

Guide for Supervisors

Integrating climate-related and environmental risks into prudential supervision

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When the NGFS started the work on this Guide, worldwide pandemics and lockdowns were still mainly limited to scripts of science fiction movies. No one could have imagined that today, the COVID-19 pandemic would have affected all our lives. No one could have imagined the resulting damage to the economy. Our priority now of course is to limit the economic impact of the pandemic crisis still unfolding in front of us. Even with economies taking their first tentative steps to start up after the lockdown, we cannot afford to lose sight of the importance of doing all we can to fight climate change and stop environmental degradation. The droughts, the floods, the fires, the famine, the refugees, biodiversity loss – all these challenges have not gone away. In fact they are expected to worsen in the near future. That is why our response to the pandemic should be not to rebuild the old economy, but to use this momentum to start building a new economy that is more sustainable and greener. We must do all we can to avoid the next crisis looming on the horizon.

Action is also urgently needed from a financial risk perspective. The challenges we face from climate change and environmental degradation are after all sources of financial risks, and dealing with these risks is at the core of our mandate. The 66 central banks and supervisors, and the 12 observers involved in the NGFS are determined to continue their valuable work to address climate-related and environmental risks. Their efforts have resulted in this Guide – the first of its kind – which will help supervisors integrate these risks into their work.

The information in this Guide is built around five recommendations for supervisors and presents illuminating insights from supervisory practices around the world. Turn its pages to find out about the Reserve Bank of New Zealand’s climate change strategy, the internal network set up by the Bank Negara Malaysia, how the Bank of England assesses mortgages against flood risks, what the Banco Central do Brasil expects from financial firms regarding risk management, and many, many more. It is a goldmine of information for prudential supervisors wishing to scale up and learn from their peers. For financial institutions, this Guide could be a valuable tool for learning more about what supervisors are doing to identify climate-related and environmental risks, as well as how supervisors expect banks and insurers to address these risks.

This Guide is a snapshot of the current state of play. The best testament to its success would be if its contents soon become outdated. That means it would have inspired supervisors around the globe to take the next steps, to identify more accurately the transmission channels of climate-related and environmental risks to the financial sector and to make improvements in metrics to quantifying risks. Everyone involved in the NGFS will keep working hard to achieve these and other goals. We aren’t there yet, but we’re getting closer every day.

This Guide would not have been possible without the considerable time and effort invested by Lisa Biermann and Léa Grisey from the NGFS Secretariat, the excellent drafting team and many other NGFS Members and Observers. We would like to extend our heartfelt gratitude to everyone involved. You have shown the world how central banks and supervisors can play a vital role in taking action against climate change.

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Executive summary

The Network for Greening the Financial System (NGFS) acknowledges that climate-related and environmental risks are a source of financial risks and that central banks and supervisors should therefore ensure that the financial system is resilient to these risks. In its first comprehensive report “A Call for Action” (NGFS, *A call for action – Climate change as a source of financial risk*, 2019) the NGFS recommended the integration of climate-related risks into micro-prudential supervision. Following up on this, and based on supervisors’ current practices, this guide sets out five recommendations for members of the NGFS as well as the broader community of banking and insurance supervisors to integrate climate-related and environmental risks into their work. Its aim is to offer supervisors the inspiration needed to accelerate their own efforts in this area, while giving them the flexibility to accommodate their own specific needs, tailor actions to their mandates and make progress at their own pace.

Recommendation 1 – Supervisors are recommended to determine how climate-related and environmental risks transmit to the economies and financial sectors in their jurisdictions and identify how these risks are likely to be material for the supervised entities.

The physical effects of climate change and environmental degradation, as well as the transition to a low-carbon and more circular economy drive financial risks. Chapter 1 sets out the main sources of physical and transition risks and describes how these risks drive conventional prudential risks for both the banking and insurance sectors. **Physical risks** are financial risks which can be categorised as either acute – if they arise from climate and weather-related events and acute destruction of the environment – or chronic – if they arise from progressive shifts in climate and weather patterns or gradual loss of ecosystem services. **Transition risks** are financial risks which can result from the process of adjustment towards a lower-carbon and more circular economy, prompted, for example by changes in climate and environmental policy, technology or market sentiment.

Recommendation 2 – Develop a clear strategy, establish an internal organisation and allocate adequate resources to address climate-related and environmental risks.

Addressing climate-related and environmental risks requires the boards of supervisory authorities and central banks to incorporate their relevance into their mandates and develop a strategy on integrating these risks in their work. The far-reaching impact in breadth and magnitude of climate change and the environmental degradation on the economy and the financial sector means that the topic is relevant to many different departments and experts within central banks and supervisors, and therefore requires an adequate organisational response.

