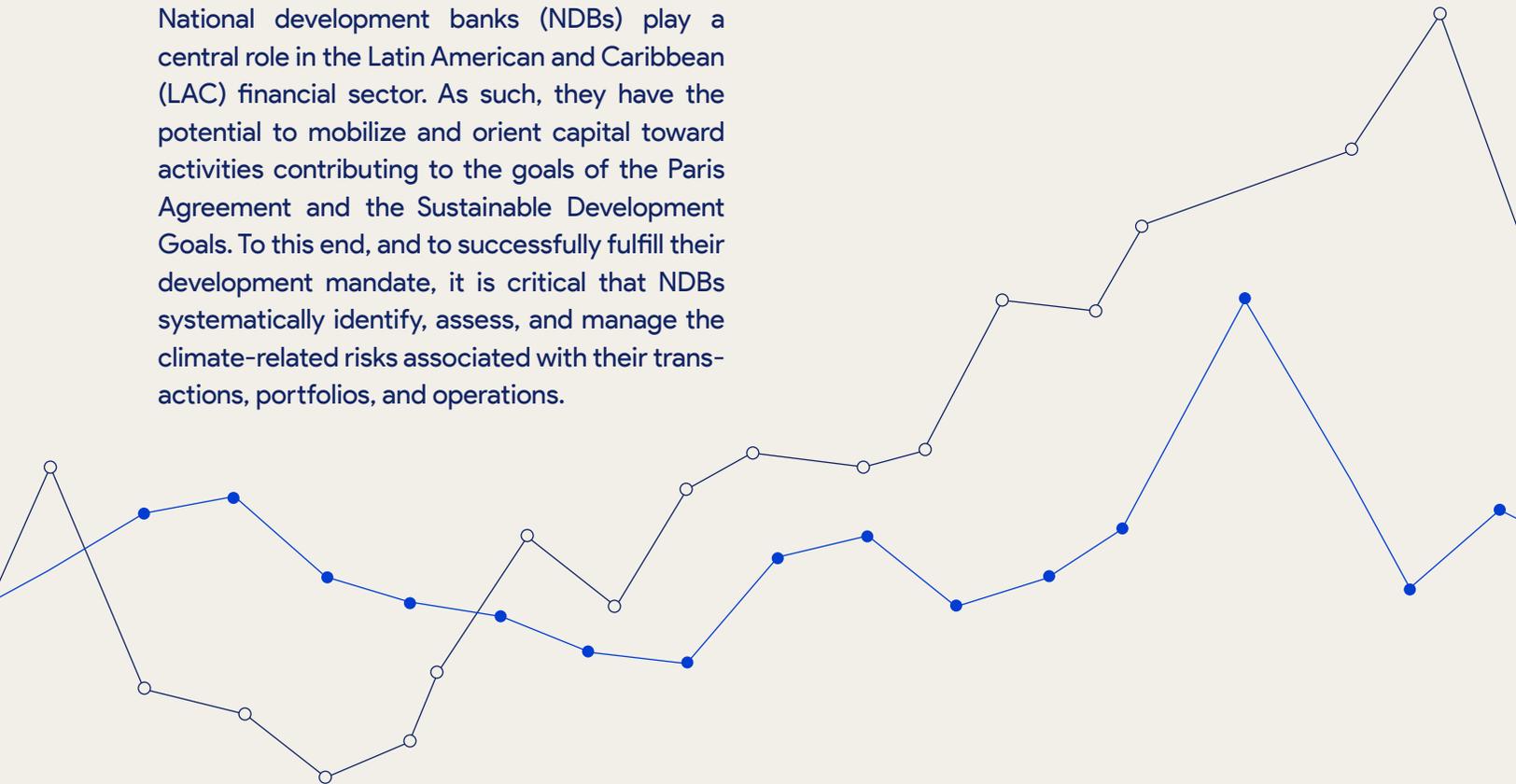
Executive Summary

Climate change is the defining issue of our time. Its impacts will be widespread and far-reaching, affecting all agents in the economy across all sectors and geographies. However, the magnitude and nature of future impacts will be determined by the actions taken today.

The financial sector has a key role to play in addressing climate change challenges with foresight and to do so by integrating climate-related risks and opportunities in capital allocation decision-making and financing the low-carbon, climate-resilient transition.

National development banks (NDBs) play a central role in the Latin American and Caribbean (LAC) financial sector. As such, they have the potential to mobilize and orient capital toward activities contributing to the goals of the Paris Agreement and the Sustainable Development Goals. To this end, and to successfully fulfill their development mandate, it is critical that NDBs systematically identify, assess, and manage the climate-related risks associated with their transactions, portfolios, and operations.

Climate change and society's response to it present financial risks and opportunities to NDBs. Climate-related financial risks and opportunities derive from two main sources: physical and transitional risk. Physical risks can arise from climate- and weather-related events, such as droughts or floods, or from progressive shifts in climate and weather patterns, such as increasing mean temperatures. Transitional risks can arise from policy, technological, and market changes resulting from the shift to a low-carbon, climate-resilient economy.





Financial institutions are exposed to physical and transitional risks and opportunities through their lending and other financial intermediary activities, and through their own operations. Climate risk drives existing financial risk categories, particularly credit, market, operational, and liquidity risks, which translate into financial risks through various channels. Asset devaluations due to climate policies or technological breakthroughs, damage to physical assets, and disruptions to supply chains can deteriorate the financial positions of firms. Negative impacts on revenue streams, balance sheets, and operations can trigger higher probabilities of default for banks. Firms and financial institutions need to re-evaluate their concept of risk and incorporate climate change into their strategic planning and financial decisions.

The recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) provide a framework for integrating climate-related risks and opportunities across the core areas that determine how organizations make decisions: governance, strategy, risk management, and metrics and targets.

This guidebook provides NDBs a roadmap to increase their climate risk maturity by taking key steps aligned with the TCFD recommendations.

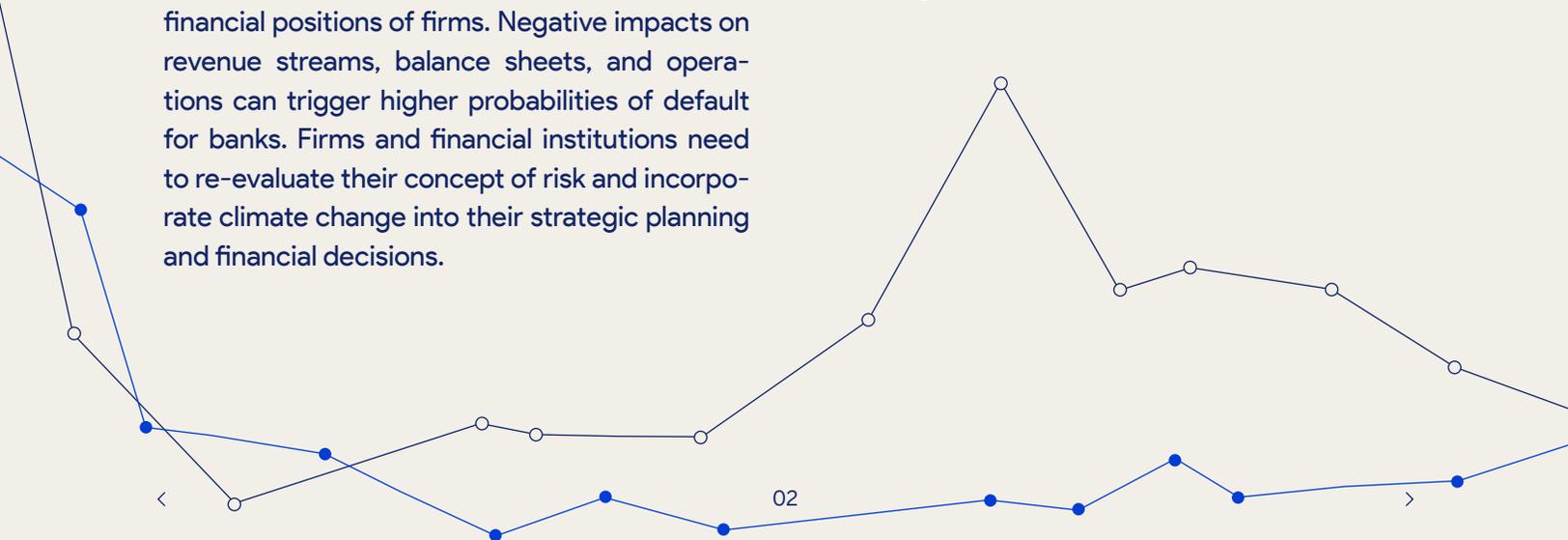
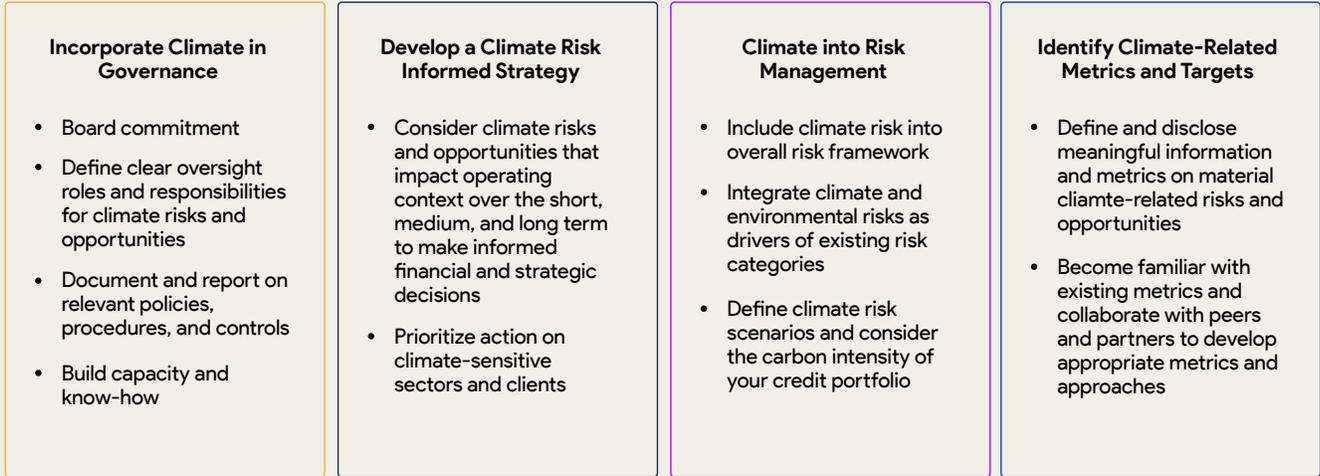


Figure 1. Overview of Key Actions on Climate-Related Risks



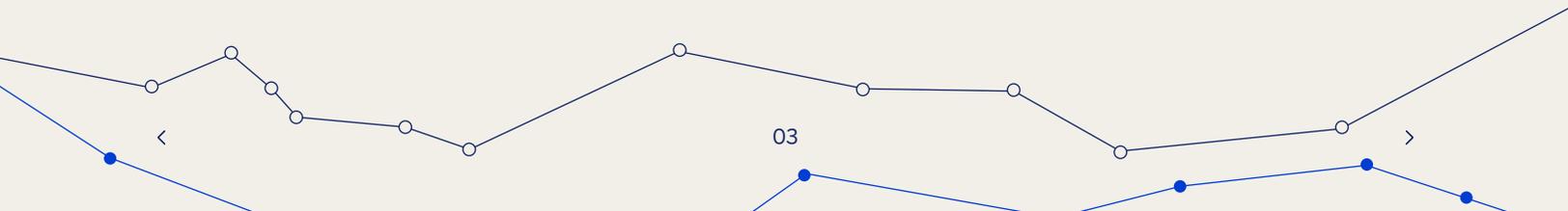
Source: Authors' elaboration.

The journey from little action on climate to becoming climate capable allows an NDB to better understand the financial risk to itself and its clients arising from climate change, and allows it to capture new opportunities. Making climate-informed investment and lending decisions and, in the long term, allocating capital in a manner that aligns with the global curbing of emissions is good business.

While this work may be daunting, NDBs are not alone in the pursuit of solutions to climate risk. Central banks, regulatory authorities and supervisory agencies, commercial banks, private and commercial investment firms, insurers, and other financial actors have started identifying, assessing, and managing climate risks and are sharing the lessons learned in the process.

As the taxonomies of climate risk and its financial implications continue to develop, NDBs can contribute to the collective action to identify, assess, and manage those risks. NDBs that are at the beginning of their journey can start with a qualitative, rather than quantitative, internal conversation and prioritize actions to affect their top climate-sensitive sector, client, or region.

This guidebook is written for those NDBs heeding the call to address the climate challenges in their country and to raise awareness of the urgency to act on climate risks among those that are new to the topic. NDBs, as financial institutions, need to be ready to address the potential impacts on their existing and future portfolios and financial positions.





Overall, the guidebook is intended to inform NDBs about climate risk; help them understand how to identify, assess, and manage it; and provide insights into how they can seize opportunities that arise from the transition to a low-carbon, climate-resilient economy. It is meant to be a companion document while NDBs realign internal structures to better position themselves to respond to the challenge being brought by climate change. This guidebook intends to both enhance their understanding of what climate risk means for NDBs and support efforts to navigate the implications that follow.

1.1. Objective, Purpose, and Structure of this Guidebook

This guidebook is intended for national development banks (NDBs) heeding the call to help finance their countries' transition toward a low-carbon, climate-resilient, and inclusive development pathway. It aims to raise awareness of the urgency to act to address the risks and impacts associated with climate change and provide guidance on how to go about doing so. It provides insights on good emerging practices and examples of how NDBs can strengthen their institutional capabilities to identify, assess, manage, and monitor climate-related financial risks. It also provides insights into how NDBs can use a climate risk lens to identify business opportunities that arise from the transition to a low-carbon, climate-resilient economy.

This guidebook provides NDBs with a roadmap to integrate climate-related risks and opportunities in alignment with the recommendations of the Financial Stability Board's (FSB) Task Force on Climate-Related Financial Disclosures (TCFD). It provides insights on NDBs' relative degree of understanding and maturity on the topic, and examples of relevant experience developed by several NDBs in Latin America and the Caribbean (LAC). Such insights and examples emerged from structured interviews with 10 NDBs and a survey submitted to the members of the Latin American Association of Development Financing Institutions (ALIDE) and the Brazilian Development Association (ABDE). These were complemented by insights and inputs from the latest literature in the field and an interview with a commercial bank.

This guidebook addresses a fast-evolving topic and is a live document that will be enriched by subsequent publications. It is structured as follows:



Chapter 1

Introduces the importance of understanding climate change-related risks given that they are a source of economic and financial risk. The chapter ends with a call to action on climate risk for NDBs.



Chapter 2

Presents climate change in the context of the financial sector. It defines the main concepts—physical and transitional risks of climate change—and explains the various transmission channels through which climate risk turns into a systemic risk threatening the stability of the financial system and the macroeconomy. It also provides an overview of the ongoing work of regulatory and supervisory bodies and other financial sector initiatives, such as the TCFD and the Network of Central Banks and Supervisors for Greening the Financial System (NGFS).



Chapter 3

Focuses on the implications of climate risk on NDBs. It highlights the importance of acting to integrate climate-related risks into capital decision-making to successfully fulfill their mandates and capture new business opportunities.



Chapter 4

Presents a practical path forward for NDBs to integrate climate risk into decision-making. To this end, it lists good emerging practices across the four pillars of the TCFD: governance, strategy, risk management, and metrics and targets. It also presents examples from Latin American NDBs and commercial banks. These examples aim to inspire NDBs to accelerate their climate risk efforts.



Chapter 5

Provides concluding remarks.

1.2. Key Take-Aways



Climate change constitutes a major challenge, generating both risks and opportunities that will affect the economy and the financial sector.



Financial regulators and supervisors expect financial institutions to develop and use forward-looking climate risk assessment methodologies to capture the scale of climate-related risks (and opportunities). They are also working to integrate climate into their supervisory and regulatory toolbox and provide financial institutions with guidance and strategies.



Industry-led initiatives such as the TCFD are providing frameworks and recommendations on how to integrate climate-related risks and opportunities into capital allocation decision-making.



For NDBs, integrating climate change-related risks and opportunities into governance, risk management, strategy, and operations is of paramount importance to successfully deliver on their mandate. Disclosure of climate-related financial risks is a core element of this effort.

1.3. The Relevance of Climate Change Risks

Climate change is a source of risk to macroeconomic and financial stability. This guidebook for NDBs comes at a pivotal time since the effects of climate change are increasingly visible around the world. The impacts of climate change are far-reaching in breadth and magnitude, affecting all agents in the economy, across all sectors and geographies.

Climate change can adversely impact the global economy and worsen social inequalities and environmental problems. Without ambitious action to reverse observed and projected trends, the rise in mean temperatures and the increase in frequency and intensity of extreme climate and weather events (e.g., floods, droughts, and hurricanes) could devastate the global economy, increase inequalities, and deeply harm biodiversity and human health. Countries that are less economically diverse, with weaker climate-resilient public infrastructure, relatively less mature capital markets, and lower capacity to adapt are at greater risk from climate change (NGFS, 2019). Developing economies, particularly those heavily dependent on climate vulnerable sectors such as agriculture, are disproportionately exposed and susceptible to the impact of climate change (Itaú Asset Management, nd). In light of its structural socio-economic characteristics and geographical context, LAC is as one of the regions most exposed and vulnerable to the physical effects of climate change (Bárcena, Samaniego, Galindo, et al., 2018; ECLAC, 2015).

Trillions of dollars in economic losses are estimated to stem from physical damage to assets, disruptions to global supply chains, and asset impairments or write-offs. Under a business-as-usual scenario, the negative effects are significant, estimated at 16.9 percent of the value of global financial assets, which is equivalent to US\$24 trillion (Dietz, Bowen, Dixon, et al., 2016). These losses will directly impact the viability of businesses, affect financial institutions' balance sheets, and pose systemic risks to the macroeconomy and financial systems.

To avoid the worst climate-related impacts, capital will need to quickly flow toward low-carbon and climate-resilient infrastructure and solutions across sectors and geographies.

The 2015 Paris Agreement calls for a substantial reduction in global greenhouse gas (GHG) emissions to “hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. To this end, GHG emissions will need to drop by half by 2030 and then reach net-zero around mid-century” (IPCC, 2018).

Achieving such goals requires capital to be mobilized on a scale toward “rapid and far-reaching transitions in energy, land, urban and infrastructure, and industrial systems” (IPCC, 2018). Estimates of the investment required to achieve the low-carbon transition in the energy sector alone, for instance, amount to about US\$3.5 trillion per year globally between 2016 and 2050 (IPCC, 2018). In the urban sector, the financing required to build sustainable infrastructure exceeds US\$1 trillion a year (Floater, Dowling, Chan, et al., 2017). Other estimates point to infrastructure investments in the order of US\$6.9 trillion up to 2030 to meet climate and sustainable development goals (OECD, World Bank, and UNEP, 2018). Increased demand for low-emission and climate-resilient technologies, products, and services from businesses, households, and governments drives climate-related opportunities for financial institutions, which play a major role in financing the transition in the real economy.

1.4. Climate Change as Systemic Risk

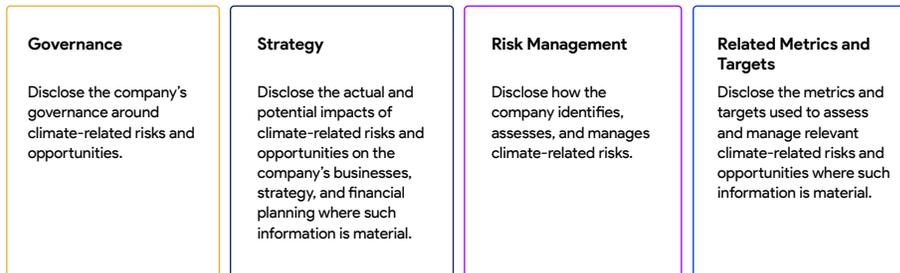
Increasingly, financial regulators and supervisors recognize the threat climate change poses to the stability of the financial system and the macroeconomy. This stability may be threatened by the physical effects of climate change on components of the demand and supply sides of the economy, such as damage to property and infrastructure, disruptions of economic activities and trade, and negative implications for labor productivity. The financial system and macroeconomy may also be threatened by the shift toward a low-carbon economy if there were a sudden, aggressive shift away from fossil fuel-based energy and its related capital to drastically reduce carbon emissions. This sudden change would result in a rapid adjustment of costs and the repricing of carbon-intensive assets. Such a stranding of carbon-intensive assets could in turn lead to corporate defaults and financial instability, which could lead to negative macroeconomic outcomes (Batten, 2018; ESRB, 2020).

The urgency of climate action has gained momentum among central banks and regulatory authorities. In 2015, the FSB created the TCFD, an industry-led task force. The goal was to develop voluntary, consistent, and forward-looking climate-related financial disclosures with a view to enhancing decision-making on material risks by investors, lenders, insurers, and other stakeholders. (See Box 1.1.)

Box 1.1. The Task Force on Climate-Related Financial Disclosures

The TCFD is a financial industry-led initiative that has been publicly backed by over 110 regulators and government entities and over 1,600 organizations globally, including financial institutions responsible for assets worth more than US\$150 trillion and investors representing a combined market capitalization of over US\$12.6 trillion.

The recommendations represent a framework to integrate climate-related risks and opportunities in strategic and financial decision-making. With widespread adoption of the recommendations, investors, lenders, and companies can make informed decisions about their exposure to climate-related risks and opportunities in their businesses and future capital allocation plans.



Source: Authors' elaboration.

Financial regulators around the world are increasingly integrating climate change within their mandate and strategies to ensure the stability of the financial system and prudential risk management. A group of 83 central banks and supervisors collaborating under the Network for Greening the Financial System (NGFS) has embarked on the task of integrating climate-related risks into monitoring and supervising financial stability (see Box 1.2) and seeking ways to mobilize capital for sustainable development.

Box 1.2. Central Banks and Supervisors, Network for Greening the Financial System

The purpose of the NGFS is to help strengthen the global response required to meet the goals of the Paris Agreement and enhance the role of the financial system to manage climate-related and environmental risks. The NGFS's comprehensive report "A Call for Action," published in April 2019, contains six non-binding recommendations, the first of which is that central banks and supervisors integrate climate-related risks into financial-stability monitoring and micro-prudential supervision. Following up on this, NGFS members produced a practical guide on how to integrate climate-related and environmental risks into prudential supervision.

Financial regulators in LAC have already taken steps to embed climate-related and environmental risks in their work (see Government of Chile, 2020; Government of Colombia, 2019; Bank of Mexico, 2020). For instance, in Chile, Mexico, and Colombia, regulators have surveyed the financial institutions under their jurisdictions to understand the current state in the industry and raise awareness about the relevance of climate-related and environmental risks. Surveys investigated the way financial institutions consider these risks in their governance, strategy, risk management, and disclosures.

The Paris Agreement and Nationally Determined Contributions (NDCs), the NGFS, the TCFD, and other government- and industry-led initiatives provide the goalposts, means, and methods financial institutions are expected to align with or contribute to.