Chapter 2 lays out different practices currently used by supervisors to embed climate-related and environmental risks in their day-to-day work. Supervisors often set an internal strategic roadmap, raise awareness on the topic and build capacity within their organisations and doing so in the wider context of other financial system stakeholders. Supervisors have created different working-level structures to ensure participation throughout the organisation and involve experts who dive deeper into the impact on financial risks. Overall, experience has shown that addressing climate-related and environmental risks requires adequate resources, and that commitment from the top of the organisation is a key driver in advancing the agenda.

Recommendation 3 – Identify the exposures of supervised entities that are vulnerable to climate-related and environmental risks and assess the potential losses should these risks materialise.

To identify exposures that are vulnerable to climate-related and environmental risks, supervisors are recommended to assess different determinants of physical risk (e.g. climate sensitivity of sector, geographical location, tenor) and transition risk (e.g. policy sensitivity, tenor). When doing so, supervisors are recommended to identify potential data gaps and determine their approach to gathering quantitative and qualitative data. To estimate the magnitude of the exposure to these climate-related and environmental risks, supervisors are recommended to develop methodologies, such as scenario analysis and stress testing. Furthermore, supervisors are recommended to develop key micro risk indicators to monitor climate-related and environmental risks.

Chapter 3 sets out the practices of **NGFS members who have pioneered identifying and assessing climate-related and environmental risks**. To determine the exposure of their financial sectors to climate-related risks, supervisors have adopted a variety of approaches.

Recommendation 4 – Set supervisory expectations to create transparency for financial institutions in relation to the supervisors’ understanding of a prudent approach to climate-related and environmental risks

Supervisors are recommended to clarify to financial institutions what is expected of them regarding climate-related and environmental risks. Initiatives are underway in some jurisdictions to set these supervisory expectations and they have typically covered the following five areas:

- **Governance:** To effectively manage climate-related and environmental risks, supervisors expect financial institutions to clearly define and assign responsibilities within existing governance arrangements.
- **Strategy:** Supervisors expect financial institutions to be aware of potential changes in their business environment and to adopt a strategic approach to cater for climate-related and environmental risks. For most financial institutions this requires a longer term view than the typical business planning horizon of three to five years. Short and medium term risks, in particular stemming from the energy transition, also need to be duly considered.
- **Risk management:** Supervisors expect financial institutions to have policies and procedures in place to identify, assess, monitor, report and manage all material risks. Supervisors also expect financial institutions to incorporate climate-related and environmental risks in their processes and procedures for credit, market, liquidity, operational, insurance and other risks, as well as to develop adequate metrics for their internal monitoring and the external reporting and management of their operations.
- **Scenario analysis and stress testing:** Given the forward-looking nature of the risks and the inherent uncertainty associated with climate-related and environmental risks, supervisors expect financial institutions to develop methodologies and tools (e.g. scenario analysis and stress testing) necessary to capture the size and scale of climate-related and environmental risks.

- **Disclosure:** Supervisors expect financial institutions to disclose information and metrics on the climate-related and environmental risks they are exposed to, their potential impact on the safety and soundness of the institution and how they manage those risks. The NGFS encourages supervisory expectations on disclosure to be in line with the TCFD recommendations.

Chapter 4 elaborates on the five topics mentioned above as well as on the process for setting supervisory expectations. Generally, supervisors have not set new legally binding requirements. Instead, some supervisors issued (i) a clarification of how existing legal requirements may be applied in the context of climate-related risks, and/or (ii) a set of good practices. When planning the issuing of supervisory expectations, it is important to consider the process and the particular format of publication selected, which will depend on the legislative frameworks that supervisors are operating in.

Recommendation 5 – Ensure adequate management of climate-related and environmental risks by financial institutions and take mitigating action where appropriate.

Qualitative and quantitative measures can be taken by supervisors to address climate-related and environmental risks. When doing so, supervisors can rely on their existing supervisory toolbox to take mitigating action. Chapters 5 and 6 set out the toolbox for mitigating measures by supervisors. Supervisors have taken a number of qualitative measures, for example, requiring the strengthening of risk management and internal control systems, procedures and processes, or the reduction of risks. Board level engagement with financial institutions is an effective tool that supervisors can use at this stage. Given that methodologies for climate-related and environmental risk quantification are still being developed, most supervisors have not yet imposed (additional) capital or solvency requirements specifically linked to these risks. In general more research is needed on the transmission channels and loss potentials of such risks as well as potential specific risk profiles of different groups of assets and exposures. It is also worth analysing to what extent the current framework adequately captures these risk drivers.