Through NDCs, the Paris Agreement calls for action to make financial institutions' portfolios consistent with a temperature rise scenario of well below 2°C above pre-industrial levels.

Established by the FSB in 2015, the TCFD promotes the development of frameworks, assessment methodologies, and approaches to integrate climate risks and opportunities into decision-making and disclosures. Following the TCFD recommendations helps financial institutions develop governance structures, strategies, and risk management frameworks capable of identifying, assessing, managing, and monitoring climate-related risks over the short, medium, and long term. The TCFD helps financial institutions assess the implications of different GHG emission pathways and across different temperature scenario outcomes (such as scenarios where the global temperature rises above the Paris Agreement goals). Forward-looking assessment of climate-related risks can help secure the resilience of a financial institution's business model over the medium to long term.

1.5. Why Should National Development Banks Act on Climate Risk?

NDBs can play a central role in their countries' economies and financial systems. Their very existence is to respond to market failures for the betterment of their national economies. To successfully fulfill their mandate, NDBs need to understand and manage the climate-related risks they face and to which they could be contributing. The rationale here is two-fold:

1. Recognizing climate-related risks and opportunities allows the NDB to make more informed decisions in asset allocation to protect their portfolio.
2. Seizing climate-related opportunities enables the NDB to correct prevailing market failures in green investments.

In re-allocating their assets, the NDBs will influence their redistributive impact on society through investments that accelerate the transition toward a carbon neutral economy.

Climate change can affect the assets and liabilities of NDBs' balance sheets. The way NDBs originate and structure financing, and manage or not the climate-related risks, influences their ability to fulfill their development mandate. This process also bears the risk that they lock-in carbon emissions and vulnerabilities in the macroeconomy and financial system of the jurisdictions in which they operate. It is therefore of paramount importance that NDBs incorporate climate risk considerations within their governance, strategy, risk management, and operations. In doing so, NDBs will become more resilient and capable of fulfilling their development mandate over the long term. NDBs that do not realign their business models may risk obsolescence, while those that adapt will be able to capture the opportunities.¹

¹ Adapted from the speech of Mark Carney, (former) Governor of the Bank of England, "TCFD: Strengthening the Foundations of Sustainable Finance." In his speech, Mr. Carney referred to all firms, pointing out that those who do not align their business models with the transition to a net zero world will cease to exist.

NDBs can pursue climate-related investment opportunities and take a leadership role in supporting the implementation of their governments' plans for the low carbon, climate-resilient transition. Sitting at the cross-section of the public and private sectors, NDBs may have an explicit role in implementing their country's NDCs, including strategically aligning lending with their country's climate commitments. NDBs, which have played a significant role in financing the immediate response to the COVID-19 crisis, can also contribute to the pursuit of a sustainable recovery as countries recover from the socioeconomic effects of the pandemic.

The significant financing required to address the socioeconomic implications of climate change urges NDBs to support governments in mobilizing national and international resources. Government budgets alone are insufficient to provide financing for the sheer scale of the economic transformation required. Therefore, NDBs will need to expand their sources of funding to include private investors, multilateral development banks, regional development banks, and climate investment funds. Mobilizing financing may become a new responsibility for NDBs and may result in new types of financial instruments to fulfill the goal of marshaling additional capital to finance climate mitigation and adaptation needs.

2. Climate Change Implications for the Financial Sector



2.1. Introduction

The chapter explains how climate change can negatively affect the performance of financial institutions. It describes the two primary sources of risk associated with climate change—physical and transitional—and provides examples of how they drive financial risks. It also discusses the interconnectedness of climate change and environmental degradation and the associated financial risks.

2.2. Key Take-Aways



Climate change is a source of financial risk that can stem from two primary sources: physical and transitional. Physical risks can arise from climate and weather-related events (e.g., droughts or floods) and are referred to as acute physical risks. They can also occur as a result of progressive (chronic) shifts in climate and weather patterns (e.g., increasing mean temperatures). Transitional risks can stem from policy, technological, and market changes resulting from the shift to a low-carbon, climate-resilient economy.



Physical and transitional risks directly and indirectly drive conventional financial risk categories: credit, market, operations, and liquidity. The exposure of most financial institutions is indirect, arising from their clients' and investees' exposures.



There is a link and some overlap between climate and environmental risks since climate change is one of the causes of environmental degradation, which can weaken resilience and thereby increase physical climate risks.



Financial regulators and supervisors have recognized climate change as a source of risk to financial stability. As such, they are taking steps to enhance their understanding of the financial system's exposure and integrating climate into their supervisory and regulatory toolboxes.

2.3. Physical and Transitional Risks of Climate Change

Climate change and society's response to it present risks and opportunities to financial institutions. Climate-related financial risks and opportunities derive from two main sources: physical and transitional.

Physical risks can arise from climate- and weather-related extreme events (acute) or longer-term, progressive shifts in climate and weather patterns (chronic). Examples of acute physical risks include droughts, floods, and storms, which can damage property and infrastructure and disrupt economic activities and trade. Examples of chronic physical risks include increasing mean temperatures, which can affect labor and agricultural productivity as well as consumption and investment preferences (Carney, 2015; NGFS, 2019a,b; TCFD, 2017).

Businesses can experience financial implications of physical risks directly (e.g., damage to assets) and indirectly (e.g., disruption to the business environment). The impacts vary depending on the level of exposure and sensitivity, which are specific to location, type of operation, technology base, and assets. Physical climate risk results from the interaction of climate-related hazards (e.g., hurricane or storm) with the vulnerability and exposure of human and natural systems, including their ability to adapt (IPCC, 2018).²

Transitional risks result from the process of adjusting to a lower-carbon economy, prompted, for example, by changes in policies and laws, technological advances, and adaptations in market sentiment. Table 2.1 provides examples of drivers of transitional risk. For instance, climate-related policies such as carbon pricing mechanisms could lead to unanticipated or premature write-downs of carbon-intensive assets (stranded assets) or to downgrades in the credit ratings of high GHG emitting companies. Write-downs and downgrades could lead to increased market and credit risk for lenders and investors exposed to carbon-intensive companies.

² The IPCC definition of risk is "the potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain." In the context of assessing climate impacts, "risk" is typically used to refer to the potential for adverse consequences of a climate-related hazard. Hazard is defined as "the potential occurrence of a natural or human-induced physical event or trend 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." (IPCC, 2018, Annex I: Glossary).

The nature, speed, and focus of these changes will pose varying degrees of financial, liability, litigation, and reputational risk to organizations, in turn leading to increased credit, market, liquidity, operational, and compliance risks for lenders and investors. For lending institutions, the degree to which transitional risk affects a borrower depends on the borrower’s exposure and sensitivity to the risk, and their capacity to adapt.

Table 2.1. Drivers of Transitional Risk

Drivers	Examples
Changes in policies and laws	<ul style="list-style-type: none"> • Introduction of carbon pricing • Obligations for enhanced reporting of GHG emissions • Mandates on and regulation of existing products and services (e.g., restrictions on coal production and tighter energy efficiency standards) • Exposure to litigation
Technological advances	<ul style="list-style-type: none"> • Replacement of existing products and services with lower GHG emission alternatives • Unsuccessful investment in new technologies • Cost to transition to low-emission technology
Shifts in public sentiment, demand patterns, preferences, and expectations	<ul style="list-style-type: none"> • Changes in (market) trends, financial agents, and consumer preferences • Uncertainty in market signals • Increased costs for raw materials • Stigmatization of a sector
Reputation	<ul style="list-style-type: none"> • Shift in consumer preferences • Increased stakeholder concern and negative feedback • Stigmatization of sector

Source: Authors’ elaboration based on TCFD (2020a) and BBVA (2020).

There is interplay between physical and transitional risks. A delay or inaction in reducing GHG emissions may limit transitional risk but result in increasing climate change and associated physical risks and impacts. Conversely, strong action to reduce GHG emissions may help avoid the worst physical impacts of climate change but could cause significant transitional risks for market participants. This interplay depends on how society’s response to climate change, among the other things, including public policy repositioning and the most timely engagement of the financial sector, will evolve.

While all companies can be exposed to varying degrees of physical and transitional risk, certain industries are particularly sensitive given that they account for the largest proportion of GHG emissions and energy and water usage. The TCFD specifically notes the energy; transportation; materials and buildings; and agriculture, food, and forest products sectors. Financial institutions engaged with these sectors are also therefore vulnerable (Table 2.2).

Table 2.2. Sectors and Industries with the Highest Likelihood of Negative Financial Impact from Climate Change

Energy	Transportation	Materials and Buildings	Agriculture, Food, and Forest Products
<ul style="list-style-type: none"> • Oil and gas • Coal • Electric utilities • Power transmission and distribution 	<ul style="list-style-type: none"> • Air freight • Passenger air transportation • Maritime transportation • Rail transportation • Trucking services • Automobiles and components 	<ul style="list-style-type: none"> • Metals and mining • Chemicals • Construction materials • Capital goods • Real estate management and development 	<ul style="list-style-type: none"> • Primary agriculture • Beverages • Packaged foods and meats • Paper and forest products

Source: Authors' elaboration based on TCFD (2017a).

Box 2.1. Latin America and the Caribbean: Agriculture and Climate Change

Many economies in Latin America and Caribbean (LAC) depend on the agriculture and agri-food sector, which accounts for more than 20 percent of gross domestic product (GDP) in most LAC economies when accounting for upstream and downstream activities (OECD/FAO, 2019). Water stress and droughts can negatively affect crop productivity and quality, thereby jeopardizing the livelihoods of farmers and the businesses of agri-corporations. This sector employed 14.1 percent of the total labor force in LAC in 2018 and thus is especially important to livelihoods in the region (OECD/FAO, 2019). According to the World Bank, countries such as Bolivia, Ecuador, Guatemala, Honduras, Haiti, Guatemala, Nicaragua, and Peru have more than a quarter of their labor force in the agricultural sector (World Bank, 2019). The physical risks of climate change can pose a significant threat to the livelihoods of these populations and consequently create adverse national and economic losses. For example, the expected losses to Brazil's agricultural sector are between R\$7.4 billion and R\$14 billion (US\$1.4 billion and US\$2.6 billion) annually between 2020 and 2070 (Itaú Asset Management, nd) if a significant climate response is not mounted, showing that combatting climate change is urgent and essential.

At the same time, agriculture's contribution to GHG emissions can be as high as 75 percent in some Latin American countries such as Uruguay (OECD/FAO, 2019). Massive changes in water efficiency and drought resistance technology are expected. These changes will provide opportunities for NDBs and the financial sector to facilitate access to credit for companies developing new, climate-smart agriculture technologies and practices to increase productivity and reduce GHG emissions in the agriculture sector.

2.4. Climate Risk Is Financial Risk

Box 2.2. Carbon Pricing as a Transitional Risk

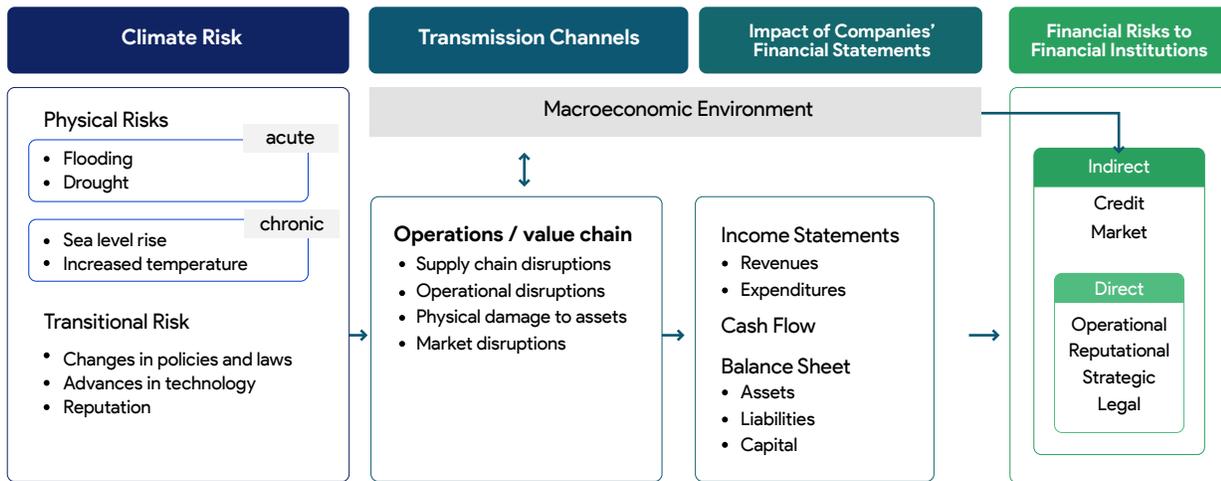
Introducing mechanisms for carbon pricing is an example of transitional risk because it could trigger fluctuations in investment trends, changes in financial valuations, changes in credit ratings, and consequent negative effects on financial institutions particularly exposed to carbon-intensive industries. While this may suggest postponing a policy change like carbon pricing, the longer countries delay in taking adequate action on climate change, the worse the losses arising from transitional risk will be because postponed actions are forecast to bring about abrupt change in the future (IEA, 2018; NFGS, 2020a).

Financial institutions are exposed to physical and transitional risks and opportunities through their lending and other financial intermediary activities, and through their own operations TCFD (2017b). Climate change drives existing financial risk, particularly credit, market, operational, and liquidity risks.³

Climate risk translates into financial risk to financial institutions directly and indirectly (Figure 2.1). For example, damage to a financial institution's buildings due to an extreme weather event would directly affect its operations. On the other hand, disruption of a corporate client's operations would negatively affect its revenue and expenditures, and assets and liabilities, damaging its creditworthiness and capacity to service its debt, thereby increasing the credit risk of financial institutions engaged with the company (Hubert, Evain, and Nicol, 2018).

³ Climate-related risks also drive non-Pillar 1 risks such as migration, credit spread, real estate, and strategic risk (ECB, 2020).

Figure 2.1. Climate Risk as Financial Risk



Source: Adapted from NGFS (2020b) and Hubert et al. (2018).

When many clients are in the same situation, the loan portfolios and balance sheets of financial institutions can be severely damaged, particularly if those clients are concentrated in certain sectors or geographic locations. Banks with credit exposure to vulnerable sectors such as agriculture are susceptible to climate-related financial risks on both the asset and liability side of their balance sheets because primary agriculture production can be affected by multiple climate variables, including temperature, precipitation, droughts, and windstorms. The same applies for banks lending to the real estate sector in coastal areas prone to flooding or storms.⁴ Such extreme events may result in damages and losses, which, if uninsured, can result in impairments of asset values and reduce the value of collateral held by financial institutions, in turn increasing credit risk (NGFS, 2020c).

Box 2.3 presents additional examples of how climate change directly or indirectly exposes financial institutions to various risks.

Box 2.3. Examples of Financial Risks Arising from Climate Change

Credit risk: Wildfires can destroy infrastructure and buildings, resulting in business disruptions, increased costs, reduced revenues, and impairment of collateral for affected businesses, potentially increasing the probability of default on a bank loan. Credit portfolio concentration in affected geographic areas can significantly affect a financial institutions' performance (NGFS, 2020a).

⁴ The climate vulnerability profile of real estate assets depends on building type and asset exposure to climate-related hazards.

Operational risk: Hurricane damage could affect a financial institution's business continuity, with bank branches located in flood zones potentially seeing an increase in costs for insurance and maintenance, for example.

Reputational risk: Changes in public sentiment about carbon-intensive sectors (e.g., oil and gas) and increased scrutiny of the banking sector's response to climate change could damage the reputation of a financial institution financing companies in such a sector. Financing, for example, oil and gas companies is considered contributing to climate change.

Legal risk: A financial institution could face litigation or liability charges from parties seeking to recover losses from damage due to climate risk, alleging negligence in managing and disclosing climate-related risks.

Climate change requires financial institutions to re-evaluate their risk concepts, management frameworks, asset valuation methodologies, and business strategies. It is therefore crucial for financial institutions to understand and manage the climate-related risks to which they might be exposed and their materiality. Equally, financial institutions must understand how to turn such risks into business opportunities by directing capital to activities contributing to climate change goals.

2.5. Environmental and Climate Risks

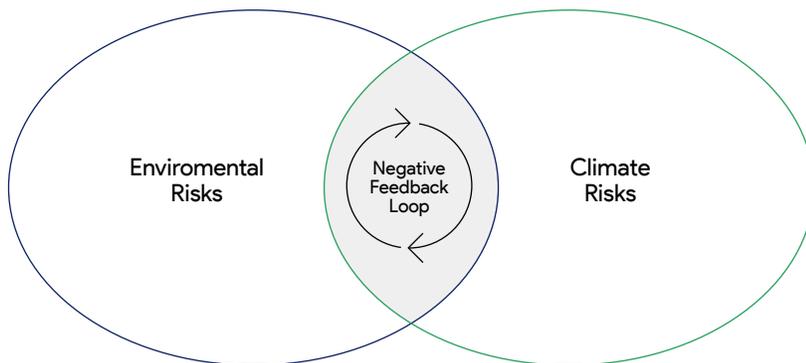
Environmental risks are “financial risks posed by the exposure of financial institutions and/or the financial sector to activities that may potentially cause or be affected by environmental degradation (such as air pollution, water pollution and scarcity of fresh water, land contamination and desertification, biodiversity loss, and deforestation) and the loss of ecosystem services” (NGFS, 2020a). Biodiversity loss, for instance, could undermine the activities of businesses in specific contexts and drive up financial risk for those financial institutions exposed to those businesses. Considering more than half the world's GDP is moderately or highly dependent on nature, the potential financial risks associated with environmental degradation and biodiversity loss can be significant. Existing estimates of annual losses from continued degradation of ecosystem services are at least US\$479 billion per year (UNEP et al., 2020).

Climate and environmental risk are linked and, to some degree, overlap because climate change leads to environmental degradation. Increasing temperatures at or beyond 1.5°C above pre-industrial levels are projected to significantly negatively impact biodiversity and ecosystems, thereby leading to greater environmental risks (e.g., see IPCC, 2018, 2019).

Human activities also lead to environmental degradation, driving climate change. For example, humans clear forests (deforestation), releasing the carbon trees store into the atmosphere, which is a key contributor to climate change.

The combined effect of environmental degradation and climate change will have an even greater adverse impact on biodiversity and ecosystems because they reinforce each other through a negative feedback loop (NGFS, 2020a), as shown in Figure 2.2.

Figure 2.2. Environmental and Climate Risks



Source: Authors' elaboration.

The potential impacts of climate change and environmental degradation on the financial sector means that financial institutions need to factor such risks into capital pricing and allocation decisions. It is necessary for financial institutions to adequately identify and evaluate the climate and environmental risks to which they are exposed through their lending and other financial intermediary activities. Integrating environmental and social risk factors into credit decisions and capital allocation can enhance the overall quality of financial assets. Research suggests that banks with a higher ratio of green lending have a lower nonperforming loan ratio because environmental performance of borrowers influences their credit risks and ultimately can be a significant credit risk indicator (Cui, Geobey, Weber, et al., 2018).

3. Climate Risk and National Development Banks



3.1. Introduction

All financial institutions should understand and prepare for the risks associated with climate change. Risks are evident today and will likely worsen in the medium and long term. National development banks (NDBs) are not immune to climate-related risks and their associated impacts and may experience some more acutely than commercial banks because of their mandate and ownership, which are the two main attributes that distinguish NDBs from commercial financial institutions. NDBs are tasked to deliver a particular public policy mandate by virtue of their government ownership or backing. Generally, NDBs' policy mandates fall into two categories: narrow, specific mandates that explicitly reference a particular sector or type of customer or activity, or broad mandates focused on general promotion of economic and social objectives.

This chapter articulates why it is of utmost relevance for NDBs to act on climate risk (see Box 3.1) and what differentiates the climate risk efforts of NDBs from those undertaken by other financial institutions.

Box 3.1. A Call to Action: Why NDBs Should Consider the Impacts of Climate Risk

NDBs need to systematically identify, assess, and manage climate risk in their own operations, planning, and portfolio management to:

- Fulfill their mandate.
- Support their governments in achieving climate goals and commitments.
- Provide a market signal and build resilient financial systems given their unique position in local, regional, and national financial communities.
- Gain access to funding from a variety of sources given that international investors and financiers are increasingly aware of and calling for climate risk management.

3.2. Key Take-Aways



For NDBs, identifying, assessing, managing, and monitoring climate-related risks is key to fulfilling their mandate, supporting their governments in achieving climate goals and commitments, and contributing to building the resilience of their countries' financial systems.



How NDBs manage climate risks is relevant for gaining access to funding from international investors and financiers, which are increasingly aware of and calling for climate risk management.



The extent of climate risks facing an NDB depends on its individual characteristics, including portfolio allocation and context of operation.



NDBs in Latin America and the Caribbean (LAC) have played a significant role in financing the roll out of clean technologies and building socioeconomic resilience. The transition to a low-carbon, climate-resilient economy brings about new financing opportunities for NDBs.



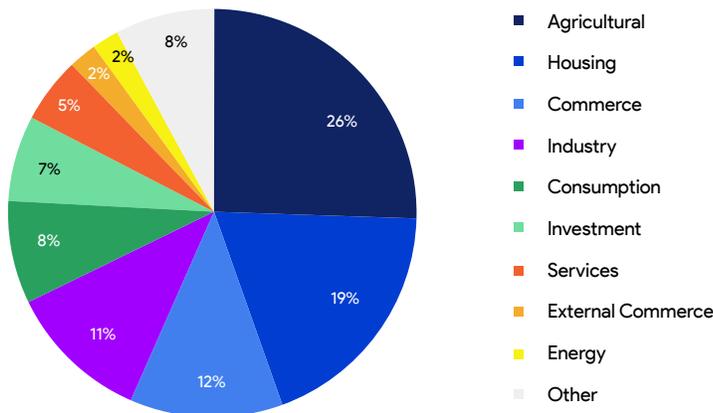
NDBs can mobilize a greater volume of capital toward the transition by engaging their clients and stakeholders in implementing the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD), disclosing climate-related financial risks and offering customized products and services.

3.3. Climate Risk and National Development Banks

In LAC, NDBs play a critical role in supporting public policies for economic development. The LAC region has 72 active NDBs in 19 countries and through a network of 78,850 branches can reach a population of 880 million people in urban, rural, and otherwise unbanked regions. In 2014, the assets of this group of NDBs were worth US\$1.7 trillion and accounted for 29 percent of the gross domestic product (GDP) of the LAC region. The total credit portfolio of NDBs in LAC is valued at US\$964 billion (ALIDE, 2018).

In the past two decades, NDBs in LAC have been key players in their nations’ financial systems. NDBs have traditionally targeted economic areas critical to the region’s development (see Figure 3.1; ALIDE, 2018).

Figure 3.1. Overall Investment Portfolio of 72 National Development Banks in Latin America and the Caribbean



Source: Authors’ elaboration based on ALIDE (2018).

NDBs can make deals and crowd in private lenders and investors by taking on risk. It is crucial for NDBs to identify, assess, and manage the full scope of the risks and opportunities they face from climate change given the size of their overall assets, their strategic importance to key sectors, and their role in contributing to national and regional growth.

NDBs have specific characteristics that distinguish them from private sector financial institutions that need to be considered when discussing climate risk. As discussed below, characteristics include their mandate, their support of government in achieving climate goals and commitments, their part in building the resilience of their countries' financial systems, and their access to a variety of funding sources.

3.3.1. Mandate

A key feature of NDBs is their role in filling market gaps and overcoming market failures. Market gaps can result from temporary shocks such as the global financial crisis of 2008–09 and the global pandemic of 2020–21. They can also be systemic. For example, micro, small, and medium-sized enterprises (MSMEs) are underserved by the commercial financial sector because of higher transaction costs. Market gaps can be a consequence of the private sector lacking information or being risk averse.

NDBs may focus on market segments that are deemed to be in the country's economic interest but have not yet been proven viable, such as the bioeconomy. They can play a countercyclical role during economic downturns and a catalytic role, leading the way for commercial financial institutions.

Sitting at the nexus of public policy and the financial sector, NDBs have a responsibility to address market failures, such as those relating to the need for more green investments and to shift capital flows toward a lower-carbon, climate-resilient economic structure. Practically, this means NDBs need to be sharply aware of the trade-offs in capital allocation between projects, which can be done using appropriate risk management measures, giving more value to green transactions through a system of ex ante assessment of climate impact and benefit.

With the mounting physical and transitional risks facing the financial sector, NDBs must undertake a closer examination of their portfolios to better manage their asset allocation.

As a result of their mandates, many NDBs inherently have high exposure to certain climate-sensitive sectors, such as agriculture and infrastructure. For example, Mexico's NDB (*Nacional Financiera*, NAFIN) has high investment portfolio exposure to climate-related transitional risk due to the 2014 financial reforms that mandated that it finance underserved sectors, specifically energy, oil and gas, and infrastructure (Bravo, 2019). NAFIN's portfolio includes loans to parties perceived by the commercial sector to be higher risk, demonstrating the fulfillment of its national developmental role.

This reality is heightened in countries that rely on scarce resources or in smaller economies that are more vulnerable and less resilient to the impacts of climate change (Kamins, Hidalgo, Stenek, et al., 2011). If the commercial sector retreats from certain sectors, NDBs may be asked to make up decreased investment flow. Thus, early action in identifying, assessing, and managing climate risk will allow NDBs to manage their exposure. Inadequate consideration of climate risk may undermine an NDB's ability to achieve its policy mandate.

3.3.2. Structural Characteristics

Some NDBs have structural characteristics that make it particularly important for them to understand, measure, and manage the climate risks and opportunities they are faced with.

Smaller asset base: While some NDBs have a significant share of the market, others have relatively small asset bases. Smaller operations may be more agile in terms of redirecting their strategy in light of climate risk, but their size may also make them more vulnerable than larger NDBs considering the added risks of less diversification, more concentration.

Sectoral obligations: Some NDBs serve only one sector because of their enabling legislation or policy mandate. These NDBs are vulnerable to the climate risk that accompanies that sector (e.g., the unique climate change issues in the agricultural sector); however, their greater insight into the specific sector may help them support the sector as it transitions to a low-carbon, climate-resilient economy. For example, NDBs with an agriculture-focused mandate may find opportunities to finance climate-smart agricultural technologies.

Client size: Many NDBs are mandated to support MSMEs, which are particularly sensitive to climate change given the inadequacy of their capital buffers and capacity to adjust their strategies and business plans. NDBs can play a critical role in supporting MSME clients by financing energy efficiency projects to reduce energy costs. NDBs can also provide technical assistance for feasibility studies or pre-investment assessments (e.g., environmental impact assessments) for energy saving or renewable energy investments to overcome the barriers and high upfront costs MSMEs face for such projects. (See Case Study 1 for an example.)

Case Study 1. Learning from Success: CORFO

In 2005, Chile's Corporation for the Promotion of Production (*Corporación de Fomento de la Producción*, CORFO) established two programs to support energy efficiency and renewable energy.

The Energy Efficiency Pre-investment Program supports small and medium enterprises (SMEs) to optimize energy consumption and reduce energy costs. CORFO co-financed studies and consultancy services to identify various energy saving investments for SMEs. The program provides up to 70 percent of the total cost of the consultancy, with a limit of about US\$10,000.

The Non-conventional Renewable Energy (NCRE) program supports energy generation projects by subsidizing preliminary investment studies and specialized assessments up to 50 percent of their total costs, to a maximum of US\$60,000, and up to 2 percent of the estimated total project investment. The program has subsidized up to 50 percent of the costs for advance studies for electricity connection and environmental impact assessments, up to 5 percent of the estimated total project investment. Between 2005 and 2009, a total of 217 wind, biomass, biogas, geothermal, and small-scale hydroelectric projects benefited from this support (IEA/IRENA, 2014). Between 2008 and 2010, the National Energy Commission and the Ministry of Energy transferred US\$2 million to CORFO to continue the program. In 2008, Germany's development bank, *Kreditanstalt für Wiederaufbau* (KfW), provided a €85 million loan to finance NCRE projects with credit facilities and concessional interest rates. The program financed 19 projects.

Since 2012, CORFO's Renewables Energy Center has developed two new programs to subsidize pre-investment studies of NCRE projects up to 40 percent of the total study costs with a cap of US\$36,000. To date, a total of 30 projects (5 biogas, 1 biomass, 13 wind, 4 photovoltaic, and 7 mini-hydro) have been financed and 78 studies have received support for about US\$726,000 (CLP\$542 million) (IEA/IRENA, 2014).

Long-term financing: Many NDBs that engage in long-term financing face a higher risk of being exposed to physical and transitional risks since the level of uncertainty increases with time. Long-term financing plays a vital role in the transition to a low-carbon, climate-resilient economy, including financing for local climate-smart infrastructure assets. NDBs can help mobilize the financing required and narrow the gap in climate-smart infrastructure investments. (See Case Study 2 for an example).

Case Study 2. Learning from Success: Inter-American Development Bank and Bancoldex

Through local financial intermediaries, the Inter-American Development Bank (IDB) supported Bancoldex, the Colombian Bank for External Commerce, in preparing a program to finance innovative, low-carbon public transport technologies in Bogota, the capital of Colombia.

Bogota's sophisticated bus rapid transit system transports more than 4 million people per day. Most buses run on diesel, contributing to GHG emissions. Concessionary firms are not obliged to invest in electric and hybrid bus technologies, which are perceived to be risky and have high upfront costs, especially for the battery system, which represents at least 50 percent of total costs. Furthermore, there is a lack of multiple clean bus technology providers with local after-sales maintenance service. Local repair shops have been reluctant to shift to newer technology, develop new expertise, and establish new relationships to import spare parts.

The total investment in hybrid and electric buses was at least US\$80 million, with loan resources of US\$40 million from the Clean Technology Fund channeled through the IDB to Bancoldex and the remainder from commercial investors. The loan resources have a tenor of 40 years, a 10-year grace period, and a 48-month disbursement period. Sub-loan conditions have tenors up to 12 years, a grace period of up to 36 months, and an average financing rate that is lower than or equal to the fixed-term deposit market or inter-bank rate. Final interest rates are negotiated between the ultimate beneficiary and the lender.

To date, the project has financed the conversion of 180 buses to hybrid technology, each with capacity for 80 passengers. An additional 160 buses were funded outside the program. The bus systems were mostly manufactured in China, illustrating the enormous opportunity to finance technology transfer with green finance projects.

Second-tier lending: Many NDBs are second-tier lenders, meaning they have less influence over and insight into the activities of the end client. It can also mean they have an in-depth understanding of the local financial sector and may be able to champion the promotion of climate risk assessment to this community. In working closely with local financial institutions, NDBs can offer technical assistance, promote disclosure, and provide climate risk management or advisory services to support on-lending institutions in transitioning to a low-carbon, climate-resilient economy. Case Study 3 shows the use of guarantee solutions to mobilize local commercial capital for renewable energy.

Case Study 3. Learning from Success: FIRA

Mexico's Trust Established in Relation to Agriculture (*Fideicomisos Instituidos en Relación con la Agricultura*, FIRA), a second-tier development bank, has historically acted as a risk taker. FIRA offers long-term financing, training, technical assistance, and technology-transfer support to help SMEs and larger enterprises implement projects in the agribusiness sectors: livestock, fishing, forestry, and related industries. FIRA offers guarantee products to local first-tier financial institutions to share lending risk. This guarantee mechanism facilitates access to credit for local commercial investors.

In 2011, FIRA and the Mexican Ministry of Agriculture, Livestock, Rural Development, Fisheries, and Food (*Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación*, SAGARPA) created a loan guarantee fund, FONAGA Verde. FIRA operates the fund within the National Strategy for Energy Transition and Sustainable Use of Energy. FONAGA Verde is a loan guarantee program that covers first loss credit defaults in renewable energy and biofuel generation projects. With an initial capital base of US\$18 million (MXN249.5 million) from the Energy Transition and Sustainable Use of Energy Fund, FONAGA Verde operates through reserves classified by type of local financial institution and credit quality. It covers about 14 percent of short-term working capital loans and 20 percent of long-term fixed investments. The maximum amount of the guarantee reserve per project is 10 percent of the fund's initial capital base. Each project has a guarantee reserve of up to US\$1.8 million (MXN23 million), which allows FIRA to diversify its portfolio and maximize the number of beneficiaries.

Eligible projects include biodigester systems, cogeneration, solar thermal and photovoltaic systems, wind energy, small hydro, production of bio-energy crops, pilot plants for biofuel production, and any project that invest in new technologies that generate or use renewable energy and/or biofuels. Between 2010 and 2011, FIRA managed the FONAGA Verde program and supported projects throughout Mexico with more than US\$1.4 million in guarantees and total direct investment in renewables and biofuels of US\$11.2 million. All guaranteed projects received FIRA loans, with an average value of US\$490,000 (Smallridge, Buchner, Trabacchi, et al., 2013).

This case study illustrates how a second-tier NDB can leverage its position within the financial system and public policy to advance and operationalize national climate and energy goals, working with local financial institutions and offering green de-risking products such as guarantees to renewable energy projects.

3.4. Playing a Role in the Transition to a Low-Carbon, Climate-Resilient Economy

NDBs are uniquely positioned to act on climate risk because they sit at the nexus of key actors within the national economy and financial sector (Smallridge and de Olloqui, 2011). Several sources estimate that the total expected capital requirement to achieve such a transition in the LAC region is beyond US\$250 billion per year, almost double the share of GDP currently spent by the public sector. Achieving LAC's Nationally Determined Contributions (NDCs) is estimated to require at least US\$27 billion annually until 2030 (Cabré, Gallagher, Li, 2018; IFC, 2016).

Case study 4 shows an example of an innovative financial mechanism developed by COFIDE to support the transition to a low-carbon economy through lower-carbon transport.

Case Study 4. Learning from Success: COFIDE

Peru's national development bank (*Corporación Financiera de Desarrollo*, COFIDE) developed the COFIGAS program to provide technology and financing to convert taxis and buses in Lima to natural gas.

The program employs an innovative financing mechanism for the vehicles. Instead of repaying capital and interest in monthly installments, payments are made every time the vehicles are refilled at the gas pump. This innovative mechanism allows vehicle owners to acquire new technology, spreading the high upfront costs over a period of time while benefiting from lower operational costs. The program uses an existing secure payment platform, which improves the credit risk of individual loans, reduces transaction costs, and allows wide-scale deployment. By 2012, the program had financed the conversion of 100,000 taxis and 572 buses with 135 supporting gas stations. It created 7,000 direct jobs through 420 new commercial enterprises and generated US\$1.9 billion in fuel savings. Further, the program reduced GHG emissions by 1 million tonnes of carbon dioxide equivalent.

Several sub-national entities from the Dominican Republic and Mexico, for example, have asked COFIDE to share best practices so they can potentially replicate and scale-up the program.

The need is significant. LAC countries have historically underinvested in economic and social infrastructure relative to national needs and face fiscal constraints to scale-up investment using public resources alone. Between 2008 and 2015, on average, LAC countries⁵ invested 2.4 percent of the region's GDP in infrastructure, for a total of US\$975 billion or US\$122 billion annually. The majority was invested in transport (42 percent) and energy infrastructure (39 percent), with the remainder in water (11 percent) and telecommunication infrastructure (8 percent). According to InfraLatam,⁶ in 2018, the average share of public investment participation was 60 percent (IDB, 2018).

Infrastructure investment needs between 2016 and 2030 amount to 5.2 percent of the region's GDP (total of US\$274 billion) (Estache, Serebrisky, and Wren-Lewis, 2015; IMF, 2018). If LAC's regional infrastructure spending continues its historical path, the total investment gap to fulfill infrastructure and climate change needs will equal about US\$150 billion annually or about 2.8 percent of LAC's GDP. Investment volume of about 1 percent of LAC's GDP is required to address climate change adaptation and mitigation or an estimated US\$17 billion to US\$27 billion annually (Vergara, Alatorre, and Alves, 2013).

Green finance and investment in sustainable infrastructure can alleviate the risk of embedding carbon in infrastructure in the long term. If this risk is not mitigated, carbon lock-in and stranded assets would result (CERES, 2016; Mercer, 2015; Baron and Fischer, 2015). Stranded assets are investments that, because of material and regulatory risks, are unable to earn economic returns before the end of their economic life. Financing green technology and sustainable infrastructure aims to avoid these risks (IDBG, 2018). NDBs can leverage their position and resources to help achieve these climate goals and align their investment strategies with the NDCs. By financing climate-smart infrastructure, NDBs have the opportunity to bridge the sustainable infrastructure finance gap.

Green finance includes financing renewable energy, energy efficiency, and low-carbon transport. NDBs are responsible for about 6 percent of all green investments in LAC, of a total of US\$10 billion in green finance annually in the region (Abramskiehn, Hallmeyer, Trabacchi, et al., 2017; IDFC, 2018; Smallridge, Buchner, Trabacchi, et al., 2013).

⁵ Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Trinidad and Tobago, and Uruguay.

⁶ Economic Infrastructure Investment Data in Latin America and the Caribbean.

Several LAC NDBs have become leaders and innovators in structuring financial strategies for green investments in their own countries and on the global scale. An example is shown in Case Study 5.

Box 3.2. Green Finance

Green finance is the provision of medium- to long-term debt, capital, grant instruments, and technical assistance to support countries in diversifying their economies toward a low-carbon development path, to finance long-term productive investments, to diversify sources of capital, and to develop the technical capacity of local stakeholders.

The IDB, with its long-standing relationship of more than 40 years with NDBs, has recently increased its green financing.* Between 2008 and 2018, the IDB's total green finance lending to NDBs was US\$2.1 billion, including technical assistance for 59 green projects and loan operations with 39 NDB partners.

The projects address challenges to green finance, including the lack of capacity for private and public stakeholders, lack of medium- to long-term financial resources and adequate financial instruments, lack of contingent financial tools for disasters, lack of environmental and social risk management systems, and lack of capacity and methodologies to monitor results.

* The IDB's average share of total official development assistance is 8 percent (ECLAC, OECD, and CAF, 2016). As of 2016, the IDB's subscribed Ordinary Capital was US\$171 billion (IDB, 2018).

Case Study 5. Learning from Success: Bancoldex

Bancoldex Capital provides equity capital to address the market gap for venture capital and private equity in Colombia. Under the Capital program, Bancoldex invests in funds rather than directly in companies or projects.

Between 2012 and 2016, the program had made eight investments for a total of US\$31.6 million, reaching 56 companies and mobilizing commercial capital of more than US\$330 million, a mobilizing factor of 11 (Botero and Melo, 2016).

The program invested in Progres Capital, a small venture capital fund of US\$20 million based in Medellín. Progres focuses on high growth-potential companies and provides individual investments ranging from US\$500,000 to US\$2 million. In 2011, Progres invested US\$416,000 in Hybrytec, a designer, retailer, and installer of photovoltaic energy systems founded in 2007. The Sustainable Equity Fund of ECOS, a sustainable development consultancy headquartered in Switzerland, was the co-investor. Hybrytec has provided energy installations for clients that are too remote to connect to Colombia's power grid or have unstable access to electricity, including hospitals and schools.

A solar-powered refrigeration system installed in an isolated fishing community enabled the community's 1,500 residents to more effectively store and sell their catch. Among other contributions, Progresa helped Hybrytec establish a five-member board of directors, including an independent member who was an expert in the photovoltaic power industry. Progresa exited its investment in March 2014 with an investment return of 1.67 times.

3.4.1. Financing Opportunities

An NDB that understands and identifies the impact of climate risk on its loan book, client base, and financed projects is better able to capture resulting opportunities and strengthen its resilience to climate change. As highlighted in the previous section, there is unprecedented need to finance the transition to a low-carbon, climate-resilient global economy. This means financing new green technology and projects but also supporting clients through the transition. Clients may need to find new or different suppliers, adjust their production processes for energy efficiency, find new markets, or even rethink their logistics altogether to weather the transition—actions that may require financing or some other form of support from an NDB.

On the green side, NDBs may find themselves focusing on clients that are climate-resilient, offering innovative solutions to clients whose technology or processes are in high demand, or taking on riskier clients who are at the cutting edge of new climate technologies. For many NDBs, these efforts to finance green technologies, clients, and projects are already underway. Among the NDBs interviewed for this guidebook, many have captured or began capturing the opportunities stemming from climate change by focusing on offering green finance products and issuing green bonds.⁷

Case Study 6 provides an example of access to international capital markets for LAC NDBs through green bonds to mobilize capital in support of the transition to a low-carbon, climate-resilient economy.

⁷ We do not discuss green banks specifically in this paper. For a detailed discussion see Smallridge et al. (2013).

Case Study 6. Learning from Success: Green Bonds

The IDB has supported NDBs in raising commercial funds at adequate maturities in both local and international capital markets by issuing green or sustainable bonds. Green bonds can provide dedicated funding to climate change mitigation, adaptation, and other environmentally friendly projects, small and large scale, with appropriate terms and conditions. They can attract national and foreign institutional and impact investors. Globally, annual green bond issues soared from US\$11 billion in 2013 to more than US\$150 billion in 2017.

The IDB supported five NDBs in each phase of issuing green bonds tailored to their clients. The total aggregate issuance volume was roughly US\$192 million. The phases included identifying the eligible sustainable portfolio, developing evaluation and monitoring methodologies, structuring the bond, preparing the framework, getting an independent second party opinion and certification when relevant, and promoting the issuance, including through roadshows.

In 2017, Bancoldex issued its first green bond, the first to be listed on the Colombian Stock Exchange, for US\$67 million with an oversubscription factor of 2.5. FIRA issued a green bond for US\$125 million in 2018. The IDB is currently working on additional green bond issuances for green infrastructure and SME financing with NDBs in Argentina, Brazil, Colombia, and Ecuador.

3.4.2. Enhanced Access to Sources of Finance

Many of the NDBs in LAC have captured the opportunities that arise from the climate change agenda, such as issuing green bonds and financing green and climate-resilient projects, technologies, and businesses, with the support of multilateral climate funds and development finance institutions.

To enhance their access to external sources of climate finance, they may also have sought accreditation from the Green Climate Fund (GCF). Through its accreditation process, the GCF assesses entities' policies and procedures, as well as their track record and demonstrated capacity to manage resources in line with the GCF's fiduciary standards. The GCF also assesses entities' ability to manage environmental and social risks that may arise at the project level, among other criteria such as the ability to implement its gender policy. While the process may be complex, it can help NDBs improve governance regarding climate change and have a positive effect on their reputation. Further, the GCF provides concessional funding that NDBs can take advantage of, as well technical assistance to de-risk investments and allow NDBs to invest in new markets.

For NDBs, like other businesses, strengthening their resilience to climate risk should enhance their access to funding sources. Implementing the TCFD recommendations enhances an NDB's attractiveness to international investors and financiers. The implementation process builds appropriate internal capacity for climate-related risk management, credit processes, data collection, and gap identification, while fulfilling the disclosure expectations of the TCFD. Integrating climate risk and aspiring to follow the TCFD's terms positions an NDB as a future-oriented organization. As lenders to and investors in NDBs, multilateral development banks (MDBs) are increasingly aware of the risks of climate change and its adverse impact on debt repayment, asset valuation, and equity. MDBs are seeking better information on how financial institutions are planning for these risks in order to make their own informed investment and lending decisions (Kamins, Hidalgo, Stenek, et al., 2011). As national and international investors and financiers are increasingly recognizing climate change as an investment risk and a strategic opportunity, they are steering their loan books to finance activities and institutions aligned with the transition to a low-carbon, climate-resilient economy. The reassessment of risk and asset values in light of climate-related physical and transitional risks will drive capital allocation. Investors and stakeholders are increasingly seeking information on how companies are planning for and managing climate-related risks and opportunities through disclosure frameworks such as the one provided by the TCFD.

Case Study 7 is an example of NDBs in Argentina, El Salvador, and Paraguay leveraging access to international public climate funding through the GCF.

Case Study 7. Learning from Success: GCF and NDBs

In 2015, the IDB conducted a capacity building conference in Mexico to inform NDBs about the possibility of accessing international funding from the GCF. By 2018, the IDB and NDBs from Argentina, El Salvador, and Paraguay received approval for individual financing lines and technical assistance grants.

The GCF's public sector sovereign guarantee provides a tenor of 20 years and an annual interest rate of 0.75 percent plus an average of 0.5 percent in additional annual fees. Sub-loans are made to small- and medium-sized borrowers through local financial institutions that receive funding from NDBs. The following is information about a project from each country:

- Argentina: Biomass, Biogas, and Energy Efficiency for SMEs
 - Project Size: US\$163 million
 - GCF: US\$100 million
 - BICE*: US\$60 million
 - GCF Grant: US\$3 million

- El Salvador: Energy Efficiency for SMEs
 - Project Size: US\$41.7 million
 - GCF: US\$20 million
 - BANDESAL*: US\$20 million
 - GCF Grant: US\$1.7 million

- Paraguay: Energy Efficiency for SMEs
 - Project Size: US\$43 million
 - GCF: US\$20 million
 - AFD*: US\$20 million
 - GCF Grant: US\$3 million

All three projects will use a nationally adapted version of Energy Savings Insurance (ESI), an innovative mechanism that addresses the financial and non-financial barriers to energy efficiency investments by SMEs, including air-conditioning equipment, refrigeration chambers, electric motors, electric drying equipment, and electric boilers. The technical assistance program, financed by grant resources, develops a pipeline of bankable projects, produces a standard performance contract for energy efficiency projects and standardized energy efficiency methodologies to monitor implementation, and third-party insurance to cover the second loss if energy savings are not realized as projected. The technical assistance builds capacity for new projects and facilitates sustainable financing and ultimately renewable energy and energy efficiency investment.