Looking forward

The NGFS will continue to leverage and update the best practices identified within its membership to help central banks and supervisors, as well as the relevant stakeholders, to better assess and mitigate climate-related and environmental risks. Based on the findings in this guide and the experiences to date, the NGFS will also work on the following issues:

- **The NGFS will look further into the data and methodologies necessary for supervisors to improve climate-related and environmental risks assessments.**

A persistent challenge for supervisors is the need for more and better-quality climate and environmental data and methodologies for better assessing and mitigating climate-related and environmental risks.

- As set out in the NGFS Comprehensive Report 2019, the NGFS will **further investigate the transmission channels through which environmental risks materialise as a source of financial risk.**

The recommendations of the NGFS are non-binding but aim to **contribute to developing an international approach that is as harmonised as possible.** The NGFS also works together with international standard setting bodies, some of them NGFS observers, to further strengthen a collective response to climate-related and environmental risks.

Origin of the NGFS



8 central banks and supervisors established the Network of Central Banks and Supervisors for Greening the Financial System.



As of end May 2020, the NGFS consists of

66 Members 12 Observers
representing 5 continents.



The NGFS is a coalition of the willing.

It is a voluntary, consensus-based forum whose purpose is to share best practices, contribute to the development of climate –and environment– related risk management in the financial sector and mobilise mainstream finance to support the transition towards a sustainable economy.



The NGFS issues recommendations

which are not binding but are aimed at inspiring all central banks and supervisors and relevant stakeholders to take the necessary measures to foster a greener financial system.



Introduction

The NGFS's purpose 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 (NGFS Comprehensive Report 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 with a supervisory mandate worked together to share experiences and have produced this hands-on guide on how to best integrate climate-related and environmental risks into their work.

It sets out five recommendations with proposed courses of action for supervisors and provides them with an overview of the current state of play among their peers in terms of integrating climate-related and environmental risks into supervision. This guide addresses supervisors, NGFS members and other parties, who operate in different financial markets and legislative frameworks and are at different stages of integrating climate-related and environmental risks. Therefore, the guide does not offer a one-size fits-all solution for supervisors. Its aim is to offer supervisors the inspiration needed to accelerate their own efforts in this area, while giving them the flexibility to accommodate their own specific needs, tailor actions to their mandates and make progress at their own pace.

This guide builds on the high-level framework for integrating climate-related factors into supervision from the NGFS Comprehensive Report 2019. The content reflects the results of a survey among 34 NGFS members with a supervisory mandate conducted in July 2019 (NGFS survey), further input received from NGFS members and other work done by supervisors outside the network. Given that most NGFS members supervise banks and/or insurers, the guide focuses on these two sectors. Nevertheless, its content could also be relevant to the supervision of other financial players.

Chapter 1 sets the scene by explaining why climate-related and environmental risks are a source of financial risks and why they are relevant for the work of financial supervisors. Chapter 2 focuses on the organizational aspects of embedding climate-related and environmental risks into the day-to-day work of the supervisors, ways to raise awareness amongst financial institutions, and methods for sharing knowledge across relevant stakeholders. Chapters 3 and 4 give an overview of current practices of prudential supervisors for climate-risk identification and assessment, as well as for setting supervisory expectations. Subsequently, Chapter 5 describes the supervisory and regulatory toolboxes that can be used to address climate-related and environmental risks, followed by Chapter 6 on how climate-related and environmental risks could potentially be relevant when determining capital requirements. Lastly, the final Chapter identifies areas for future work.

The NGFS Comprehensive Report 2019 noted that the integration of climate-related factors into prudential supervision was still at an early stage. Since then, progress has been made. In the past twelve months alone, NGFS members undertook risk analyses, built up their expertise and resources and organized many outreach events. NGFS members published findings from climate-related and/or environmental risk assessments, and issued supervisory expectations or related public consultations aimed at banks and insurers. The practices showcased in this guide aim to further inspire supervisors and help them accelerate their efforts.

The journey towards embedding climate-related and environmental risks in regular activities has begun for many supervisors, yet more work lies ahead. There is a need for collective leadership and globally coordinated action to better identify transmission channels of climate-related and environmental risks. Metrics and methodologies for sound risks analysis must be developed further for different groups of assets and exposures. NGFS members will continue to work within the NGFS's mandate to enhance the role of the financial system in better managing climate-related and environmental risks, and the NGFS urges all other actors in the financial sector to take action and contribute to this shared goal.

1. Climate-related and environmental risks as a source of financial risks

Recommendation 1 – Supervisors are recommended to determine how climate-related and environmental risks transmit to their economies and financial sectors in their jurisdictions and identify the risks that are likely to be material for the supervised entities

The physical effects of climate change and environmental degradation, as well as the transition to a low-carbon and more circular economy drive financial risks. This Chapter sets out the definition of climate-related and environmental risks, the main sources of physical and transition risks and describes how physical and transition risks drive conventional prudential risks for both the banking and the insurance sector.

1.1 Definition of climate-related and environmental risks

The NGFS aims to contribute to the development of climate-related and environmental risk management in the financial sector. **Climate-related risks** in this guide refers to financial risks posed by the exposure of financial institutions to physical or transition risks caused by or related to climate change, for example, damage caused by extreme weather events or a decline in asset value in carbon-intensive sectors. **Environmental risks** in this guide refers to 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. Environmental degradation could cascade to risks for financial institutions. Reduced availability of fresh water or biodiversity loss could, for example, weaken supply chains or limit the operations of businesses in a specific region, and drive financial risks and affect financial institutions' exposures to those businesses.¹ There is widespread scientific consensus that environmental degradation has already reached levels that endanger the stability of ecosystems² that underpin the global economy through the provision of the stock of natural capital or the flow of ecosystem services.³

There is a **connection and to some degree an overlap between climate-related and environmental risks**. Climate change also leads to environmental degradation, as an increase of just 1.5°C is expected to have a significant impact on biodiversity and ecosystems on land and in the sea.⁴ Yet, not all environmental degradation is a result of climate change, it could stem from other sources as well. For example, increasing population and income growth leading to higher water demand will cause a large part of the world and its inhabitants to face water stress⁵, while unsustainable exploitation of natural resources could contribute to further loss of biodiversity such as the extinction of endangered species.

For supervisors and financial institutions it is also important to be aware of **potential greater impacts due to the combined effects of climate-related and environmental risks**, as these may reinforce each other through a negative feedback loop. The negative impact of climate change could increase degradation of the environment and weaken our resilience to the physical impacts of such change. For example, reductions in the diversity of cultivated crops due to the rise in temperatures may mean that agroecosystems are less resilient against future climate change, pests and pathogens.⁶

1 NGFS, *A call for action – Climate change as a source of financial risk*, 2019.

2 Nature Climate Change (2019): Nature provides renewable and non-renewable resources that combine to yield a flow of benefits to people. These are commonly referred to as "ecosystem services".

3 IPBES, *The global assessment report on biodiversity and ecosystem services*, 2019: Nature and its vital provisions to the human race, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide. The IPBES stated that "land degradation has reduced productivity in 23 per cent of the global terrestrial area, and between \$235 billion and \$577 billion in annual global crop output is at risk as a result of pollinator loss. Moreover, loss of coastal habitats and coral reefs reduces coastal protection, which increases the risk from floods and hurricanes to life and property for the 100 million to 300 million people living within coastal 100-year flood zones."

4 The Intergovernmental Panel on Climate Change: Special Report on Global Warming of 1.5°C, 2018; Special Report on Climate Change and Land, 2019; Special Report on Oceans and the Cryosphere in a Changing Climate, 2019.

5 World Resources Institute, *Aqueduct Water Stress Projections: Decadal Projections of Water Supply and Demand Using CMIP5 GCMs*, June 2015.

6 IPBES, *The global assessment report on biodiversity and ecosystem services*, Summary for policymakers, 2019.

In turn, environmental degradation significantly reduces the capacity of ecosystems to absorb carbon. Ecosystems such as forests, soils and oceans provide essential carbon storage as they absorb 60% of all anthropogenic carbon emissions.⁷ Conversely, healthy ecosystems contribute to resilience by enabling the adaptation to conditions caused by climate change that are already taking place, such as higher temperatures, rising seas, fiercer storms, more unpredictable rainfall and more acidic oceans.⁸

The examples highlighted in this guide mainly address climate-related risks. The transition to a carbon-neutral economy consistent with the objectives of the Paris Agreement requires a radical shift of resource allocation, and thus, a seminal response by the financial sector. It was against this background that the NGFS was founded. The NGFS survey results show that supervisors have advanced most on assessing transition risks, by taking the carbon intensity of financial institutions' portfolios as a proxy. Yet, given the connection between climate-related and environmental risks and the fact that environmental degradation can lead to financial risk regardless of whether it is caused by global warming, the NGFS recognises that more work needs to be done on identifying the financial risks stemming from environmental degradation.