The ESI mechanism is an integrated strategy that builds trust in the market between SME borrowers, technology providers, and local financial institutions. The financing lines allow each of the three NDBs to provide long-term financing to the local financial institutions, which subsequently finance eligible projects. The mechanism depends on the quality of the technology and the post-sale service of technology providers to realize its full potential in LAC and beyond. The potential for energy efficiency in SMEs is between US\$10 billion and US\$100 billion per year (Micale, Stadelmann, and Boni, 2015). The energy efficiency market depends on access to high-quality, efficient equipment either sourced locally or imported, which provides an opportunity for high-quality technology manufacturers to enter, grow, or even produce locally.

* BICE: Banco de Inversión y Comercio Exterior SA or Bank for Investment and Foreign Trade
BANDESAL: Banco de Desarrollo de El Salvador or Development Bank
AFD: Agencia Financiera de Desarrollo or Development Finance Agency

3.4.3. A Leadership Opportunity

Because of their mandate and their role in filling market gaps, NDBs can have different climate risk profiles than commercial financial institutions and, therefore, the onus is on NDBs to understand and manage their own climate risk in order to protect their long-term financial sustainability.

As market shapers and risk takers, NDBs play a pivotal role in the economies of their countries. In many cases they are the policy instrument for advancing a country's strategic development and economic issues. With climate change, many NDBs are also aligning their objectives with their respective countries' NDCs. As evident from interviews with NDBs in LAC, a number have been asked to play a leading role in fulfilling their country's Paris Agreement commitments by becoming an important climate finance intermediary of global climate funds (Smallridge et al., 2013). NDBs can also contribute to the pursuit of a "green recovery" as countries recuperate from the economic effects of the COVID-19 pandemic.

Through their strong relationship with governments, NDBs can act as a key lever for green banking and entice local financial institutions to integrate climate change considerations across their organizations (GCF, 2019). In the same vein, in their position in the finance value chain, NDBs can develop expertise in climate risk management, transfer the knowledge to their local financial institutions, and encourage the adoption of climate risk management practices. NDBs can also integrate sustainability and climate targets through key performance indicators, balanced scorecards, and other performance incentives. An NDB that is focused on one particular sector may have particular insights to share to develop sector-specific climate policy.

Case Study 8 illustrates a success in unlocking domestic commercial finance with international climate funds.

Case Study 8. Learning from Success: BANDESAL

In 2006, the Development Bank of El Salvador (*Banco de Desarrollo de El Salvador*, BANDESAL) established the Empresa Renovable financing program to promote MSME investments in industrial energy conversion, energy efficiency, renewable energy (mainly solar photovoltaic), and small hydro. Developed and financed with resources provided by KfW, the program supports projects through (i) a grant for technical assistance to increase knowledge and overcome capacity barriers and (ii) a credit line channeled through local financial institutions on preferential terms and conditions to overcome the lack of long-term finance at competitive rates for investment in these sectors.

The grant covers a portion of the costs of feasibility studies and consultancy services for an amount that varies according to the type of intervention supported: up to US\$4,000 for energy conversion and energy efficiency projects, and up to US\$30,000 for renewable energy projects.

Commercial sector applicants cover the remaining costs, contributing at least 25 percent of the costs of energy conservation projects and 50 percent for renewable energy projects. These costs are fully reimbursed to applicants that ultimately request and use the associated credit line. The credit line, which covers up to 80 percent of the total investment, is characterized by a long-term repayment option, with a grace period of up to three years and a competitive interest rate fixed over the entire term of the loan. The fixed interest rate from BANDESAL to local financial institutions is 3.6 percent, and local financial institutions can add a maximum 400 basis point intermediation margin to ensure the competitiveness of the line. Investors can receive complementary guarantees to improve their access to credit through the PROGAPE Guarantee Fund managed by BANDESAL or the Mutual Guarantee Company (*Sociedad de Garantías Recíprocas*, or G&S). Both funds offer credit guarantees under favorable conditions (BANDESAL, 2017).

Between 2010 and 2013, BANDESAL's Empresa Renovable deployed almost US\$11 million in loans and US\$308,408 in technical assistance grants, financing about 70 companies at an average interest rate of 7–8 percent, which is 1–2 percent lower than the average market rate and fixed at mid- and long-term rates as opposed to market rate. This initiative mobilized about US\$6 million in commercial investments. Households recently became eligible for the program for investments in renewable energy or energy efficiency (i.e., to use solar energy for domestic electrical systems). Broadening the target audience implies enhancing the commercial finance leverage potential of this initiative.

There is global momentum in the financial sector to address climate risk and leverage the investment opportunities. As such, no NDB should consider itself alone in the work that needs to be undertaken nor feel compelled to solve these problems independently. From central banks to stock exchanges to ministries of trade and development, climate change is understood to be a problem to be tackled with *collective action* and an opportunity to pivot the trajectory of our global economy. NDBs that are deeply embedded in the financial ecosystem of the communities they serve can use this opportunity to address new market gaps and mobilize financing for new sectors that are aligned with the transition to a low-carbon, climate-resilient economy. Collaborative efforts across this network will bring about a higher level of success than many one-off actions, reflecting the systemic and interconnected nature of the problem. Chapter 4 provides a road map for NDBs in their efforts to address climate risk.

Case Study 9 is an example of the IDB's support for NDBs to develop green finance strategies to leverage local commercial investment through a blended finance mechanism.

Case Study 9. Learning from Success: Blended Finance

The IDB supported Mexico's Federal Mortgage Society (*Sociedad Hipotecaria Federal*, SHF) in a successful three-way collaboration between the IDB, SHF, and KfW to develop a financial strategy for energy-efficient, low-income housing. By June 2018, the program had financed 55,312 energy-efficient EcoCasas, benefited 216,000 people in 22 Mexican states, and mitigated 1.76 million tons of CO₂ (Barbosa, 2018). The program exceeded its goals three years early for the EcoCasa I standard and six years early for the EcoCasa II standard. Total project resources of US\$396.16 million consisted of US\$49.5 million in concessional financing from the Clean Technology Fund, US\$245.09 million from KfW, US\$80 million in loan resources from the IDB, US\$11.3 million from the NAMA Facility, and US\$8 million from the Latin American Investment Facility. The total expected investment is US\$1 billion. The blending of these various funding sources increased the production and supply of mortgages for low-carbon housing via adequate financing terms. Beyond providing loan resources, the program supported SHF in strategy development and implementation. The plan allowed SHF to build strong ties with the National Housing Commission (CONAVI), the Mexican Federal Institute for Workers Housing (INFONAVIT), and housing developers. These ties allowed SHF to scale-up its projected low-carbon housing program to help fill annual demand for 0.6 million additional new housing units.

NDBs can take advantage of blended financing instruments to support the transition to a low-carbon, climate-resilient economy by increasing the supply and mobilizing financing for green projects.

4.1. Introduction

This chapter provides national development banks (NDBs) a roadmap to integrate climate-related risks and opportunities into their decision-making. The roadmap is structured along the four pillars of the 11 Task Force on Climate-Related Financial Disclosures (TCFD) recommendations: governance, strategy, risk management, and metrics and targets (see Figure 4.1). Table 4.1 summarizes the key activities suggested for NDBs embarking on their climate risk journey. The activities were developed following the guidance provided by the Bank of England’s Prudential Regulatory Authority, the European Central Bank, and the Bank of France. They also consider the World Economic Forum’s principles for setting up effective climate governance on corporate boards and relevant insights from the Sustainability Accounting Standards Board (SASB) and Carbon Disclosure Project.

The actions to be taken by each NDB would depend on its level of maturity regarding climate-related risks; the nature, scale, and complexity of its business operations; and the context of its operations. The goal is that each NDB can use this roadmap to develop an action plan based on its current position and its ambitions for climate action.

To provide evidence of relevant actions already implemented by NDBs in Latin America and the Caribbean (LAC), this chapter presents case studies drawn from interviews with a group of LAC NDBs and a commercial bank, and from the Inter-American Development Bank’s (IDB) long-standing experience and partnership with NDBs in the region.

“Now is the time to ensure that every financial decision takes climate change into account.” Mark Carney, UN Special Envoy on Climate Action and Finance, (former) Governor of the Bank of England (December 2019)

Figure 4.1. Climate Risk Roadmap



Source: Authors' elaboration.

Disclaimer: This Climate Risk Roadmap provides one approach to climate risk integration. However, the four pillars are not intended to be sequential. While integrating climate change into governance is an ideal starting point, other activities can take place in parallel or in a different order than represented here. Each NDB's approach will be unique based on their level of maturity in climate-related risk management.

Table 4.1. Recommendations and Supporting Recommended Disclosures

Governance	Strategy	Risk Management	Metrics and Targets
Disclose the organization's governance in relation to climate-related risks and opportunities.	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	Disclose how the organization identifies, assesses, and manages climate-related risks.	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.
Recommended Disclosures			
Describe the board's oversight of climate-related risks and opportunities.	Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	Describe the organization's processes for identifying and assessing climate-related risks.	Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.
Describe management's role in assessing and managing climate-related risks and opportunities.	Describe the impact of climate-related risks and opportunities on the organization's business, strategy, and financial planning.	Describe the organization's processes for managing climate-related risks.	Disclose Scope 1, Scope 2, and if appropriate, Scope 3 GHG* emissions and the related risks.
	Describe the resilience of the organization's strategy considering different climate-related scenarios, including a 2°C or lower scenario.	Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

Source: Authors' elaboration.
* GHG = greenhouse gas

4.2. Governance

An effective climate governance structure is essential to ensure that an NDB properly assesses climate-related risks and opportunities, makes informed strategic decisions on how to manage those risks and opportunities, and sets and discloses relevant goals and targets. Effective governance should ensure understanding, oversight, and accountability for financial risks stemming from climate change (CFRF, 2020).

Failure to incorporate climate governance and delay in making strategic decisions about managing climate risk could hinder an NDB's ability to effectively achieve its development goals. Therefore, the board's duty is to oversee decision-making related to climate risks and opportunities and ensure that the roles and responsibilities for identifying, assessing, and managing them are duly assigned in the same manner as any other corporate risk faced by an NDB.

Figure 4.2 and the following sections describe the key governance activities of the climate risk roadmap.

Figure 4.2. Summary of Key Activities: Governance



Source: Authors’ elaboration.

1. Secure the board’s commitment to action on climate risks and opportunities.

Securing the support of the board of directors at an early stage is essential for advancing the climate risk rationale and integrating it as a theme across all of the NDB’s operations. To encourage buy-in, the risks to and opportunities for the NDB’s business from climate change must be clearly presented because the board will be accountable in the long term.

Management should seek a commitment from the board that it will work to understand and assess the financial implications of climate change and to address and oversee the risks and opportunities within the firm’s overall strategy and in its risk appetite statement. An NDB’s success in implementing a climate risk program depends on how seriously the issue is taken by its board. To demonstrate commitment and leadership on climate action, the board can commit to publicly supporting the TCFD and implementing its recommendations

The board should regularly be informed about the risks most relevant to the NDB in the short, medium, and long term, including their likelihood and level of severity as well as the potential benefits and opportunities, such as financing interventions in renewable energy or technologies for climate resilience.

A commitment from the board should include defined timelines for integrating climate risk factors into corporate action plans, existing risk management frameworks, annual budgets, financial and investment decision-making processes, and business plans. These deadlines can be set before any strategic action plans (see Section 4.3) are developed. The board should understand the long-term financial risks beyond usual business planning horizons.

2. Create a cross-functional working group to coordinate and influence climate-related decisions and priorities.

Creating a dedicated cross-functional climate risk management working group with the mandate to influence strategic and operational decisions is good practice (see Case Study 10). With representation from relevant departments, such a working group can set the focus and priorities for integrating climate risk and leverage internal expertise (see Case Study 11).

Case Study 10. Learning from Success: Banobras' Multidisciplinary Working Group for Environmental and Social Management

Banobras* created a multidisciplinary working group when it made the decision to develop and implement its environmental and social management system (ESMS). The working group has expertise from various departments, including credit, risk management, legal, finance, and project finance. The group has enabled Banobras in sharing knowledge of environmental and social (E&S) risks across the organization. It receives input from relevant departments on the requirements to fully integrate E&S risks into project financing, particularly for credit and legal risk assessments and mitigation measures. Banobras has received technical assistance and training support from the IDB to enhance its internal capacity to manage E&S risk.

* Banco Nacional de Obras y Servicios Públicos is Mexico's state-owned development bank.

A working group can ensure that all of the organization is aware of climate risks as financial risks and can coordinate the credit, risk, legal, finance, and strategy functions. The group can be responsible for keeping up to date with the latest developments in climate risk activities in peer institutions, commercial banks, and financial regulators regionally, nationally, and globally.

Working group members can arrange to attend workshops, participate in forums and pilots, and leverage partnerships and knowledge sharing platforms. They can be tasked with completing research on climate risk assessment methodologies and periodically update the board and its committees on progress.

Case Study 11. Learning from Success: COFIDE's Eco Committee

COFIDE* created an Eco Committee with members from its administration, marketing, processes, finance, information technology, operations, and business divisions. The committee's goal is to promote efficient management of environmental issues and minimize the bank's negative impact on the environment.

The Eco Committee's role is to identify sources of greenhouse gas (GHG) emissions and propose new solutions to reduce its corporate carbon footprint by 10 percent in 2021. As part of its key activities to measure, record, and offset its corporate carbon footprint, it identifies new opportunities to improve internal efficiencies. As this practice evolves, the committee believes it can become a gateway to account for GHG emissions in its financial projects and investments. The Eco Committee is also responsible for communication and awareness campaigns related to climate change activities, such as the responsible use of natural resources and the social impact of recycling, among COFIDE's stakeholders.

The committee's next step is to create an Ecoefficiency Plan to develop awareness campaigns among COFIDE's financial partners to change their practices and help the environment. This is a good example of knowledge transfer to local intermediary financial institutions.

* Corporacion Financiera de Desarrollo is Peru's national development bank.

3. Assign clear roles and responsibilities to identify, assess, monitor, manage, and report on climate risk.

Designing the appropriate approach to integrating climate change into key governance processes and committee structures is critical to ensuring board-level oversight and accountability. To reflect this, the roles and responsibilities allocated must be clearly defined, coherent, enforceable, and duly documented:

- Which committee of the board is responsible for managing the bank's resilience to climate risk and
- The parameters of that committee's responsibilities in identifying, assessing, and managing the financial risks of climate change.

Based on internal capacity, existing committees, and governance arrangements, this could mean the board creates a dedicated climate risk committee or adapts an existing committee to incorporate climate risk actions. Alternatively, the board could appoint an external committee (the SASB and the Carbon Disclosure Project used the title Integrated Sustainability Advisory Committee) to oversee matters related to sustainable management of the company's activities (TCFD, 2019).

Climate risk considerations have to be incorporated into existing governance frameworks and relevant board-level policies, such as the bank's risk framework and its E&S policy. In many financial institutions, the most important risk issues are discussed by the risk and audit committees, which thus may be best placed to take on the added responsibility of ensuring climate risks are understood, managed, and reported. In this case, the board should adjust the terms of reference of these board committees to ensure climate risks are included and discussed.

NDB management will need to discuss what internal changes must be made to meet expectations arising from the board's new responsibilities. One way to structure this conversation is to ask what internal changes would be needed to treat climate risk as financial risk. There are usually management-level positions or committees assigned responsibility for written procedures on how to examine a risk and guidance on how information and analysis is to be created and presented to the board in its regular reporting. Responsibilities and accountabilities should be laid out explicitly in committee terms of reference, job descriptions, and performance workplans. Roles and responsibilities should be clearly defined and assigned to all relevant departments, including the teams responsible for sustainability (environmental, social, and governance [ESG]); strategy; finance; credit; legal; risk; and compliance. The roles and responsibilities could also state the processes by which climate risks are assessed, managed, monitored, and reported.

4. Create a climate change policy and consider which existing policies and procedures must be adjusted or enhanced.

Create a climate change policy to codify the organization's commitment, to outline how it will achieve its goals, and to underline the board's role. The comprehensiveness of the policy will depend on the NDB and the level of expected integration of climate risk throughout the organization. One outcome could be that the board and senior management are asked "How does this change with the addition of climate risk?" whenever there are conversations about strategy, management plans of action, and risk management policies.

This question should also be considered when looking at annual budget and business plans; overseeing major capital expenditures, acquisitions, and divestitures; and setting organizational performance objectives (TCFD, 2019). All objectives should be Specific (simple, sensible, significant), Measurable (meaningful, motivating), Achievable (agreed, attainable), Relevant (reasonable, realistic, resourced, results-based), and Time bound (time based, time limited, time/cost limited, timely, time-sensitive), otherwise known as SMART goals.

5. Determine reporting processes to inform the board about climate-related issues, strategies, and risk assessment.

Board oversight of climate risk can only be successful if the board is kept up to date on implementation of the climate risk program, informed when climate-related issues arise (such as a worsening credit profile for a portion of the loan book due to an extreme weather event), and notified of the latest public expectations regarding how financial institutions and government entities should be addressing climate risk. It should be clear which senior executives are responsible for managing climate risk, into which committee they report, and the frequency and form of this reporting.

6. Define capacity and resource needs based on the NDB's climate risk commitment and strategy.

Like all projects, integrating climate risk will not be successful unless internal resources are adequate and properly skilled. Once the climate risk agenda has been set, determine the capabilities of internal teams in order to seek external expertise as needed. Resources in terms of climate risk assessment tools and data requirements will also need to be specified. It is important to recognize how much human resource and technical capacity is required and what the cost of climate risk assessments and the overall implementation a climate risk resilient strategy would be. Once the NDB current capacity is determined and a gap in needs is identified, plan how to seek additional resources in capacity building. Good sources of support for technical assistance in capacity building are multilateral or regional development banks, as well as bilateral development finance institutions, which may help design and implement climate risk tools. Another question to address is whether there are competing priorities that could hinder developing a climate risk plan.

One means to gauge capacity needs is to undertake a pilot program. Research some publicly available climate risk assessment approaches that could be developed or adapted at a later date.

Complete climate scenario analysis or climate stress tests (discussed later in this chapter) on a key part of the portfolio. By trialing processes on one portion of the portfolio, data gaps can be identified. Determine which approaches or methodologies are best suited to obtain data, whether upstream through government agencies (on environmental-related data) or downstream with clients and financial intermediaries (on portfolio-related data).

7. Build internal capacity and understanding of climate risks at all levels.

An effective climate governance framework requires an understanding of climate risk across the organization from the board to the front-line staff.

Increasing the technical capacity and skills of the NDB's internal teams to assess risks may require engaging in special training from climate risk experts and consultants, seeking technical assistance support from external organizations on the necessary tools and methodologies, and peer learning and knowledge sharing from experiences of other NDBs and commercial banks locally, regionally, and globally (see Case Study 12). While all units of the organization should receive some level of climate risk training, creating a specialized climate unit within the NDB may be a way to build capacity and attract funding. A consolidated unit may be able to communicate the NDB's expertise on climate risk externally and pursue relationships with funding organizations' climate teams.

Case Study 12. Learning from Success: NAFIN and IDB Partnership

The IDB supported NAFIN* to create a technical team for a sustainable energy financing facility to co-develop and implement the Clean Technology Fund (CTF) Renewable Energy Financing Facility to directly finance local wind energy projects. Total financing resources amounted to US\$1.2 million. The IDB provided US\$1.3 million for technical assistance and US\$370 million in sovereign lending, NAFIN provided US\$798 million, and the CTF provided another US\$70 million.⁸ The combination of technical assistance for capacity building, concessional resources from the CTF, and sovereign lending from the IDB leveraged considerable commercial sector investment totaling over US\$6 billion in wind technology investments. The IDB supported NAFIN in establishing and staffing the Sustainable Energy and Climate Change team within NAFIN. With support from senior management, the team hired and trained young professionals who developed strong technical and project development skills, leading to the development of a highly analytical and efficient organization. The installed renewable energy capacity increased eightfold from 250 Megawatts in 2009 to 2 Gigawatts in 2014. This example indicates the possibility of using public funding to address demand in renewable energy technology transfer and financing.

* *Nacional Financiera* is Mexico's national development bank.

⁸ The conditions of the CTF loan channeled to NAFIN were as follows: Annual service fee 0.75 percent, MDB upfront fee 0.25 percent, 20-year maturity; 10-year grace period, 48-month disbursement period; principal repayment at 10 percent for years 11–20 (Smallridge et al., 2013).

Clearly presenting the implications of the climate risks facing the NDB and the actions being put in motion by financial regulators and commercial banks should increase the overall level of awareness and understanding of its criticality throughout the NDB, translating into cross-functional cooperation between the strategy, risk, credit, and ESG teams.

The board and senior management need to develop complementary skills and experience in climate-related issues and familiarize themselves with emerging best practices in climate governance. This can be achieved by engaging with central banks, commercial banks, peer NDBs, and other stakeholders to keep updated with the latest developments on climate risk management and policies. The NDB can participate in international and regional initiatives on climate risk management to learn from and partner with other financial institutions (see Case Studies 13, 14, and 15).

Case Study 13. Learning from Success: BNDES and IPACC II

As BNDES* made headway on incorporating climate risk analysis to support its decision-making, it partnered with the Adapting Public Investment to Climate Change in Latin America (IPACC II) project, a technical cooperation program implemented by GIZ, a German development agency.

The goal of this partnership was to minimize the impacts of extreme weather events on Brazil's infrastructure investments and build resilience. The initiative encompassed capacity building, benchmarking, and framework development as well as internal and external dissemination of the partnership's activities. The capacity-building exercises involved designing training courses to enhance internal knowledge and awareness of the importance of climate risk to the workforce, particularly analysis of climate risks to investment projects. The benchmarking study performed a comparative analysis of climate change best practices in advanced financial institutions in parallel with an assessment of possible entry points for climate considerations in designing projects in the energy and transportation sectors.

* *Banco Nacional de Desenvolvimento Econômico e Social* is Brazil's National Bank for Economic and Social Development.

Case Study 14. Learning from Success: FIRA

FIRA's* sustainability team has increasingly gained strategic importance. In 2019, FIRA created a sustainability principles policy that underpins institutional efforts to tackle sustainability-related issues, including climate change. FIRA also formed a multi-departmental working group tasked with identifying, assessing, and mitigating sustainability-related issues internally and for projects that are aligned with the Mexican national and international objectives, such as the Paris Agreement and the Sustainable Development Goals (SDGs). The working group and different departments that participate in sustainability efforts work to offer financial solutions that contribute to improving the NDB's overall performance on climate change.

** Fideicomisos Instituidos en Relación con la Agricultura is Mexico's Trust Established in Relation to Agriculture.*

Case Study 15. Learning from Success: Bank of Brazil*

Bank of Brazil has been developing a specific policy for climate risk management in which it commits to adopting a governance structure for climate risk management compatible with the size and nature of its business. The policy also considers the complexity of its products and services and its relationships with various stakeholders. This policy will enable it to evaluate the climate risks it is facing and in creating contracts for guarantees, investments, and corporate partnerships with third parties, as well as in their operations and facilities, and relationships with their counterparties.

Bank of Brazil has integrated climate risk into its integrated risk management structure and line of defense model. In doing so, the bank aims to identify, measure, evaluate, monitor, report, control, and mitigate climate risk and improve its management.

The bank's commitment to managing climate-related risks will ensure that its business portfolio is more resilient to climate change, seeking to ensure balance between risks and returns.

** Banco do Brasil*

8. Set climate risk performance indicators and embed targets into incentive schemes to ensure long-term success.

To align corporate objectives with climate risk management, an NDB's board can incorporate climate risk performance indicators and targets into remuneration packages or incentive schemes to ensure long-term success.

Governance underpins the sections that follow: strategy, risk management, and metrics and targets. In these sections, similar to this governance section, we provide lists of actions that can be taken. We note that these actions do not need to be completed in order and efforts related to strategy, risk management, and metrics and targets can move in parallel.

4.3. Strategy

Strategy has a pivotal role in institutions and therefore should fully integrate the risks and opportunities associated with climate change in the short, medium, and long term (ACPR, 2020). Strategy must include not only the risks associated with climate change facing the NDB, but also the opportunities, such as potential new product offerings or the decision to further penetrate a climate-relevant market or sector.

Some NDBs may already be including climate risk in their strategy conversations. For example, for an NDB whose sole focus is the agricultural sector in a region that has seen a serious increase in droughts that are projected to worsen, the implications of climate risk may have already resulted in strategic conversations related to its longer-term financial sustainability, how it will best serve its clients going forward, and new types of equipment loans that allow for farm retrofits to water-efficient practices.

Survey: Only 10 percent of Latin American Association of Development Financing Institutions (ALIDE) and Brazilian Development Association (ABDE) respondents to the survey for this report said their organization had discussed climate risks as part of longer-term strategic planning.

The most advanced NDBs may have dedicated teams versed in strategic planning methodologies that follow an annual planning cycle. For strategy formulation, they might rely on their enterprise risk management (ERM) and business development (BD) teams, with the ERM team highlighting short-, medium-, and long-term risk and the BD team promoting new ways of doing business, including new products and product lines, new mechanisms for connecting with clients, and new and upcoming sectors to explore. For other NDBs, a standalone ERM function may not yet exist or may be at an early stage of development (see Case Study 16). Even without an ERM team, a risk appetite statement may exist. Regardless of the maturity of these internal functions, the urgency of climate risk is such that integrating it into existing processes (however immature) is more important than delaying action to strengthen these functions.

Case Study 16. Learning from Success: Thinking Innovatively

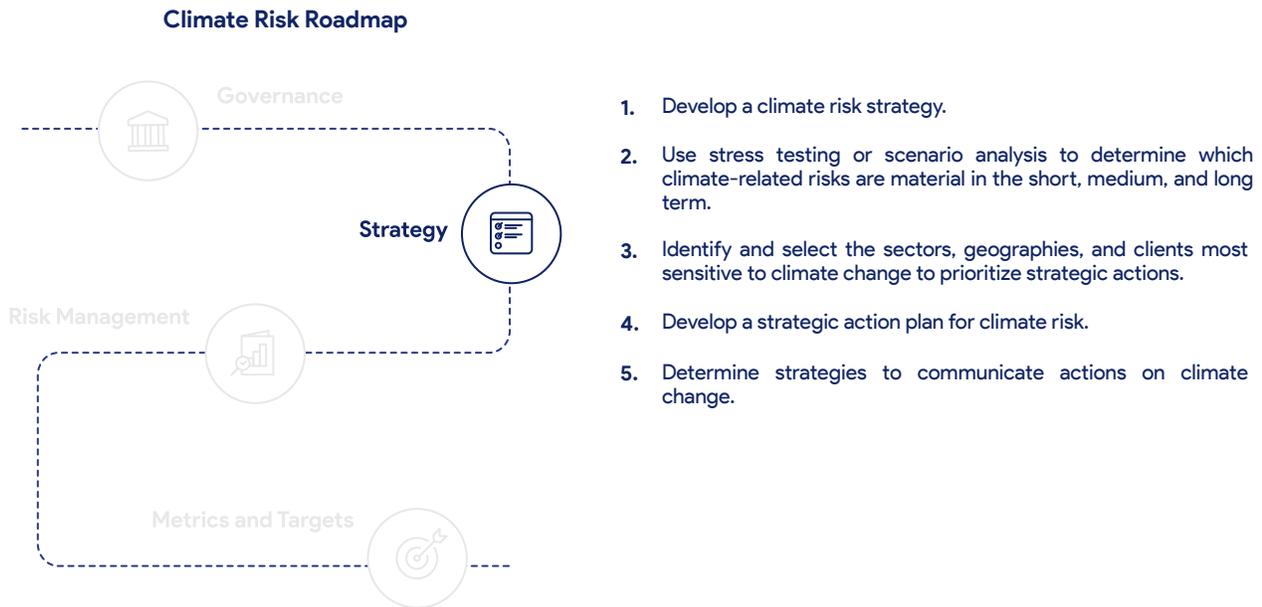
The IDB developed a flexible guarantee instrument that can be used to cover credit and political risks for green infrastructure financed through public–private partnerships or concessions. The IDB provides an AAA guarantee for up to 100 percent of the financed amount and up to 25 years for investment operations. The guarantee can be combined with a loan and issued in U.S. dollars and local currency. If triggered, the guarantee can be converted to a credit for the remainder of its duration.

The guarantee requires a sovereign counter-guarantee and is financially and operationally neutral for sovereign-guaranteed operations. The guarantee can be issued to sub-national entities, local governments, or any other public entity.

Figure 4.3 summarizes the key strategy activities and the following sections provide good practices related to strategic planning. These practices are based on good practices and recommendations for climate risk strategy put forward by the European Central Bank, the Bank of France, the SASB, and the Carbon Disclosure Project, as well as the Brazilian Federation of Banks (*Federação Brasileira de Bancos, Febraban*) roadmap for implementing the TCFD (Febraban, 2019).

Survey: Respondents of the survey mentioned that the nascent phase of their ERM and strategic planning functions were among the key challenges of climate risk management.

Figure 4.3. Summary of Key Activities: Strategy



Source: Authors' elaboration.

1. Develop a climate risk strategy.

An NDB may have had internal discussions regarding opportunities (e.g., increased demand for financing of green [low-carbon, climate-resilient] projects or product lines) or reputational risk (e.g., public perception that the NDB is not doing enough) related to climate change. It may also have discussed its contribution to the country's climate goals with the national government. However, integrating climate risk into the NDB's strategic planning, or a climate risk strategy, should evolve to express climate risks as financial risks. Such a strategy includes using scenario analysis to clarify and inform business development and financial planning about climate risks (ACPR, 2020).

A climate risk strategy should explicitly identify the adverse consequences of climate change on the NDB's strategic positioning and the associated financial risks. The strategy should be developed by executive management with the involvement of the board in its supervisory function and the relevant committees in their implementation role. The strategy should also account for longer planning horizons, include monitoring indicators, and align with the risk appetite statement and risk management framework.

2. Use stress testing or scenario analysis to determine which climate-related risks are material in the short, medium, and long term.

Climate risk can have financial impacts on an NDB in the short, medium, and long term. If an NDB has particular exposure to climate risk from one sector, it should research best practices for that sector and see what time horizons match forecast material financial risks (TCFD, 2019). Using stress testing or scenario analysis is a good exercise to help identify and determine which climate-related risks are material in the short, medium, and long term. Additionally, the NDB should tie the time horizons to milestones consistent with (or referring to) international agreements such as the Paris Agreement (2015) and the country's planned dates or milestones referenced in climate risk-related laws. Finally, the NDB should reference international scientific consensus, such as referencing the work of the Intergovernmental Panel on Climate Change (IPCC) (ACPR, 2020).

3. Identify and select the sectors, geographies, and clients most sensitive to climate change to prioritize strategic actions.

Identifying and recognizing the NDB's exposure to climate-related risks will increase the chances of advancing a climate risk management agenda. Performing an early materiality assessment or sensitivity analysis of the loan portfolio for qualitative and quantitative exposure (or by using Febraban's Climate Risk Sensitivity Assessment Tool, see Annex for details) will allow for a clearer understanding of the NDB's exposure to sectors, clients, and operations that are most sensitive to climate-related risks. This information would enable the NDB to identify the priority sectors and clients that require the most immediate attention for climate risk management.

Whether using a qualitative or quantitative approach, prioritize clients, geographies, and sectors that are at higher physical and transitional risk (see Case Study 17). Priorities will enable the NDB to focus its efforts and resources on identifying the risks and assessing and managing the potential losses in the most material areas of concern. The NDB may consider developing sectoral policies to include in its climate risk strategy. Quantitative targets for business volumes within a specified time horizon can be set.

Case Study 17. Learning from Success: Santander Brazil

Early on, Santander Brazil created a Sustainability Study Group as a holistic approach to looking at climate change issues. The group was initiated by the Sustainability Unit but involves the E&S Risk Unit and input from other divisions, including the risk, finance, credit, and legal departments. Santander, which has been a pioneer in incorporating the climate change agenda into its governance, strategy, risk management, and operations, recognized the utility of learning from others and the effectiveness of collaborative work. Knitting perspectives from different experts has helped establish a robust understanding of climate change challenges and opportunities.

Having focused on grasping the opportunities arising from climate change, Santander is further incorporating climate risk analysis into its portfolio and overall business planning, and reporting on it. Based on its local context, Santander has chosen to tackle the agribusiness and electricity sectors as its top two priorities. Many regions in Brazil have been affected by severe droughts, which has significant implications for agribusiness and electricity because they depend on precipitation and water and thus are highly vulnerable to water scarcity.

Santander has sought support from external sources by inviting specialists to talk to the commercial and risk analyst teams to help them understand how climate change can affect businesses in these sectors. Santander has taken a broader qualitative approach to its analysis as a first step and highly recommends this approach. Santander is willing to pair up with NDBs to share experiences and transfer best practices.

Santander was one of the leading global financial institutions that participated in the United Nations Environment Programme Finance Initiative (UNEP FI) TCFD Pilot Project. The goal of Phase I was to develop initial methodologies to enhance transition risk assessments for a broad range of economic sectors in loan portfolios. This exercise generated insights into how climate-sensitive sectors may be affected by a low-carbon transition. The report from Phase II provides rich technical guidance and information about the resources available to support forward-looking scenario-based assessments of physical risks and opportunities. A critical success factor of physical risk assessment for Santander Group is a clearly defined and comprehensive framework for calculating the financial impact of climate change. Given its diversity in geographies and businesses, which leads to stable financial performance in stress tests, the Group emphasizes the importance of the data and models from risk assessments being granular enough to capture the different hazards in various geographies and sectors. Time horizons are also important to factor into scenario analysis and regulatory stress tests. When reviewing external tools, it is important to evaluate the versatility of methods and approaches to impact assessment that account for specificities of portfolios by sensitivities and vulnerabilities. Ultimately physical risk assessment tools should be leveraged as a resource to support internal calculations of quantitative impacts on loans regarding values, probabilities of default, and losses given defaults.

4. Develop a strategic action plan for climate risk.

A strategic action plan will lay out the detailed steps required to successfully achieve the board's climate risk commitments. The plan can elaborate on the different phases of planning, designing, and implementing set objectives. Key components include identifying key requirements and dedicated teams responsible for delivering on the objectives. Three areas covered in a climate risk action plan might be (i) mainstreaming climate risk management throughout the organization, (ii) directing financial investments toward climate mitigation and adaptation projects, and (iii) enhancing transparency.

A first step in developing a strategic action plan can be confirming the NDB's role in relation to the government's climate commitments and goals. For example, some NDBs are tapped to contribute in a specific way to their government's Nationally Determined Contributions. Actions to meet these expectations may form a significant part of the strategic action plan.

In developing a strategic action plan, an NDB can benchmark itself against similar, like-minded NDBs and financial institutions by asking, "What actions are they taking?" and "How have they fared?" Benchmarking allows the NDB to gather information about the actions other organizations have already tested and get an idea of whether it is ahead or behind its peers in terms of progress.

An NDB can also undertake stakeholder mapping and hold engagement sessions to be clear on the interests and motivations of stakeholders. This would help the NDB know what its stakeholders expect in terms of the response to climate change.

5. Determine strategies to communicate actions on climate change.

A communications plan to internally and externally disseminate its climate risk strategy builds an NDB's institutional knowledge, ensures engagement, and strengthens its relationship with stakeholders. Financial regulators and good industry practice suggest communicating and disclosing the climate-related risks and opportunities that the organization has identified over the short, medium, and long term; their possible impact on business activities, strategy, and financial planning; and how the organization is and will ensure its resilience in the face of such risks.

4.4. Risk Management

Climate risk cuts across an entire organization, manifesting through established risk categories. Thus NDBs need to integrate climate risk into their existing risk management framework with a view to managing, monitoring, and mitigating the climate-related risks over a sufficiently long time horizon. An institution-wide risk management framework typically extends across all business lines and internal units, including internal control functions. Effective management of climate risks requires integration across the range of elements of a risk management framework. Integration of climate risk can facilitate more informed credit portfolio structuring and risk-based pricing. Using risk methodologies such as climate scenario analysis, incorporating climate risk factors into borrower- and transaction-level credit risk assessments, and requiring new information from borrowers on their climate risk exposure and vulnerability are all tangible examples of how climate risk can be integrated (Colas, Khaykin, and Pyanet, 2019).

An NDB's existing ESG risk management system is an entry point for integrating climate-related risks. Climate risk might be incorporated into an NDB's existing system where it directs senior management to escalate the Delegation of Authority level when high E&S risks are present in a loan or with a borrower. Evaluating the potential impact of climate change on strategy, credit risk, and financial planning in the short, medium, and long term requires different expertise and tools than assessing E&S risks.

Survey: The survey of ALIDE and ABDE members showed that the main obstacles for NDBs were the lack of external data availability for risk modeling tools and minimal knowledge of such tools and methodologies internally.

It is not easy to introduce the financial implications of climate risk into existing risk management systems. Nonetheless, ongoing efforts provide insights (see Case Study 18) on how to translate climate risks into clients' financial performance and, in turn, into financial metrics such as probability of default and loss given default. Figure 4.4 summarizes the key risk management activities and the following sections describe the activities related to the uncertainties inherent in climate risk models, the benefits of climate risk assessment, and a detailed approach to climate scenario analysis. Annex A provides a more in-depth review.

Case Study 18. Learning from Success: Bank of Brazil

Bank of Brazil, the largest bank in Brazil and Latin America in terms of assets and 59 percent owned by the Brazilian government, has introduced climate risk as another corporate risk. This addition reinforces the importance of climate risk and thus increases its visibility in the processes of granting loans and financing, especially for the bank’s agribusiness portfolio. Since the bank accounts for approximately 60 percent of the credit market share allocated to the agricultural sector in the country, management has chosen to focus its efforts on incorporating climate risks into the bank’s governance structures, strategy, risk management, and credit operations. These efforts are aligned with the bank’s existing Agenda 30 BB: Action Plan for a Sustainable Future (Bank of Brazil, nd).

From a governance standpoint, Bank of Brazil has developed and published its commitment to climate change, providing its position on climate issues and stating its internal activities to reduce carbon emissions, the climate commitments made, and the climate risk management models used in implementing mitigation and adaptation actions.

Figure 4.4. Summary of Key Activities: Risk Management



Source: Authors’ elaboration.

1. Incorporate climate change into the risk management framework as a driver of established risk categories.

Adapting existing risk management processes to incorporate climate risks as a driver of existing risk categories will help NDBs fully account for risks facing their portfolios. (See Case Study 19 for BDMG's upcoming plans to incorporate climate change into its credit operations and risk management.) An initial step is to document how climate-related risks impact existing risk categories.

For example, ERM can be reworked to include physical and transitional climate risks in all applicable parts of the framework rather than as a standalone risk, enhancing the strength of the NDB's overall risk management and ensuring financial sustainability over a long-term horizon.

Case Study 19: Learning from Success: BDMG*

BDMG's Environmental and Social Responsibility Policy was established in 2013 and complies with the Central Bank of Brazil's Resolution 4327 and Febraban SARB 14. The policy guides BDMG's E&S practices in business as well as its relationship with stakeholders. It sets specific E&S principles, guidelines, and procedures for the bank, including risk management and identifying opportunities. BDMG has integrated E&S risks into its Integrated Risk Management Framework and its strategic and financial planning.

ESG-related projects are quantified and translated into the asset allocation of its loan portfolio. The environmental team is embedded in the credit strategy through its involvement in projects related to reducing carbon emissions. BDMG has raised funds from multilateral institutions to finance projects related to mitigating and adapting to climate change. The bank also receives funds from BNDES for such projects.

BDMG has defined a growth percentage for its ESG portfolio in its Sustainability Report, with projects supporting the low-carbon, climate-resilient transition, such as solar, photovoltaic, hydroelectric power, and energy efficiency.

In 2019, important milestones were achieved in aligning the bank with the transition to a low-carbon, climate-resilient economy and in contributing to the SDGs by structuring new products. Attaining these milestones and the new products allow the bank to build a more sustainable portfolio while minimizing E&S risks. In addition, in 2020, BDMG became a signatory to the United Nations Global Compact and published on its website a framework for issuing bonds in line with the SDGs.

In its upcoming initiatives, BDMG plans to identify ways to integrate climate change into its analysis of credit operations and risk management. As the bank uses stress testing tools to monitor its credit portfolio and identify maturity, liquidity, and risk sensitivity (which are measured and controlled using interest rate shocks and stress scenarios), its risk team may have the capacity to pilot forward-looking climate risk scenario analysis.

* Banco de Desenvolvimento de Minas Gerais is the Development Bank of Minas Gerais in Brazil.

Incorporating climate risk into the existing risk management framework is a foundational step in managing climate risk. An NDB can take the following steps to get started in different directions:

- Integrate climate risk into existing sustainability or ESMS processes
- Prioritize climate-sensitive sectors for deeper assessment
- Pursue disaggregation
- Measure the carbon intensity of the portfolio
- Undertake climate risk scenarios
- Engage with first-tier financial institutions and other clients on climate risk

2. Examine how climate risks could be incorporated into existing sustainability or environmental and social management system processes.

One entry point for climate risk can be the existing ESMS, particularly if those processes are already integrated into the governance structure, institutional strategy, and management of credit operations. This is because the E&S principles and guidelines have already established pathways to which climate-related risks can be integrated. For some NDBs, the ESMS may be very mature and embedded. For NDBs that have relatively recently established and implemented their ESMS, a strong understanding of E&S risks and the implications of climate risks as financial risks is required first.

Survey: Only 6 percent of ALIDE and ABDE respondents had engaged in climate risk discussion as part of an environmental scan or integration into an ERM risk framework.

NDBs can strengthen their ESMS (if it already exists) by incorporating climate risks to enhance decision-making for credit and investment decisions. (See Case Studies 20 and 21 for examples of NDBs enhancing their environmental and social risk management capacity as a baseline.) Key climate elements that are well suited to being integrated into an existing ESMS include a borrower's degree of reliance on natural resources such as water, its GHG emissions profile, and the presence of assets on flood prone areas (see Case Study 22).

Existing standards for E&S reviews of investment projects such as the Equator Principles have been updated to include climate-related risks.⁹ Some of the NDBs interviewed mentioned that they follow Equator Principles where applicable and, hence, they will have to strengthen their climate risk management capabilities to comply with the revised requirements.

Case Study 20. Learning from Success: IDB Technical Assistance

Developing an ESMS is a crucial, and often a first, step for a public or commercial financial institution to actively promote sustainability. An ESMS needs to be tailored to the requirements of the institution to be effective. Senior management support and adequate resources for capacity building and strengthening are essential. The IDB developed a technical assistance program tailored to NDBs in the LAC region to design and implement their ESMS. The program offers institutional capacity building, ESMS program design, and development of internal training tools.

The IDB is supporting 12 institutions in LAC: BICE in Argentina; Fonplata in Bolivia; AFEAM in Brazil; Finagro, La Financiera del Desarrollo Territorial, FINDETER, and Bancoldex in Colombia; BANDESAL in El Salvador; Banobras, Financiera Rural, and FIRA in Mexico; AFD in Paraguay; and BROU in Uruguay. For most NDB beneficiaries, the design and implementation of an ESMS occurred in parallel with, or resulted in, new product lines dedicated to sustainable products. Examples include an energy efficiency credit line for hotels and hospitals for Bancoldex, sustainable cities for FINDETER, sustainable forestry for Financiera Rural, and sustainable water use for FIRA. The program also supports government organizations such as the ABDE in Brazil in complying with its central bank's new regulation on E&S risk management.

Case Study 21. Learning from Success: Banobras

Banobras has confirmed its commitment to help Mexico on issues related to climate change. The bank is working toward becoming a Direct Access Entity of the UN Green Climate Fund and developed a Sustainability Bond Framework to directly or indirectly (re)finance renewable energy, energy efficiency, and water efficiency projects, among others.

The Sustainable Bank Strategy is a multi-faceted policy of corporate sustainability that seeks to mitigate exposure to E&S risks in the projects in which the bank participates, allowing it to access resources with preferential rates from international funds. Banobras' Sustainable Strategy and E&S Policy establishes the commitment of the bank to integrate E&S principles and guidelines into the governance structure, institutional strategy, management of credit operations, and internal processes, as well as partnerships, helping it identify allies to keep updated on international practices regarding E&S issues and then implement them at the bank.

⁹ The July 2020 update of the Equator Principles requires a climate change risk assessment aligned with the recommendations of the TCFD for projects that are being qualified for financing. The update also retains the existing requirement for an alternatives analysis for all projects with Scope 1 (direct) and Scope 2 (indirect) emissions in excess of 100,000 tonnes of CO₂ annually and adds a requirement for consideration of relevant transitional risks.

Recent developments include the design and implementation of an ESMS to improve the E&S risk profile of its loan portfolio, with the technical support of the IDB. Implementing an ESMS has many diverse benefits, including attracting international funds and identifying new business opportunities. The ESMS seeks to better integrate risk management into Banobras' internal credit processes and to verify compliance with national E&S regulations. The ESMS will be piloted on financing for infrastructure projects with the highest exposure to ESG risks, such as highways and solar and wind parks. Once the ESMS is well established in the bank's governance, systems, and processes and employees are well versed in E&S risks, Banobras believes ESMS will be a good entry point for climate risk considerations.

Banobras participated in the Sustainable Financing Week Forum, allowing its employees to learn about and use tools that enable them to identify, evaluate, and mitigate risks associated with projects financed or refinanced by the bank. With still a long way to go, together technical support and ESMS initiatives build and strengthen the bank's capacity to increase its ability to incorporate climate risk management.

Case Study 22. Learning from Success: Santander's Water Assessment

Between 2014 and 2017, Brazil was hit by what was described as the worst drought in 100 years and the country continues to face long-term water supply shortages. This water shortage triggered Santander Brazil to integrate climate risk (mainly a water stress factor) into its E&S risk rating system in early 2018.