1.2 Climate-related and environmental risks as sources of financial risks

Both the physical effects of climate change and the transition to a low-carbon economy are sources of financial risks. **Physical risks** can be categorised as either acute – if they arise from climate and weather-related events – or chronic – if they arise from progressive shifts in climate and weather patterns. Physical risks include the economic costs and financial losses resulting from the increasing severity

and frequency of extreme climate change-related weather events (such as heat waves, droughts, landslides, floods, wildfires and storms), as well as longer-term progressive shifts in the climate (such as ocean acidification, rising sea levels and average temperatures). **Transition risks** are financial risks which can result from the process of adjustment towards a lower-carbon and more circular economy, prompted, for example, by changes in climate and environmental policy, technology or market sentiment.⁹ Emissions must rapidly reach “net zero”¹⁰ to prevent further climate change. The process of reducing emissions is likely to have a significant impact on the global economy, thereby affecting the value of financial assets, in particular those in certain carbon-intensive sectors. While determined actions are urgently required, a credible long-term approach based on effective measures is needed, as an abrupt transition could also have an impact on financial stability and the economy in a broader sense. In addition, climate-related legal cases are emerging. These cases involve parties seeking compensation from corporates as well as from financial institutions that they hold responsible for loss and damage resulting from the effects of climate change.¹¹ The potential associated financial impact on the banking and insurance sectors as a result of potential liability will be considered in this guide as a subset of either physical or transition risk and is referred to as “liability risk”.

Climate-related risks are not just future risks; they are already impacting the economy and financial system today. Overall, worldwide economic costs from natural disasters have exceeded the 30-year average of USD 140 billion per annum in seven of the last ten years.¹² Since the 1980s, the number of extreme weather events has more than tripled.¹³ Estimates suggest that absent action to reduce emissions, the resulting physical impact of climate change on the global economy in the second half of the century will be substantial. The more sophisticated studies suggest that average global incomes may be reduced by up to a quarter by the end of the century

7 IPBES, *The global assessment report on biodiversity and ecosystem services*, Summary for policymakers, 2019.

8 Global Commission on Adaptation, *Adapt now: A global call for leadership on climate resilience*, 2019.

9 For example, the EU Commission proposed a Regulation to legally enshrine the objective of climate neutrality by 2050 (https://ec.europa.eu/clima/policies/eu-climate-action/law_en), and many other jurisdictions have taken similar measures to cut emissions.

10 Net Zero means no net release of carbon dioxide into the atmosphere, as a result of reduced emissions and carbon offsetting for those emissions that cannot be reduced any further.

11 Mark Carney: *Breaking the Tragedy of the Horizon - climate change and financial stability*, 2015, p 6.

12 Munich Reinsurance Company (2019), “Natural Catastrophe Review 2018” Geo Risks Research, NatCatSERVICE.

13 Munich Reinsurance Company (2018), “A stormy year: Natural catastrophe 2017” Geo Risks Research, NatCatSERVICE.

compared to a path without further climate change.¹⁴ In addition, the increased probability of disruptive events such as mass migration, political instability and conflict in these scenarios means that economic estimates are likely to understate the size and timing of the associated risks.

Next to the aforementioned economic impact of climate change, there is increasing evidence that environmental degradation also has substantial economic impact (see Box 1). Each of these types of environmental deterioration poses a unique challenge to economic activity on the one

Box 1

Examples of evidence of economic damage stemming from environmental degradation beyond climate change

Environmental degradation	Evidence of economic damage
Climate change and air pollution	The estimated damage from climate change amounts to almost 3% of GDP by 2060, and that from air pollution to around 1%. For both environmental issues, the majority of the damage will be located in the most vulnerable economies in Asia and Africa, with costs of damage in many regions exceeding 3% of GDP and in some cases 5%. (Source: OECD, <i>Economic interactions between climate change and outdoor air pollution</i>, 2019.) The burden of ambient air pollution in the 41 countries under study stood at a toll of around 3.2 million deaths and at a cost of around USD 5.1 trillion in 2015. (Source: OECD, <i>The Rising Cost of Ambient Air Pollution thus far in the 21st Century</i>, 2017.)
Water pollution (including nitrogen and phosphorus run-off)	The cost of current water pollution from diffuse sources exceeds billions of dollars each year in OECD countries. Water pollution has a lasting negative impact on human health, water security, economic productivity and freshwater ecosystem services as well as social values. (Source: OECD, <i>Economic costs and policy approaches to control diffuse source water pollution</i>, 2017.) The combined annual costs and loss of value in recreational water usage, waterfront real estate, spending on recovery of threatened and endangered species, and drinking water were approximately USD 2.2 billion annually as a result of eutrophication in U.S. freshwaters. (Source: Dodds et al., <i>Eutrophication of U.S. Freshwaters: Analysis of Potential Economic Damages</i>, 2008.)
Land use transformation (e.g. deforestation)	The results show that the annual costs of land degradation due to land use and land cover change (LUCC) are about USD 231 billion per year or about 0.41 % of global GDP, amounting to USD 56.49 trillion in 2007. (Source: Nkonya et al., <i>Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development</i>, 2016.) Between 1997 and 2011, the world lost an estimated USD 4-20 trillion per year in ecosystem services owing to land cover change and USD 6-11 trillion per year due to land degradation. (Source: OECD, <i>Biodiversity: Finance and the Economic and Business Case for Action</i>, 2019.)
Water stress	Some regions could see their growth rates decline by as much as 6% of GDP by 2050 as a result of water-related losses in agriculture, health, income, and property – sending them into sustained negative growth. (Source: World Bank, <i>High and Dry: Climate Change, Water, and the Economy</i>, 2016.)
Biodiversity loss	Businesses and financial organisations also depend on biodiversity for the production of goods and services. The profitability and long-term survival of a number of business sectors (such as agriculture and fisheries) depend directly on biodiversity and well-functioning ecosystems. Globally, the total economic value of ecosystem services is estimated to be between USD 125 and 140 trillion per year. (Source: OECD, <i>Biodiversity: Finance and the Economic Case for Action</i>, 2019.)
Ocean acidification	Ocean acidification affects marine ecosystem services and it is scientifically plausible that it could cause a complete collapse of marine capture fisheries and complete destruction of coral reefs by 2200. Upper-bound estimated values for losses from the first two effects range from USD 97 to 301 billion 2014 per year (0.09 – 0.28% of current world GDP). (Source: Colt and Knapp, <i>Economic Effects of an Ocean Acidification Catastrophe</i>, 2016.)