The water stress assessment is two-fold. First, the E&S risk analyst rates a company's water management quality as high, medium, or low based on the client's answers in the E&S risk questionnaire, verified by publicly available data (e.g., on official company websites and government documents). Second, this rating is combined with the score from the Brazilian Water Agency's (ANA) color-coded map, which lists all municipalities by water stress level (an average score is taken for companies with several plants in different regions). The water stress component forms a significant part of a client's sustainability rating, which in turn impacts their financial credit rating during the bank's annual review.

In 2019, the water stress assessment was upgraded with the support of a Brazilian consultancy firm to help identify additional factors, such as the proximity of a company to water basins. The challenge in the water stress risk assessment in the annual E&S risk review is that the quality of answers varies significantly from client to client. Santander also states that there is still standardization work to be done internally on what constitutes "excellent" or "average" water management. Other limitations identified include the ability to factor in supply chain risks and account for the impact of water scarcity for hydroelectricity generation.

Santander's advice to banks initiating their climate risk assessment journey is to begin by identifying one or two climate risks that are critical and most relevant locally. In its case, drought in the south-east region of Brazil is critical. Then select a publicly available climate risk assessment tool to stress test certain clients or sectors in their portfolio, again starting with the most economically important. This process would enable an NDB to investigate climate risk and better understand the financial and strategic implications before scaling the complex climate risk tool to all sectors and all clients.

3. Prioritize clients, geographies, and sectors for deeper analysis of climate risk sensitivity and to determine data gaps to fill.¹⁰

To deepen understanding of the magnitude of its climate risk exposure over time, an NDB can prioritize segments of its credit portfolio for analysis. For instance, an NDB can focus on sectors highly sensitive to physical and transitional risks to which it has a high level of credit exposure. This initial assessment should give the NDB some direction on more in-depth or precise analysis and dedicated data gathering.

Factors for physical risk that require data for a deeper analysis can include climate sensitivity and exposure of clients' assets. This implies collecting data about the geographic locations and characteristics (e.g., building type) of its assets and clients' know-how on context-specific physical climate risks. Transitional risk requires data on, for instance, the carbon intensity of clients' operations and technology mix. The NDB will need to revise its existing data gathering approaches to integrate data relevant to physical and transitional risks. NDBs need to engage directly with clients on these matters.

To closely track its overall risk profile, an NDB needs a clear taxonomy of green and brown assets in its loan portfolio and the availability of granular data. Studies by the Network for Greening the Financial System (NGFS) have shown that many financial institutions use national or international taxonomies to classify green and brown assets and, in some cases, financial institutions follow up by developing their own taxonomies. If an NDB is able to establish a consistent link between brown assets and higher default rates, it may be able to take steps to safeguard itself against the increased probability of default (NGFS, 2020d). Establishing a consistent link between brown assets and higher default rates is where risk monitoring and capital allocation is deemed crucial.

¹⁰ See Febraban Climate Risk Assessment Sensitivity Framework in *Annex B: Climate Risk Assessment Resources, Pilots, and Framework*.

Case Study 23. Learning from Success: BNDES and IPACC II

As discussed in Case Study 13, the BNDES partnered with the IPACC II project to minimize the impacts of extreme weather events on Brazil's infrastructure investments and build resilience.

Along with capacity development and benchmarking, the project focused on risk management. The project looked at designing a methodology and tools, and at identifying information sources and data gaps. Additionally, the team drafted guidelines for the practical application of the methodology and tools. To test and evaluate the methodology and make adjustments to it, a pilot application of the framework was used on infrastructure investment projects supported by BNDES. Other activities included appropriate dissemination and disclosure of climate risk information internally and externally, for example, presenting the methodology at the seminar on Climate Risk in Infrastructure Projects promoted by the BNDES in partnership with the Ministry of the Environment and the Ministry of Finance.

To operationalize the climate risk approach in BNDES, the following processes and criteria were followed:

- 1. Qualification:** know the client and its approach to climate events
- 2. Eligibility:** know the project and its vulnerability to climate events
- 3. Analysis and approval:** evaluate the project based on sector, location, and expected climate and environmental risks
- 4. Contracting:** if any impact has been identified, agree on an action plan to mitigate those risks

The head of BNDES's environment division noted that these climate risk management processes will be incorporated into its Social and Environmental Responsibility Policy in the next business cycle. Action plans in the following years will include specific work plan components on climate risk in projects, whether in credit, structuring, or in parts of the portfolio.

4. Disaggregate climate risks and opportunities by sector and geography.

Disaggregation can allow an NDB to identify differences within its portfolio. Clients based in one region may be more exposed to water scarcity than those in another area, while one sector may be more sensitive in the short term whereas another may be more likely to feel the effects in the medium term.

Recognizing such differences can help an NDB target mitigation and adaptation plans for certain clients and work with them to address the climate risks facing their business and context of operation. Addressing clients' exposures and sensitivities to climate-related risks is an opportunity for NDBs to target or expand their credit offerings.

5. Consider the credit portfolio's carbon intensity.

To determine its exposure and sensitivity to transitional risk, an NDB needs to consider the carbon intensity of its credit portfolio since carbon-intensive sectors have a greater risk of being negatively affected by introducing climate policies. Carbon intensity can be measured by looking at the portfolio composition (balance sheet data) or at the carbon intensity of different constituents (e.g., emissions data such as GHG emissions as disclosed by companies following the TCFD).

As a first step, an NDB can classify its balance sheet by sector. Next, it can obtain emissions data by mapping sectors to a measure of carbon intensity. To perform more detailed analysis of individual credit or client exposures within the same sector, a more granular level of data is required. In particular, the NDB needs more data to identify decarbonization pathways in clients' facilities and operations. Carbone 4 is an off-the-shelf tool that provides a bottom-up assessment of a firm's adaptive capacities to a low-carbon transition. It uses a methodology based on a mix of qualitative and quantitative indicators, such as investments made in research and development, CO2 reduction objectives, and Scope 1, 2, and 3 emissions.

6. Conduct climate risk scenario analysis to inform strategic planning and determine the financial risks of climate change.

Given the complexities and uncertainties in projecting climate change, approaches to quantifying climate risk for businesses and financial institutions are evolving and expected to mature over time. Scenario analysis is an approach suggested by the TCFD and financial regulators and is an advanced analytical tool.

Scenario analysis is a well-established methodological approach and is the current suggested methodology within the TCFD. Scenario analysis models a range of future states (hypothetical constructs) to assess the flexibility and resiliency of an organization to the potential materialization of various risks and disruptions in the short, medium, and long term. To gain the most informative analysis, scenarios should be extreme but plausible. The approach does not assign probabilities to the scenarios.

The utility of scenario analysis is two-fold:

1. The approach is *forward looking* and focuses *away* from probabilities. For some NDBs, the large number of uncertainties and complexities of climate change and the possibility of a multitude of outcomes may act as an obstacle to taking action.

Scenario analysis can lessen this. For example, for an agricultural producer, the NDB can assess what the future would be for the company in four different climate change scenarios without having to settle on which scenario is the most likely. This is particularly important when it comes to transitional risk, which includes so many human variables.

2. Scenarios can give an internal risk management department direction on the kinds of stress testing it should apply to the NDB’s assets, loans, and investments. Stress testing can be completed even though it is not clear what particular scenario will come to pass. It also creates potential to identify weaknesses and allows for informed discussion to manage risks in strategic decisions and prioritize capital allocation in financial planning.

At a high level, an NDB can use scenario analysis to explore the resilience and vulnerabilities of its business model under a range of outcomes. Scenario analysis addresses outcomes related to different transition paths to a low-carbon economy or a business-as-usual path where no transition occurs. Where appropriate, the NDB can perform short- and long-term assessments of its exposure to climate-related financial risks within its existing business planning horizon to quantify risks.

Box 4.1 is a simplified representation of a climate scenario analysis that may help NDBs visualize a relevant illustrative example.

Box 4.1. Illustration of Scenarios for the Agriculture Sector

The agriculture sector was chosen because it is highly sensitive to climate risks and most NDBs in LAC have high exposure to the sector. We developed four extreme but plausible scenarios:

Scenario 1: 4°C global temperature rise. (This scenario illustrates physical risk.)

Scenario 2: The national government abruptly puts a carbon policy in place. (This scenario illustrates policy-related transitional risk.)

Scenario 3: A new technology is invented that makes local crops more drought resistant. (This scenario illustrates technology-related transitional risk.)

Scenario 4: A baseline or “business-as-usual” scenario.

An NDB would use these scenarios to look at possible outcomes and would perform relevant stress tests on its portfolio and client exposures.

Scenario Potential Interpretation (for illustrative purposes only)

1. This level of temperature rise would lead to a significant increase in the frequency of climate events, such as droughts and floods. One outcome might be a drop in crop yields. An NDB would perform stress tests on its portfolio of agriculture-related loans, shocking the portfolio with the effects of a range of decreased yields (from minimal declines to extreme but plausible declines). The goal would be to measure the relationship between these shocks and loss of revenues for the sector and expected loan defaults.
2. An NDB's risk team would first review the research on carbon policies and the agricultural sector. It could start its analysis by focusing on the effect of an increase in the cost of fertilizer, since natural gas is an input in producing fertilizer. Using different cost scenarios and accounting for differences in its clients' reliance on fertilizer, the team would perform stress tests on the NDB's portfolio.
3. New technology would increase costs for agriculture companies but would also likely create higher and more predictable revenues. An NDB could model the effects on its portfolio of agriculture-related loans of a short-term cost increase of 10 percent (acquiring the technology) and then medium-term increases in revenues of some amount (say, 5 percent, 10 percent, or 15 percent). This scenario analysis would allow the NDB's risk team to model which clients might withstand the initial technology outlay.

Source: Authors' elaboration.

Climate scenario analysis can enable an NDB and its senior management to

- better frame strategic risk issues in its planning,
- prioritize actions, and
- inform long-term development plans and public budgeting.

Furthermore, it can help management identify and communicate the potential impacts climate risk may have on the overall performance of the organization (an assessment of its adaptive capacity) (TCFD, 2017). An NDB may also uncover financing and investment opportunities, such as new financing products and financing programs specific to mitigating climate risk. Scenario analysis improves the clarity of decision-making in mobilizing financing. Given the urgent investment needs in many countries, employing these methodologies can make a significant difference to the pace of investment made by the financial sector (OECD, World Bank, and UNEP, 2018).

A greater understanding of climate risk would likely lead to internal conversations about how to adjust strategic and operational procedures such as internal risk reviews and portfolio management. It could also contribute to adjusting key performance indicators and engaging with NDB oversight bodies on the subject of future market gaps. In circumstances where the major climate risk factors are identifiable and known to an NDB, these factors could be added alongside traditional credit risk factors. An example might be including a numerical representation of water reliance for a set of borrowers in a water-scarce geography.

Lastly, gaining a full understanding of risks facing a borrower has many advantages for a financial institution. It allows for the *long-term financial sustainability, strength, and resilience of a portfolio by enhancing the underwriting and credit review processes*. Identifying, assessing, and managing climate risks would enhance an NDB's ability to fulfill its mandate to have a *positive, sustainable developmental and environmental impact on its country's the economy*. Furthermore, information on key risk drivers helps NDBs foster better engagement with their clients, help them mitigate climate risk exposure, and help transition to a low-carbon, climate-resilient economy. It may be particularly beneficial for NDBs to then position themselves as trusted advisors to clients.

NDBs can use publicly available climate scenario models and tools developed by international organizations, such as the IPCC's representative concentration pathways (IPCC, 2007) and the International Energy Agency's World Energy Outlook Scenarios (IEA, 2020, 2021), among others (TCFD, 2017c).

While climate scenario analysis is very useful, it is also very challenging. *Annex A: Approaches to Climate Risk Assessment* gives further details for NDBs ready to explore the process further.

4.5. Metrics and Targets

The TCFD recommends defining and disclosing the metrics used to assess climate risks and opportunities in line with its strategy and risk management process to make better informed capital allocation decisions. Metrics can be qualitative, quantitative, and semi-quantitative (see Case Study 24). They can include, for example, physical climate risk vulnerability scores, relative portfolio exposures in high transition risk industries such as oil and gas and coal, average portfolio carbon intensity, and percentage of mortgage portfolio with poor energy performance rating. They can also include capital mobilization metrics associated with an NDB's green finance portfolio. To date, many banks have assessed the impact of climate factors on credit risk metrics, such as probabilities of default, loss given default, and loan-to-value ratios, by working out the impact of climate scenarios on clients' financial statements and using the results to quantify the credit risks for loans in financial models (NGFS, 2020b).

The disclosure of identified metrics should be accompanied by relevant methodologies, definitions, and criteria.

Forward-looking metrics and targets for financial climate risks are still evolving and new approaches to calculating them are still being developed. There are several technical and methodological challenges related to quantifying the financial impacts of the physical and transitional risks of climate change.

Figure 4.5 summarizes the key activities for metrics and targets and the following sections describe those activities.

Figure 4.5. Summary of Key Activities: Metrics and Targets



Source: Authors' elaboration.

Case Study 24. Learning from Success: BDMG

BDMG's goal is to constantly develop effective measures to align its activities with minimizing harm to and conserving the environment. In 2015, BDMG began accounting for its internal carbon footprint through a GHG inventory in order to understand, quantify, and manage the impact of its operations. The planning and preparation for this process was guided by the GHG Protocol Program, the method most used worldwide to carry out GHG inventories.

BDMG uses the results to guide actions to reduce emissions. For example, it encourage virtual meetings to reduce the impacts of business travel.

As part of its opportunities and challenges, particularly environmental and social, BDMG plans to strengthen its role in contributing to sustainability and renewable energy in the process of diversifying the country's economic matrix, including alternatives for renewable energy to meet its own demand (BDMG, 2019).

1. Engage in education on climate risk disclosure with local financial institutions and clients.

As a prerequisite to disclosure of climate risk management, NDBs are encouraged to engage with local financial institutions and clients to increase their awareness and understanding of their exposure and vulnerability to climate-related risks. By identifying the high-risk sectors and clients in their loan portfolios and assessing the potential financial risks, NDBs can strengthen their ability to manage their exposure to those risks.

As a next step, for NDBs that are able to conduct climate risk scenario analysis, there is an opportunity to encourage the financial institutions with whom they do business, as well as clients, to support and undertake the TCFD recommendations. NDBs, particularly those embedded in the local financial community through second-tier lending, would benefit from seeing greater climate risk disclosure by their clients and the local financial institutions.

To enhance awareness and the technical capacity to implement tools for climate risk scenario analysis, coordinate training sessions with local financial institutions and clients. Encourage implementation of the TCFD recommendations at the national level or through national banking associations. Harmonizing disclosure requirements for clients across the various financial institutions in a country can reduce costs for clients.

An NDB's ability to manage its risks will only be as strong as the data it receives and the resilience of its long-term clients. In the case of NDBs whose client base is small or whose list of clients is fairly consistent, reaching out to clients to increase their capabilities around managing climate risk may be a risk mitigation strategy for the NDB.

2. Disclose the strategy, organization, and risk management mechanisms with regards to climate change.

The point of reporting externally is two-fold. First, is to share the financial risks arising from climate change. For example, banks can make better credit decisions if their borrowers are sharing how climate risk impacts their profitability and long-term financial sustainability. Second is to communicate the important work being done regarding governance, strategy, and risk management to manage climate change now and in the future.

To this end, the TCFD calls on reporting organizations to share not only the expected financial effects of climate change but also the strategic, organizational, and risk management arrangements to address climate change. These include roles and responsibilities, commitments, plans for monitoring, and resources deployed.

3. Disclose climate-related risks that are financially material.

The TCFD calls on reporting organizations to make disclosures about their business model and how it is affected by climate risk, policies and due diligence processes to show that systems have been put in place to manage climate risk, risks specific to the reporting organization and how those risks will be managed, key performance indicators, and outcomes. These reporting approaches call on reporting organizations to disclose climate-related risks that are financially material.

For a more granular approach to measuring carbon emissions, banks can report on Scope 1, 2, and 3 GHG emissions, a pre-defined set of reporting categories.¹¹ The aim of disclosing climate-related financial risks is to make better informed financial and capital allocation decisions. What gets measured gets managed more effectively. Reporting organizations also disclose or reference the methodologies used and assumptions made in their reporting approaches.

Examples from emerging practice include the following:

- The amount or percentage of carbon-related assets of the total portfolio or as a percentage of the current portfolio, and to the extent possible, a forward-looking best estimate of this amount or percentage over the course of the planning horizon.
- The weighted average carbon intensity of each portfolio, where data are available or can be reasonably estimated and, to the extent possible, a forward-looking best estimate of this weighted average carbon intensity over the course of the planning horizon.
- The volume of exposures by sector of counterparty and, to the extent possible, a forward-looking best estimate of this volume over the course of the planning horizon.

¹¹ The TCFD recommends following the GHG Protocol Methodology to allow for aggregation and comparability across organizations and jurisdictions. The GHG Protocol Corporate Standard classifies a company's GHG emissions into three scopes. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from generating purchased energy. Scope 3 emissions are all indirect emissions not included in Scope 2 that occur in the value chain of the reporting company, including both upstream and downstream emissions. To read more, go to https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf

- Credit risk exposures and volumes of collateral by geography and country of location of the activity or collateral, with an indication of those countries and geographies highly exposed to physical risk (see Case Study 25).

Case Study 25. Learning from Success: RBC’s Climate-Related Financial Risk Disclosures

The Royal Bank of Canada (RBC) first identified climate change as an emerging risk in 2017. Climate risk is considered a cross-cutting issue as transitional and physical risk factors could affect other risk types unless they are appropriately identified, assessed, and planned for.

The following two tables show results from RBC’s 2019 assessment of the relative sensitivity of sectors to climate risk drivers (as defined by the TCFD recommendations) to inform their risk management approach. Sector sensitivity to climate risk drivers does not imply that those risks will materialize for all clients in that sector. The impact at a client level will depend on factors such as geography, location of assets, and mitigation strategies. As RBC may be exposed to climate risk, they regularly review the risks that they face and the actions to mitigate those risks.

Table 1. Client sectors most sensitive to transition risk

Sector	Credit risk		Climate risk drivers					Example of potential impacts for clients in these sectors may include
	\$bn	% of total exposure	Technology	Policy	Markets	Legal	Reputation	
Wholesale								<ul style="list-style-type: none"> • Changes in demand for goods/ services • Reduced revenue • Increased operating and production costs • Asset devaluation • Difficulty accessing financing • Increased capital costs • Business model failures • Reputational damage • Legal fines or judgments
Automotive	\$17.0	1.5%						
Oil & gas	\$20.2	1.8%						
Industrial products	\$16.6	1.5%						
Mining & metals	\$6.8	0.7%						
Transportation	\$14.1	1.3%						
Utilities	\$32.7	3.0%						
Sub-total	\$107.4	9.8%						

Table 2. Client sectors most sensitive to physical risk

Sector	Credit risk		Climate risk drivers		Example of potential impacts for clients in these sectors may include
	\$bn	% of total exposure	Chronic	Acute	
Wholesale					<ul style="list-style-type: none"> • Change in asset valuation • Impaired assets, write-offs and early retirement of existing assets • Lower property values • Increased capital costs and operating costs • Reduced or disrupted production capacity • Reduced revenue from lower sales or output • Increased insurance premiums or inability to insure
Agriculture	\$10.9	1.0%			
Forest products	\$2.3	0.2%			
Industrial products	\$16.6	1.5%			
Mining & metals	\$6.8	0.6%			
Real estate & related	\$74.9	6.8%			
Retail					
Residential mortgages & home equity lines of credit	\$380.9	34.6%			
Sub-total	\$492.3	44.8%			



Based on the TCFD 2020 Status Report, RBC’s reporting is considered a good example of climate risk disclosure because it provides information on the material climate-related issues identified for each sector and geography.

4. Set metrics, targets, and verifiable key performance indicators related to climate risk.

Once an NDB has an understanding of its climate risk profile, with knowledge of clients, sectors, and regions that need to be monitored, it can set metrics, targets, and key performance indicators to monitor and improve results. Using information gathered through scenario analysis and stress testing, the NDB can set indicators or triggers that signal a worsening situation with regard to a client, sector, or region (see Case Study 26). Declining revenues, rising costs at the client level, increased temperatures, and increased frequency of a particular group of weather events could all be relevant, as inspired by the scenario analysis and stress testing. An NDB could set a target for a percentage of the loan portfolio that will be assessed for climate risk vulnerability on a regular basis.

Targets can be set for operations and financial investments, such as a business volume target for financing green projects as a percentage of total annual investment volume. Examples of operations could include increased sourcing of electricity from renewable energy sources, reducing GHG emissions from or the carbon footprint of a building, or an online training module on climate risk for staff. For an NDB's clients, objectives could include reducing water use or incorporating water stress to the corporate credit rating.

Case Study 26. Learning from Success: Bank of Brazil

Bank of Brazil has a unique approach to climate risk management, particularly due to its significant exposure to the agriculture sector, where it provides loans accounting for 60 percent of the market share. For the past several years, the bank has been monitoring climate-related risks throughout Brazil using a Weather Events Alert system that was issued by the network of agribusiness advisors that are registered in the Crop Monitoring Panel. This tool allows the bank to observe the recurrence of extreme weather events such as drought, frost, excessive heat, and rainfall, as well as changes in local climate patterns throughout the national territory. The tool has been a key driver for adopting measures to mitigate crop loss. During a harvest period, the alerts allow for short-term preventative measures to mitigate financial losses in credit operations by triggering production insurance. In 2019, more than 3,500 Climate Event Alerts were registered for over 1,700 Brazilian municipalities.

Another tool used to assess the adverse impacts of climate change is Agricultural Climate Risk Zoning and the Technical Agricultural Reference System, through which the bank complies with the recommendations of the Ministry of Agriculture, Livestock and Food Supply. An annual review indicates the municipalities with climate and soil adequacy for certain crops and the most adapted cultivated plant varieties.

Using these publicly available climate risk assessment tools enhances the bank's risk management framework and therefore strengthens the resilience of its strategy and portfolio to the impacts of climate change by proactively engaging in preventative and mitigation measures that reduce the adverse impact of climate change on its agribusiness portfolio.

Climate risk performance indicators should take into account available data and be confirmed by the board of directors or executive team. More advanced methodologies for the indicators should be validated by internal teams in the same way the NDB may already use internal teams and experts to validate other risk management indicators (ACPR, 2020).