14 See, for example, Burke, Hsiang and Miguel, “Global Non-Linear Effect of Temperature on Economic Production”, *Nature* Vol. 527, pp. 235-239 (12 November 2015).

hand and well-being of humans on the other. Despite the complexities of comparing the potential economic effects, studies estimating the financial impact of environmental damage suggest that the costs associated with broader environmental degradation have the same order of magnitude as the costs associated with greenhouse gas emissions.¹⁵ Bearing in mind that most of these studies provide global estimates, there may be large differences between geographies. Supervisors are strongly advised to assess which of these environmental degradations are material in the geographies in which the financial institutions they supervise operate.

Even though more research is needed, the examples mentioned in Box 1 show that there is growing evidence that water stress, biodiversity loss and resource scarcity can drive financial risk, alongside the effects of climate change. Available studies find that **financial risks associated with the environment may likewise be categorised as either physical or transition risks**. Risks related to water stress, for example, can be a consequence of physical shortages of water impairing the ability of business facilities that depend on water to operate (physical risks), as well as a consequence of (local) government action aimed at regulating the supply of available water through extraction restrictions or pricing (transition risks). Biodiversity loss serves as another example. The loss of ecosystem services, such as animal pollination, can directly affect crop yields (physical risks) and/or lead to regulation, such as stricter certification requirements or the limitation of business activities to areas with high biodiversity (transition risk).¹⁶ Liability risks can also arise from legal action taken against financial institutions that finance companies whose activities have negative environmental impacts.

1.3 Transmission of climate-related risks to the financial system

An increasing number of supervisors and international bodies have already presented the transmission channels through which climate change might affect the economy and the financial system. For instance, the NGFS gave an overview of these transmission channels in its Comprehensive Report 2019¹⁷ (see Figures 1 and 2 below) as well as in its technical supplement on the macroeconomic and financial stability implications of climate change.¹⁸

Physical risks can affect the financial sector through two primary channels: extreme weather events and gradual shifts in climate patterns. For instance, increased risk of flooding of residential property can result in changes in the debt repayment capacity of borrowers and the value of the collateral, thereby affecting the mortgage portfolios of banks. Physical risks can also have a significant impact on non-life insurers, including on the liability side of their balance sheet.¹⁹ For example, the Dutch Central Bank (DNB) estimated that the climate-related claims burden may rise between 25% and 131% by 2085 compared to 2016 due to more frequent and severe hail and thunder, an increase in the intensity of rainfall, and sea level rise.²⁰

Transition risks drivers are threefold. First, **climate-related mitigation policies** such as the introduction of carbon pricing²¹ could lead to reductions in financial valuations and/or downgrades in credit ratings for companies not compliant with the 2-degree scenarios, because they no longer earn an economic return on past investment²² (“stranded assets”), for example due to the impact on the future discounted

15 See Box 1 for examples of evidence of economic damage stemming from environmental degradation beyond climate change.

16 The transition to a more circular and resource-efficient economy is clearly foreseen by the European Commission. See, for instance: European Commission, *Action Plan: Financing Sustainable Growth*, 2018.

17 NGFS, *A call for action – Climate change as a source of financial risk*, 2019.

18 NGFS, *Macroeconomic and financial stability – Implications of climate change*, 2019.

19 This is not taking into account the risk reduction capacity of non-life insurers. Due to the short-term nature of most non-life policies, insurers are able to price physical risk into their policies. In that case, two new issues may arise: (i) impact of insurers’ repricing on the banking sector- for instance, higher premiums resulting in fewer homeowners with mortgages from insurers (the “protection gap” issue); (ii) a solvency issue for insurers if such repricing is restricted.

20 DNB, *Waterproof? – An exploration of climate-related risks for the Dutch financial sector*, 2017.

21 For instance: The German Federal Government presented key elements of a climate change mitigation plan in September 2019, including a fixed price per ton of carbon dioxide applied to heating and motor fuels. The price will be imposed on companies trading in heating oil, liquid gas, coal, petrol or diesel via a new national emissions trading scheme in the traffic and heating sectors. The price is fixed at EUR 25/tCO₂ in 2021, further increasing to EUR 55/tCO₂ in 2025, followed by a price corridor between EUR 55 and EUR 65/tCO₂ thereafter.

22 The International Energy Agency defines stranded assets as “those investments which have already been made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return as a result of changes in the market and regulatory environment brought about by climate policy” (IEA, 2013, p. 98).

Figure 1. **From physical risk to financial stability risks**

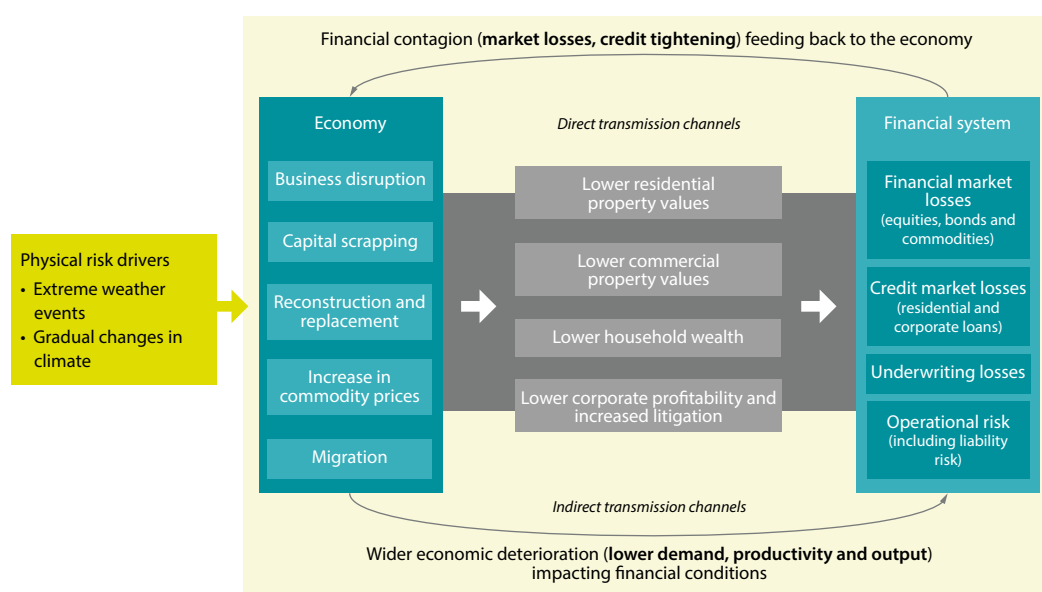
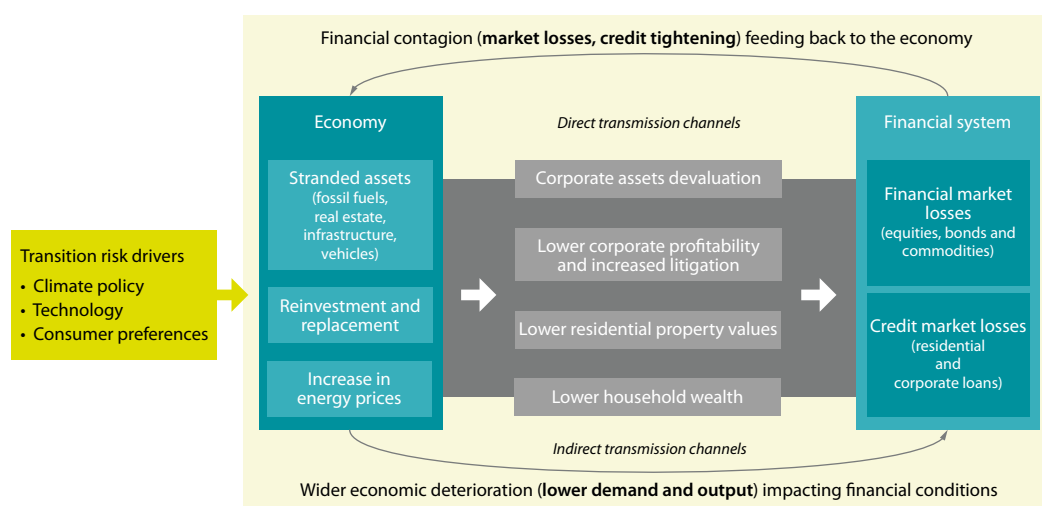