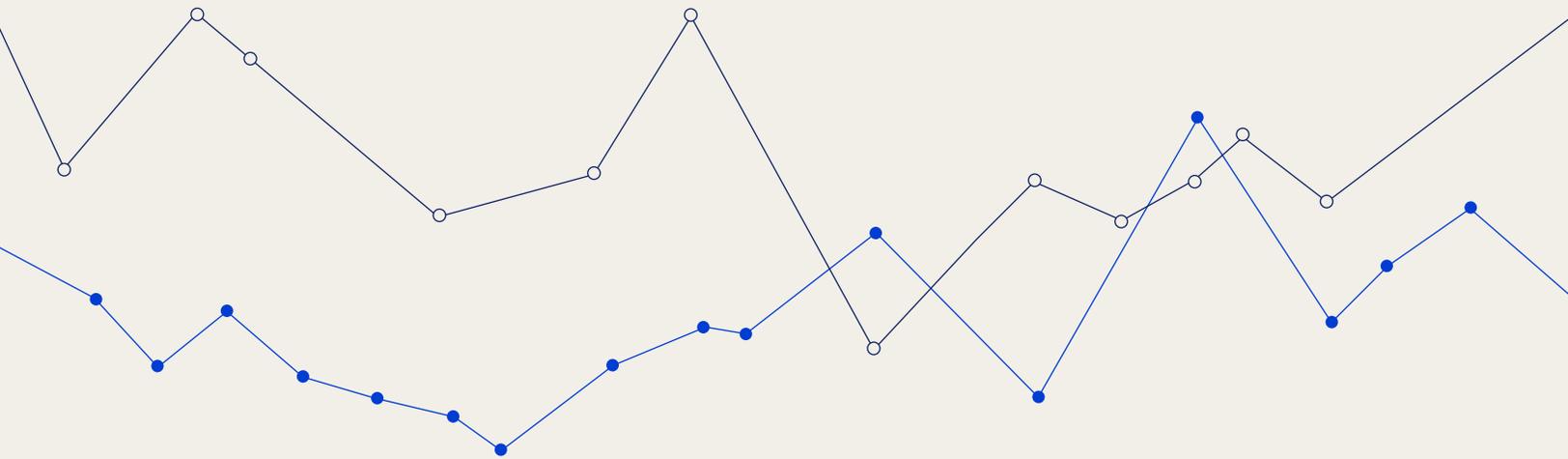
This guidebook discusses the urgency of addressing climate risks due to their potential catastrophic impact on human lives, the environment, and the economy. Climate change poses significant risk but is also an opportunity to rebuild infrastructure systems to become more resilient and to divest of unsustainable energy sources by investing in innovation, climate technologies, and low-carbon sectors.

The guidebook explains how climate risks translate into financial risks. It recognizes the magnitude and far-reaching impact of climate change on all regions and all sectors of the economy as a threat to the stability of the financial system and the macroeconomy. As such, the exposure of balance sheets to direct and indirect impact from physical and transitional risk has incentivized central banks and bank regulatory bodies to identify, assess, and manage climate risks and it should also incentivize NDBs.

Despite the uncertainties regarding when and how climate risks will materialize and the ongoing developments in translating climate risks into financial implications, there is an imperative to act now. As mentioned, disregarding climate change or delaying action to mitigate its effects only increases the associated physical (e.g., damage to structures) and transitional (e.g., abrupt changes in policy) risks. A gradual transition to a low-carbon, climate-resilient economy will allow financial institutions and companies to prepare by identifying, assessing, and managing the potential implications of climate change.



It is imperative that NDBs integrate climate risk into their governance, strategy, and risk management, and contribute to public disclosures and reporting on climate risks. NDBs must systematically identify, assess, and manage climate risk in their own operations, in their planning, and in their portfolios to allow for the continued fulfillment of their mandates. Since NDBs are public policy instruments, their work regarding the effects of climate change is critical to their continued contribution to positive societal impacts. Through risk management and government support, NDBs should better manage their asset allocation to align with the transition to a low-carbon, climate-resilient economy. NDBs should support their governments in achieving climate goals and commitments; between Nationally Determined Contributions to the important changes needed for economies to transition to a low-carbon, climate-resilient economy, NDBs play a critical role. NDBs must signal their support for combating climate change and building resilient financial systems given their unique positions in local, regional, and national financial communities. NDBs should also consider the potential of new funding from a variety of sources, given that international investors and financiers are increasingly aware of and calling for climate risk management.



Annex A: Approaches to Climate Risk Assessment

This annex describes some of the current methods and practices a national development bank (NDB) can apply to start rethinking risk through a climate lens. Annex B provides some resources for climate risk data and assessment tools that are publicly available or available for purchase.

Climate Scenario Analysis

Figure A.1 is an example of Citibank’s Scenario Analysis exercise (Citigroup, 2018). It outlines four scenarios: global temperature risks of 2°C, 1.5°C, and 4°C, and a range of carbon prices. Analysis of these scenarios allowed Citigroup to forecast potential ratings downgrades and production declines. Its risk departments could then analyze the associated effects and the strategy and business planning departments could take them into account in terms of deciding medium- and long-term planning.

Figure A.1. Citi’s Climate Scenario Analysis

Physical Risks		
Scenario	Key Assumptions	Impact - 2030 to 2040
2°C	<p>Carbon Price: 2030: \$68 2040: \$111</p> <ul style="list-style-type: none"> Use of fossil fuels continues throughout the century but at a declining rates as they are replaced by renewables Carbon capture and storage is commercial after 2030 Electricity prices increase as growing electric vehicle adoption and electrification of transport increases demand In the short term, oil and gas serve as substitutes as the world transitions from coal, and oil remains an important transport fuel as transport demand grows 	<p>Utilities (U.S.)</p> <ul style="list-style-type: none"> Regulated low-carbon utilities: no change to 1 notch downgrade Regulated heavy-carbon utilities: 1-2 notch downgrade Unregulated low-carbon utilities: 1-2 notch downgrade Unregulated heavy-carbon utilities: 2-3 notch downgrade <p>Oil & Gas Exploration & Production (U.S. and Canada)</p> <ul style="list-style-type: none"> Offshore: no change Shale and non-conventional: no change Conventional: no change
1.5°C	<p>Same Assumptions, but Higher Carbon Price: 2030: \$117 2040: \$190</p>	<p>Oil & Gas Exploration & Production (U.S. and Canada)</p> <ul style="list-style-type: none"> Offshore: 1-2 notch downgrade Shale and non-conventional: 1-2 notch downgrade Conventional: no change
Physical Risks		
Scenario	Impacts - 2040	
2°C	<p>Utilities</p> <ul style="list-style-type: none"> Production declines 9.5–15.1% with an average decline of 11% by 2040, driven primarily by incremental (chronic) climate change Half of companies have 1 notch downgrade due to productivity decline 	
4°C	<p>Utilities</p> <ul style="list-style-type: none"> Production declines 10.7–15.1% with an average decline of 13.2% by 2040, driven primarily by incremental (chronic) climate change Half of companies have 1 notch downgrade due to productivity decline 	

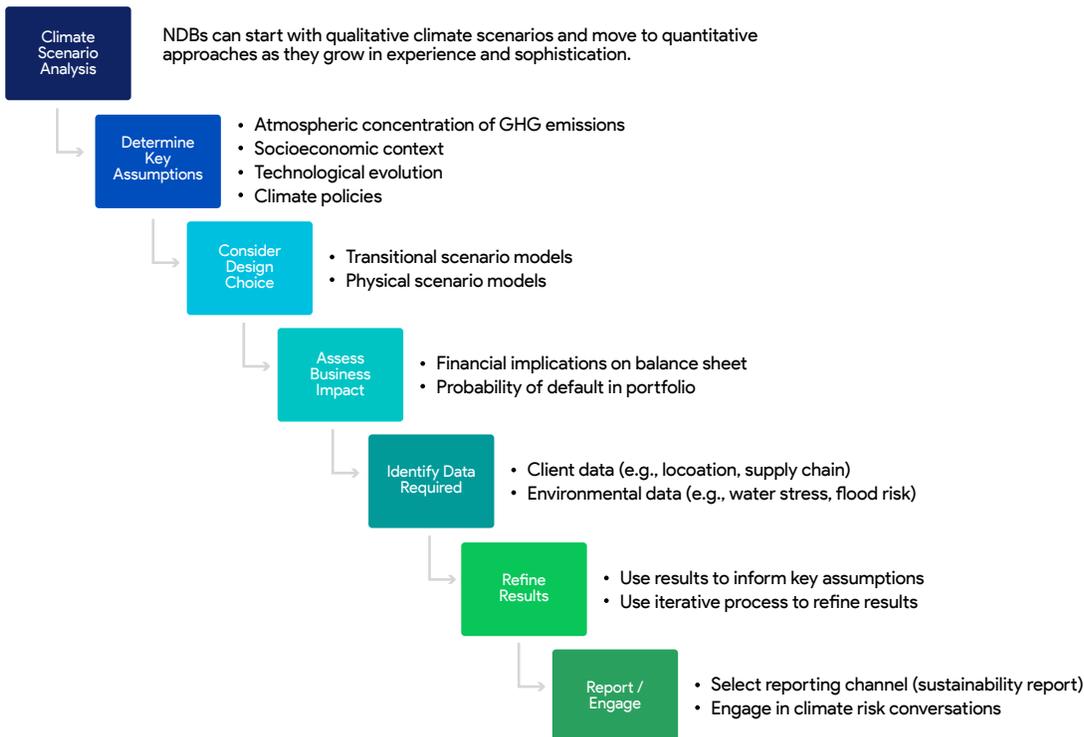
Source: Citigroup (2018).

Note: Citi used the assumptions and outputs of the REgional Model of Investment and Development (REMIND) CD-LINKS scenarios developed by the Potsdam Institute for Climate Impact Research. Citibank notes that the downgrades are within the context of its internal risk rating system.

How to Undertake Climate Scenario Analysis

Figure A.2 summarizes an approach to climate scenario analysis that an NDB can undertake, followed by a detailed description of each step and references to examples and climate scenarios.

Figure A.2. An Approach to Undertaking Climate Scenario Analysis



Source: Adapted from the TCFD Knowledge Hub (<https://www.tcfidhub.org/>) and UN-PRI (nd).

The first step in scenario analysis is to create scenarios for transitional and physical risks. NDBs should begin with qualitative scenario analysis and move toward quantitative approaches as they gain experience and become more sophisticated.

Choosing a climate scenario that is relevant to an NDB entails determining key assumptions, such as the atmospheric concentration of GHG emissions, the socio-economic context, technological evolution, climate policies, consumer preferences, and climate impact, among others.

In considering a scenario design there are two categories to choose from—physical and transitional risk scenarios—or a combination of both. Physical risk scenarios assess the effect of climate change given an assumed level of emissions or increase in temperature (usually 1.5°, 2°, 3°, or 4°C above pre-industrial levels). An example of implementation would be evaluating the expected changes to the credit quality of a loan or investment portfolio due to increased physical risks along those emissions or temperature change scenarios. Transitional scenarios model the trajectory of potential government climate policies or climate technology advancements.

The International Energy Agency, an organization focused on shaping energy policies globally while managing the risks of climate change, has designed its scenarios as follows:

- **Current Policies:** the world continues along its present climate change path, without any additional changes in policy
- **Stated Policies:** incorporates present-day policy intentions and targets
- **Sustainable Development:** sustainable energy goals are met and the rise in global temperatures is held to well below 2°C

The TCFD Technical Supplement (TCFD, 2017c) also provides references to a range of climate risk assessment scenario models and resources that are publicly available. Other frameworks and pilots are referenced in Annex B.

An example would be a scenario analysis by an NDB that is mandated to encourage small businesses. The NDB noticed an increase in loan repayment delays after floods affected the countryside. The country has seen an increase in the frequency of floods and extreme weather events over the past 10 years. Both the weather events and the flooding are influenced by climate change. While the NDB expects a greater number of floods in the next 20 years, it cannot accurately predict exactly how many floods will happen, how severe they might be, or if, hopefully, new flood-prevention methods are invented to keep rising waters at bay. Using scenario analysis, the NDB develops a number of scenarios using these potentialities and assesses its 2-, 5-, and 10-year business plans against them.

Scenarios can then be translated into macroeconomic and sectorial outputs, for which most methodologies rely on climate-economic models, such as integrated assessment models. See Annex B for potential sources. Another option is to use technologically based models that can use bottom-up market analyses.

The next steps are an evaluation of the business impact (e.g., risks for different sectors and geographies) of the various scenarios and identification of potential responses. At this stage, the NDB would assess implications for its financial statements, such as the balance sheet and probability of default in its loan portfolio.

Most of the international initiatives (e.g., the G20 Green Finance Synthesis Report [G20 Green Finance Study Group, 2017]) focus on global scale environmental data and impact of climate risks. BNDES and other banks interviewed highlight the need for more regional and local-level climate information, which would require a closer look at the physical and transitional risk scenarios for a country's industries sector-by-sector at a more granular level. NDBs can begin with information that is readily available and then identify data gaps, such as detailed client information and environmental data, and where and how it will obtain such data. NDBs can work upstream with government entities to obtain climate-relevant data or downstream with its clients to track climate risk indicators.

Furthermore, NDBs may use the results from scenario analysis to identify the sensitivity to key assumptions made in the underlying scenario. Scenario analysis is an ongoing iterative process that requires NDBs to continuously refine results. NDBs might find it useful to change assumptions (e.g., temperatures) to see how much the results change (e.g., the probability of default). Exploring different scenarios is insightful and enables NDBs to gain a clearer understanding of their vulnerability and exposure to climate risk. NDBs can also use the results to inform their financial and strategic decisions, help identify whether the risks are being mitigated by current policies and risk management processes, and highlight any investment opportunities.

Lastly, NDBs can choose to document and report results to improve awareness of climate risks. There is significant value in sharing details about methodology, assumptions, and limitations of climate risk assessments. NDBs can choose to disclose information on climate risks and opportunities on their websites or in periodic publications, such as financial, annual, or sustainability reports. Documentation and communication should follow the TCFD's guidelines for reporting and disclosure on climate risk. In this case, climate risk information is released to the general public similar to a sustainability or annual report. NDBs can become official supporters of the TCFD.¹

¹ Details here: <https://www.fsb-tcfd.org/support-tcfd/>

NDBs can engage with relevant government entities, peers, commercial banks, and local financial institutions by hosting webinars or workshops to share experiences. This exercise can be undertaken by a cross-functional team with expertise from risk, finance, credit, ESG, and other related departments.

Other Methodological Approaches

The following approaches may also be useful to NDBs, could be considered entry points into climate analysis, and can contribute to scenario analysis undertaken at a later point.

Case Studies

Case studies can be used to assess the potential impacts of a climate-related transitional or physical shock on one specific sector or region. Huxham, Anwar, and Nelson (2019) noted that case studies are a more qualitative approach to analysis. In their work, they assessed the transitional risks for the South African economy under a scenario consistent with temperature rises well below 2°C above pre-industrial levels. They looked at potential impacts of a reduction in demand for and price of energy sources such as coal, which provides 91 percent of South African electricity and significantly contributes to the country's export revenues. This case study looked at the effects on supporting infrastructure (e.g., power plants, ports), on individual companies, and on government tax revenues.

Using Externally Derived Assessments of a Sector, Region, or Client Segment

Academic quantitative analysis of climate risk may provide NDBs insights that they can use within their own risk analysis.

Battiston, Mandel, Monasterolo, et al. (2017) developed an approach that focuses on how financial institutions or an individual financial institution may have interrelated exposure to climate risk. They classified economic activities into six sectors (fossil fuel, utility, energy intensive, transportation, housing, and finance) and 20 subsectors based on their relative vulnerability to climate transitional risks (as a function of their emissions). They mapped out the equity and debt exposures of financial institutions to capture the potential knock-on effects of a sectorial shock (e.g., a change in policy) within financial networks. Cahen-Fourot, Campiglio, Dawkins, et al. (2019) modeled the effect of a production decrease in one sector through the value chain.

Instead of developing their own scenarios, or to complement their own scenario analyses, NDBs may want to look at the academic literature relevant to their country, sector, or key clients. These may be sources for the technical analysis of climate risks that are, in many cases, very difficult to carry out in-house. NDBs can then take the assessments and assumptions and use them to create scenarios or stress tests. This approach may be useful for an NDB that is engaged with only one or two sectors since it can look for sector-specific academic analysis.

Taking the Analysis to the Firm Level

While the approaches described above can give NDBs insight into geographic or sectorial vulnerabilities, they may want to take the analysis to the firm or client level, particularly if a few clients make up a large proportion of the loan book. Taking analysis to the client level makes the connection between scenario approaches and internal risk management procedures and portfolio monitoring easier. In addition, the described approaches often do not factor in action on the part of the firm.

At the firm level, NDBs can assess the sensitivity and adaptive capacity of client firms with exposure to the situations in the scenario analysis, sensitivity analysis, or case study. Examples include the ability of a client to develop new technology in response to a climate-related risk, such as volatility in their supply chain, or the ability to pass on additional costs to their customers. In the case of oil and gas firms, this examination could include the likelihood of owning stranded assets or the level of diversification into renewable energy.

If a client is publicly reporting its climate risk through the TCFD, an NDB should be able to understand the client's Scope 1 (direct emissions), Scope 2 (emissions resulting from purchased energy), and Scope 3 (emissions related to the firm's upstream and downstream value chain) emissions. Businesses generally start with reporting their Scope 1 emissions, which are the easiest to measure, and then move to Scope 2 and then Scope 3, the most challenging, although each industry is different.

Methodological challenges exist at firm-level analysis. For example, assumptions about a firm's adaptive capacity may quickly be out of date given the introduction of new technology. Both a firm's ability to pass on new costs to its customers and its liability risk (risk of legal cases related to climate risk) are difficult to assess.

The Methodological Challenges to Climate Risk

Climate risk assessment is evolving quickly and, as seen above, innovative approaches are being used to measure and manage climate risk. The distinctive features of climate change make climate risk assessment challenging (and, by extension, mitigation strategies as well). First, climate-related physical and transitional risks involve “interacting, nonlinear and fundamentally unpredictable environmental, social, economic and geopolitical dynamics that are irreversibly transformed by the growing concentration of GHGs in the atmosphere” (Bolton, Despres, Pereira da Silva, et al., 2020, p.9). Thus, traditional backward-looking assessment models that created probabilities based on historical data and trends and assume that shocks follow a normal distribution do not reflect the systemic and interconnected nature of climate risk.²

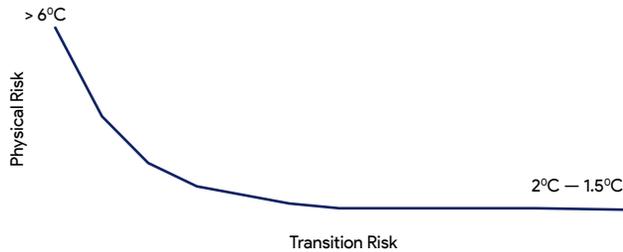
Box A.1. The Green Swan

The Green Swan: Central Banking and Financial Stability in the Age of Climate Change, published by the Bank of International Settlements in January 2020, is written mainly for central banks and supervisors. The book summarizes the thinking to-date on oversight authorities’ role vis-à-vis climate change. In providing guidance for supervisors on assessing climate risk in the financial sector and financial system, it gives an overview of the methodological approaches to forecasting climate risk. Green Swan is the name the authors give to the scenario of climate-related events triggering a systemic financial crisis.

The inherent trade-off between physical and transitional risks also adds to the uncertainty. If transitional risks are low because of inaction, physical risks will worsen over time. However, if ambitious climate policies are implemented, transitional risks will be high but physical risks will be minimized in the long term. The uncertainty lies in the timing and extent of climate policies. Figure A.3 shows the trade-off between physical and transitional risks.

² The fundamental financial concept of value-at-risk (VaR) captures the losses that can be expected with a 95-99% level of confidence and over a relatively short-term horizon. Capital requirements are also typically calculated (through estimated [probabilities of default], exposure at default and estimated [loss given default]) on a one-year horizon and based on credit ratings that largely rely on historical track records of counterparties” (Bolton et al., 2020).

Figure A.3. Trade-Off between the Physical and Transitional Risks of Climate Change



Source: TCFD (2017c).

As a practical matter, NDBs may be impeded in their analysis of clients by the lack of quality data on a client’s facility locations, critical suppliers, and publicly available local environmental risk assessments, such as flood risk. Given these impediments, the financial sector is pursuing multiple methodological approaches that are explanatory and illustrative rather than definitive. The intention is that a financial institution (or NDB) will choose and trial an assessment method, using the resulting insights to deepen its understanding of its own climate risk profile. As new methodologies are developed and current methodologies improve, there will likely be consolidation of views on the best approaches. Central banks, the Network of Central Banks and Supervisors for Greening the Financial System, and international organizations are working to standardize scenarios, including the interplay between physical and transitional risks, incorporating macroeconomic variables and key assumptions, and translating climate risks into financial risks.

Annex B: Climate Risk Assessment Resources, Pilots, and Framework

The following table provides a list of some tools and resources for climate risk assessment, scenario analysis, and climate risk disclosure.

	Description	Publicly Available	Link
Climate Risk Tools			
UNEP-FI: Drought Stress-Testing Tool	Allows financial institutions to see how incorporating drought scenarios changes the perception of risk in their loan portfolios based on the catastrophe modeling framework that the insurance industry has used for 25 years. The tool looks at five drought scenarios in four countries—Brazil, China, Mexico, and the United States—to model the impact on 19 different industry sectors, the companies in those sectors, and the likelihood they will default on their loans.	Yes	https://www.unepfi.org/ecosystems/nca/drought-stress-testing-tool/
World Resources Institute: Aqueduct	A tool/database to help companies, investors, governments, and communities better understand where and how water risks are emerging around the world. Aqueduct maps water risks such as floods, droughts, and stress using open-source, peer-reviewed data.	Yes	https://www.wri.org/aqueduct
United Nations Food and Agricultural Organization (FAO): Modelling System for Agricultural Impacts of Climate Change (MOSAICC)	An innovative, interdisciplinary tool to carry out climate change impact assessment studies at the national level. Its aim is to build expert capacity in countries to better understand potential climate change impacts and to help policymakers with climate change adaptation strategies, programs, projects, and investments. MOSAICC's models are organized in five main components: climate, crops, hydrology, forests, and economy. MOSAICC is a powerful tool for simulating the impacts of climate change for decision-makers pressed to provide answers to the challenges posed by changing climate conditions.	Yes	http://www.fao.org/in-action/mosaicc/en/
Princeton Climate Analytics	Highest quality, scientifically validated climate science products and data for government and industry for high resolution risk and vulnerability analysis around the globe.	Yes	https://www.princetonclimate.com/
UNEP: Global Risk Data Platform	A multiple agency effort to share spatial data information on global risk from natural hazards. Users can visualize, download, or extract data on past hazardous events, human and economical hazard exposure, and risk from natural hazards. The platform covers tropical cyclones and related storm surges, drought, earthquakes, biomass fires, floods, landslides, tsunamis, and volcanic eruptions.	Yes	https://preview.grid.unep.ch/
Global Facility for Disaster Reduction and Recovery: ThinkHazard!	For a given location, provides a general view of the hazards that should be considered in project design and implementation to promote disaster and climate resilience. The tool highlights the likelihood of different natural hazards affecting project areas (very low, low, medium, and high) and provides guidance on how to reduce the impact of these hazards and where to find more information. The hazard levels are based on published hazard data provided by a range of private, academic, and public organizations.	Yes	http://thinkhazard.org/en/

	Description	Publicly Available	Link
Climate Risk Tools			
WWF and DEG*: Water Risk Filter	A practical online tool that helps companies and investors assess and respond to water-related risks facing their operations and investments around the world. This tool has become a leading and trusted source of water risk data for thousands of users—from multinational corporations and SMEs to financial institutions—that have used it to evaluate hundreds of thousands of specific sites. After a major upgrade in 2018 and a wealth of new functions, Water Risk Filter 5.0 enables companies and investors to explore, assess, value, and respond to water risks. It now provides scenarios of water risks for 2030 and 2050, integrating climate and socioeconomic changes in three different pathways. <i>*DEG: Deutsche Investitions- und Entwicklungsgesellschaft, a development finance institution.</i>	Yes	https://waterriskfilter.panda.org/
World Bank: Climate and Disaster Risk Screening Tools	A proactive approach to considering short- and long-term climate and disaster risks in project and national/sector planning processes.	Yes	https://climatescreeningtools.worldbank.org/
2° Investing Initiative (2DI): Paris Agreement Capital Transition Assessment (PACTA) for Banks	An extension of the flagship PACTA methodology to the corporate lending sector, PACTA for Banks enables banks to measure the alignment of their corporate lending portfolios with climate scenarios across a set of key climate-relevant sectors and technologies. It represents a major step forward in climate scenario analysis for lending by providing banks insights into the climate alignment of their corporate clients' capital stock and expenditure plans.	Yes	https://www.transitionmonitor.com/pacta-for-banks-2020/
Transition Pathway Initiative (TPI) Tool	This tool can be used to assess companies' strategic resilience to transitional risks for a subset of large global firms. TPI, a global, asset-owner led initiative that assesses companies' preparedness for the transition to a low-carbon economy, is rapidly becoming the go-to corporate climate action benchmark.	Yes	https://transitionpathwayinitiative.org/
Acclimatise Aware	An online, rapid, climate risk screening tool designed to help easily identify and understand the potential risks from climate change to specific companies.	No	https://www.environmental-expert.com/software/acclimatise-aware-online-rapid-climate-risk-screening-tool-212207
Four Twenty Seven (427): Physical Climate Risk Application	An on-demand climate risk scoring tool, this application responds to the financial sector's growing call for the seamless integration of granular, forward-looking climate data into investment decisions and risk management practices.	No	http://427mt.com/2020/02/27/four-twenty-seven-announces-climate-risk-app/
Climate Risk Resources			
Climate Impact Lab	A team of economists, climate scientists, data engineers, and risk analysts building the world's most comprehensive body of research quantifying the impacts of climate change sector-by-sector and community-by-community around the world. This research will allow public and private sector decision-makers to understand the risks climate change presents and mitigate those risks through smarter investments and public policy. The Climate Impact Map provides a highly localized picture of future climate impacts across the United States and around the globe.	Yes	http://www.impactlab.org/
Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index	Summaries of countries' vulnerability to climate change and other global challenges in combination with their readiness to improve resilience. The index aims to help governments, businesses, and communities better prioritize investments for a more efficient response to the immediate global challenges ahead.	Yes	https://gain.nd.edu/our-work/country-index/rankings/

	Description	Publicly Available	Link
Climate Risk Tools			
Moody's Investors Service: Climate Change & Sovereign Credit Risk	This resource provides country rankings. The sovereign bond methodology captures the effects of physical climate change in a broad set of rating factors that influence a sovereign's ability and willingness to repay its debt.	Yes	Moody's.com
Task Force on Climate-Related Financial Disclosures (TCFD)	Guidance on Risk Management Integration and Disclosure	Yes	https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Risk-Management-Integration-and-Disclosure.pdf
	Scenario Analysis for Non-financial Companies	Yes	https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Scenario-Analysis-Guidance.pdf
	<i>TCFD Report Playbook</i> The first step toward developing standardized templates for TCFD disclosures by financial institutions. Templates are necessary to guide the alignment of disclosures and this Playbook provides guidance and insight for each of the 11 recommended TCFD disclosures in order to help firms enhance their TCFD reports and climate risk disclosures. For each of the TCFD disclosures, the Playbook provides a perspective on baseline disclosures, advanced considerations, and remaining open questions. Examples of how banks are reporting their data are provided for each recommendation.	Yes	https://www.unepfi.org/wordpress/wp-content/uploads/2020/09/UNEP-FI-IIF-TCFD-Report-Playbook.pdf
Network for Greening the Financial System (NGFS)	Climate scenarios for central banks and supervisors	Yes	https://www.ngfs.net/sites/default/files/medias/documents/820184_ngfs_scenarios_final_version_v6.pdf
UNEP-FI	<i>From Disclosure to Action: Applying TCFD Principles Throughout Financial Institutions</i> A stock-take on the myriad ways financial institutions are incorporating climate risk considerations into their businesses and risk operations. Guided by the TCFD framework, this top-to-bottom perspective on climate risk applications explores board and executive strategic planning, risk analysis and reporting, and business line engagement with clients.	Yes	https://www.unepfi.org/wordpress/wp-content/uploads/2020/10/Climate-Risk-Applications-From-Disclosure-to-Action.pdf
	<i>Beyond the Horizon: New Tools and Frameworks for Transition Risk Assessments from UNEP-FI's TCFD Banking Program</i> Three primary enhancements to transition risk assessments undertaken by program participants. This work generated insights into how climate-sensitive sectors may be impacted during a low-carbon transition. The heatmaps produced not only evaluate transitional risks for sectors overall but also for more granular subsectors.	Yes	https://www.unepfi.org/wordpress/wp-content/uploads/2020/10/Beyond-the-Horizon.pdf https://www.climateactioncheck.com/#/home
	<i>Charting a New Climate: State-of-the-Art Tools and Data for Banks to Assess Credit Risks and Opportunities from Physical Climate Change Impacts. TCFD Banking Pilot Project Phase II</i> This report on physical climate risks and opportunities provides a state-of-the-art blueprint to support financial institutions to navigate the changing physical climate risk landscape. The report also gives financial institutions an expanded toolbox with which to approach this important work.	Yes	https://www.unepfi.org/wordpress/wp-content/uploads/2020/09/Charting-a-New-Climate-UNEP-FI-TCFD-Banking-Physical-Risk.pdf

Drought Stress-Testing Tool Pilot

Water scarcity is an issue of great concern that is faced by many different regions around the world. It severely affects human lives and businesses directly and indirectly. Many industries depend heavily on the supply of water for production.

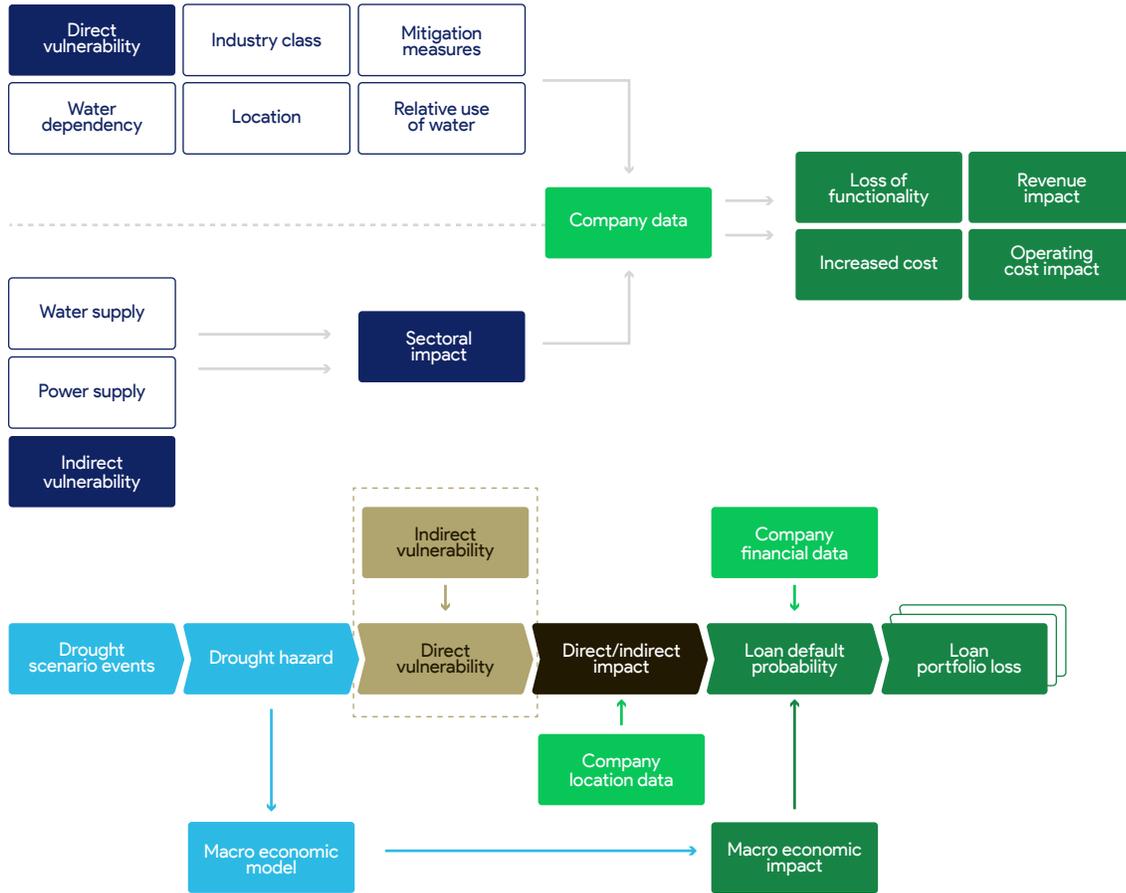
With climate change, the frequency and intensity of droughts have been increasing, causing many negative social and economic consequences. For example, a decline in rainfall may cause power shortages in areas that rely on hydro-electricity and can affect crop irrigation, severely devastating the energy and agriculture sectors. Droughts have serious implications for financial institutions as there has been limited work undertaken to assess and understand how they can trigger defaults. Companies' inputs, whether resources or labor, may be affected, resulting in business decisions to reduce outputs or halt production, decreasing the likelihood of debt repayment. As a result, droughts are a huge risk factor that can manifest in the financial risk of banks' portfolios. Therefore, incorporating such climate risk factors into credit assessments at the portfolio level enables banks to assess the resilience of their loan portfolios and make strategic and financial planning decisions accordingly.

In 2017, the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with Risk Management Solutions, the Natural Capital Finance Alliance, and GIZ developed an innovative framework and tool for drought stress testing. As the first drought risk assessment tool of its kind, it has been piloted with several banks from Brazil, China, Mexico, and the United States that supported the model design and tested its capacity and compatibility with their existing stress-testing processes. The tool is an open and freely downloadable resource for use by banks from these four countries and can also be used for other regions that have developed drought scenarios. The framework is highly flexible and can be adapted to assess default risk for ESG issues, as well as other extreme environmental disasters, such as hurricanes, earthquakes, and floods. This risk assessment tool allows for the consideration and incorporation of transitional risks, such as legislative and carbon risk arising from climate change policies. It could even be applied to more standard and mainstream financial risks, such as equity price volatility and infrastructure risk.

The tool covers five drought scenarios that vary in duration, intensity, and geographical extent. It covers at least eight industries in each country by stress testing selected corporate lending portfolios of the nine banks (Caixa Econômica Federal, Itaú, Santander, Banorte, Banamex, Trust Funds for Rural Development [FIRA], Citigroup, Industrial and Commercial Bank of China [ICBC], and UBS), representing more than \$10 trillion in assets.

The tool aims to measure the impact of the drought scenarios on companies' credit ratings, expected losses, and likelihood of default on their loans. The model assesses the vulnerability of companies to drought risk across its operations, by sector and region, based on the direct impact (due to water deficit) and indirect impact (due to electric power shortages and reduced raw materials and labor supply) to calculate how the different scenarios reduce output, consequently decreasing revenue and increasing operating costs. The risk factors, categories, and processes are visualized in Figure B.1.

Figure B.1. The Vulnerability Module of the UNEP-FI Drought Tool



Source: Carter and Moss (2017).

The tool also allows macroeconomic shocks on the global economy to be integrated, feeding them into the calculation of the probability of default. Expected losses are aggregated across all companies to determine total expected loss for a loan portfolio in each scenario. The macroeconomic factors considered include prices of oil, metals, agricultural inputs, interest, and exchange rates; GDP; inflation; and share prices. The macroeconomic modeling methodology reflects the proportionality of these factors to calculate the higher economic activity at risk in regions with higher GDP compared to poorer areas with lower economic risk (Carter and Moss, 2017). Banks can replace the tool's standard credit models with their own.

The quantification of drought risks allows banks to analyze the regions most vulnerable to each scenario and understand how drought affects companies of different sizes and in different sectors. The results of drought risk assessments inform banks about the exposure of its clients and whether the impact will likely cause individual companies to downgrade or default on their loans. Lenders can also evaluate the effect of drought on their entire portfolios and make more informed financial decisions for different industries, segments, and regions. Banks could then provide incentives to companies that show better water management or are drought resilient, such as lower interest rates.

Overall, the tool presented significant variation in how the different scenarios affected each country's businesses and sectors. However, in almost all scenarios, companies' credit ratings were downgraded and the probability of default increased as the financial performance and shareholders were critically hit by the impact of a drought. The performance of industries with direct or indirect dependence on water was negatively affected. The results from the drought stress-testing tool revealed that extreme droughts could increase loan defaults ten-fold for institutions with portfolios that have high exposure to drought risk. Expected results included the sectors that are overwhelmingly negatively affected by drought, including water supply, agriculture, and power generation, especially for countries that heavily rely on hydroelectric power. Other sectors that are indirectly but significantly negatively affected include the food and beverage industries. Less predictably, banks that appeared to have diverse portfolios at first glance realized from a portfolio-level analysis that they have a concentration of companies, industries, and regions with heavy dependence on water, and thus drought unfavorably affected their overall portfolio. At the macroeconomic level, petroleum refining showed high sensitivity to the economic impacts of drought, even if it is less water dependent.

As a prototype and in its preliminary development phase, the tool has some limitations and challenges. There is a lack of historical data linking previous droughts to defaults. This is an area for improvement for banks in terms of data collection. The tool is limited in its range of up to 10 industries modeled for each country, therefore, potential losses in other industries in a typical lending portfolio are not accounted for. The default rating model dismisses qualitative information used by the banks' proprietary stress-testing tools. For the most complete view of the drought impact, banks need to include the financial statements and location of operating sites of companies, and in many cases this information is not available to the credit modeling teams. The stress-testing tool's "archetype" data can supplement a bank's own data, providing the benefits of an analysis of results for a typical industry portfolio instead of representing the accurate underwriting practices of each institution. Santander Brazil noted that the water stress assessments took place during a recession, which is not an ideal or typical economic period, that the tool does not take into account the quality of water management, and that more and better data collection is required (Wells, 2018).

A drought stress-testing tool provides insights into the level of loss experienced in different scenarios and allows for reassessment of a bank's resilience to such events. These results enable a bank to:

- enhance its risk management by identifying high-risk borrowers,
- effectively discuss with clients the risks posed by drought,
- present incentives for firms showing more resilience to climate risks,
- apply stricter loan criteria or a higher cost of capital in areas at risk, and
- diversify its loan portfolio.

Febraban Climate Risk Sensitivity Assessment Framework

The Brazilian Federation of Banks (Febraban) has taken steps to guide the Brazilian banking sector toward implementing the TCFD recommendations by developing a roadmap and a climate risk tool. The Climate Risk Sensitivity Assessment Tool helps banks analyze the sensitivity of their credit portfolios to climate risks. The tool has two main objectives: it enables banks to prioritize climate risk management activities and it enables analysis of the materiality of climate risks (according to the TCFD Recommended Disclosures) based on the results of the assessment. In line with *Brazil's National Monetary Council Resolution 4327/2014 (Social and Environmental Responsibility Policy)*, the tool is based on the principles of relevance and proportionality to determine sensitivity to climate risks.

The relevance factor examines the level of exposure to climate risk based on the nature of economic activities financed by the institution. It considers sectors in which economic activities are more or less sensitive to climate risks, ranging from “AA” through “H” of credit rating of clients from these sectors. To be classified as investment grade, the portfolio’s credit rating must be AA or A. The proportionality factor is associated with the nature of the financial institution’s operations and the total amount of loans in the institution’s balance sheet. The greater the portfolio of a given sector in relation to the total credit portfolio, the greater representation that the climate risk brings to the portfolio: low (< 0.5 percent), medium (0.5–2.5 percent) and high (> 2.5 percent).

This tool is limited in that users may find it difficult to obtain data such as the location of the activities financed and the precise allocation of resources captured by the client, as well as certain financing characteristics such as working capital. However, these limitations can be addressed by using proxies provided by the model or by assessing sensitivity at different levels of detail based on existing information.

Table B.1. Climate Risk Sensitivity Assessment Tool Elements

Layers (by unit of analysis)	Principles		Expected messages
	Relevance	Proportionality	
SECTOR Sectorial portfolios that make up credit portfolio	<ol style="list-style-type: none"> 1. Nature of the economic sector activities 2. Quality of the economic sector portfolio (based on rating) 	<ol style="list-style-type: none"> 1. Amount of the active credit portfolio of the economic sector 	<ul style="list-style-type: none"> • Degree of sensitivity of the portfolio, in a macro look, that does not demand great detailing effort • More sensitive sectors • Reasons that contribute to greater sensitivity
CLIENTS Clients who make up a sector portfolio	<ol style="list-style-type: none"> 1. Nature of activities 2. Client Rating 	<ol style="list-style-type: none"> 1. Weighted average term of the client’s operations 2. Exposure per client 	<ul style="list-style-type: none"> • Clients to be prioritized in climate risk management • Reasons that contribute to the greater sensitivity of the clients that make up sector portfolio
CREDIT OPERATIONS Operations which make up a client’s portfolio	<ol style="list-style-type: none"> 1. Nature of activities 2. Operations Rating 3. Locaitonal climate risk of the operation 	<ol style="list-style-type: none"> 1. Operation tenor 2. Operation amount 	<ul style="list-style-type: none"> • Operations to be prioritized in climate risk management • Reasons that contribute to client sensitivity • Need for adjustment in the process of granting credit and monitoring operations

Source: SITAWI (2019).

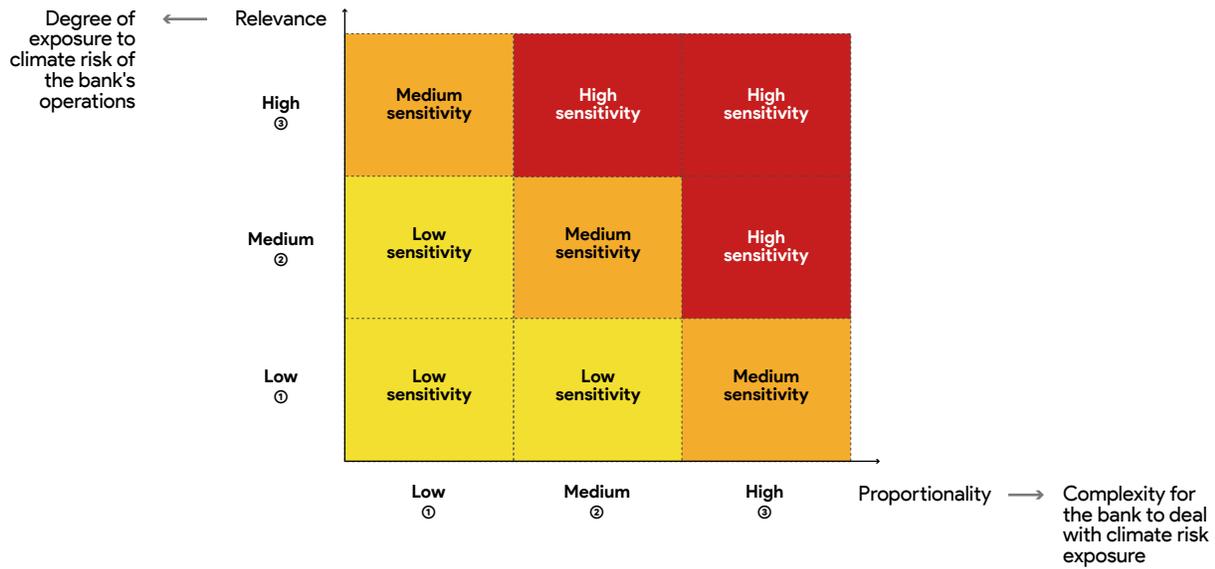
Table B.1 shows that the tool performs three layers of climate risk analysis: sector, client, and credit operation. The granularity and sophistication of the analysis increases progressively and requires greater level of effort with every additional layer. The tool allows for flexibility in performing a sensitivity analysis at each level independently or can be applied sequentially based on the amount of data available to the bank and its desirability to perform a partial diagnosis or full analysis of its credit portfolio.

The first level of analysis considers relevance (nature and quality of economic activities of each sector) and proportionality (amount of the active credit portfolio in this economic sector) of climate risks on the **sectorial** makeup of the credit portfolio. The outcomes of this analysis indicate the degree of sensitivity of the overall portfolio, highlight the most sensitive sectors, and help identify the factors that contribute to higher sensitivity. This process does not require a great level of effort or details.

The second level of analysis considers the relevance (based on the nature of economic activities and client credit rating) and proportionality (based on weighted average term of client's operations and exposure per client) of the **clients** that make up the sector portfolio. The results show the reasons that certain clients have greater sensitivity and enable the identification and prioritization of clients for climate risk management.

The third level of analysis considers the relevance (nature of activities, operations rating, and location) and proportionality (operation tenor and amount) of the **credit operations** that make up a client's portfolio. The outcome of the analysis underscores the reasons that contributed to the client's sensitivity to climate risks and enable operations to be prioritized for climate risk management. This process will need to be adjusted and integrated into the credit-granting process as well as the monitoring operations.

Table B.1. Climate Risk Sensitivity Assessment Tool Elements



Source: SITAWI (2019).

Figure B.2 shows the matrix of low, medium, and high sensitivity on relevance (degree of exposure to climate risk of the bank's operation) and proportionality (complexity for the bank to deal with climate risks exposure). The combination of relevance and proportionality indicates the portfolio's sensitivity.

Annex C: List of National Development Banks and Commercial Banks Interviewed

Name of Bank	Country
Banco do Brasil	Brazil
Banco de Comercio Exterior de Colombia (Bancoldex)	Colombia
Banco Nacional de Comercio Exterior (Bancomext)	Mexico
Banco de Desarrollo de El Salvador (BANDESAL)	El Salvador
Banco Nacional de Obras y Servicios Públicos (Banobras)	Mexico
Banco de Desenvolvimento de Minas Gerais S.A. (BDMG)	Brazil
O Banco Nacional do Desenvolvimento (BNDES)	Brazil
Corporacion Financiera de Desarrollo (COFIDE)	Peru
Fideicomisos Instituidos en Relación con la Agricultura (FIRA)	Mexico
Nacional Financiera SNC (NAFIN)	Mexico
Santander Brasil	Brazil

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