Figure 2. **From transition risk to financial stability risks**



cash flows generated by the company. This could result in market losses for the financial institutions exposed to these carbon intensive companies. Moreover, a study by the IEA and IRENA²³ estimated the losses the economy could incur in the case of delayed mitigation policies; these could go up to USD 20 trillion. Second, **technological advances**, such

as those contributing to energy transition, could affect the relative pricing of alternative products and reduce the market shares of certain companies, resulting in lower profitability and eventually losses for financial institutions.²⁴ Third, **shifts in public sentiment, demand patterns, and preferences and expectations** can affect the economy and

23 IEA and IRENA, *Perspectives for the energy transition – Investment needs for a low-carbon energy system*, 2017.

24 See, for example, the case study by the Bank of England on the impact of the low-carbon transition on the automotive industry and the UK banking sector, BoE, *Transition in thinking: The impact of climate change on the UK banking sector*, 2018, p. 30.

the financial system. For instance, increased litigation against companies involved in carbon-intensive sectors failing to adapt could result in financial costs and reputational risks for the companies and even for financial institutions financially exposed to these companies²⁵. Supervisors have also estimated the impact of transition risk on the insurance sector. As EIOPA and IAIS note²⁶, there is an important potential impact of climate change on the insurance sector via liability risk. This may arise from (1) climate-related claims from people or businesses seeking compensation for losses they may have suffered from the physical or transition risks under liability policies, as well as (2) direct claims against

insurers for failing to manage climate risks. In its 2019 report²⁷ the Autorité de contrôle prudentiel et de résolution (ACPR) estimates that 10% of French insurers' portfolios would be subject to transition risk (EUR 250 billion) affecting the fossil fuel, electricity, gas and water producing sectors as well as energy consumers (based on 2017 data).

Several supervisors' reports have shown that these climate-related risks are in fact drivers of conventional prudential risk types for both the banking and insurance sectors.²⁸ Box 2 provides an example of how physical and transition factors can lead to increased prudential risks.

Box 2

Climate-related risks as drivers of prudential risk categories

Prudential risk categories	Examples of climate-related factors affecting prudential risks
Credit risk	The destruction of a production site by wildfire can increase the probability of default of the company operating the site. Loss stemming from default of mortgage-backed loans can increase when the value of buildings provided as collateral decreases due to new energy-efficiency standards.
Operational risk	Extreme weather events can have an impact on financial institutions' business continuity through, for instance, damage affecting critical functions of the financial entity or of its main providers. Financial institutions or their customers might face a liability ¹ charge from parties who have suffered losses from physical and transition effects and seek to recover these losses from those they view as responsible.
Market risk	Severe weather events or political measures regarding the transition could lead to re-pricing of financial instruments and corporate debt affecting the value of securities held on financial institutions' balance sheets (and/or the value of collateral used in some operations). The introduction of a carbon tax can result in investment losses and lower assets' values (stranded assets).
Underwriting risk	Extreme weather events such as floods in coastal areas may result in higher than expected insurance claim pay-outs in the case of damaged insured properties.
Liquidity risk	A lack of reliable and comparable information on climate-sensitive exposures of financial institutions could create uncertainty and cause procyclical market dynamics, including fire sales of carbon-intensive assets, and potentially also liquidity problems.

¹ Liability risks are often categorised as operational risks.

25 According to the UNEP, as of March 2017 climate change cases had been filed in 24 countries (25 if one counts the European Union), with 654 cases filed in the United States and over 230 cases filed in all other countries combined, UNEP, *The status of climate change litigation: a global review*, 2017.

26 EIOPA, *Opinion on Sustainability within Solvency II*, 2019; and IAIS and SIF, *Issues Paper on Climate Change Risks to the Insurance Sector*, 2018.

27 ACPR, *French insurers facing climate change risks*, 2019.

28 E.g. DNB, *Good Practice Integration of climate-related risk considerations into banks' risk management*, 2020; EIOPA, *EIOPA issues opinion on sustainability within Solvency II*, 2019.

2. Awareness raising, organisational aspects and capacity building

Recommendation 2 – Develop a clear strategy, establish an internal organisation and allocate adequate resources to address climate-related and environmental risks.

Addressing climate-related and environmental risks requires the boards of supervisory authorities and central banks to incorporate the relevance of climate-related and environmental risks into their mandate and develop a strategy for integrating these risks into their work. The far-reaching impact in breadth and magnitude of climate change and environmental degradation on the economy and the financial sector means that this topic is relevant to many different departments and experts within central banks and supervisors and therefore requires an adequate organisational response.

This Chapter lays out different practices currently used by supervisors to embed climate-related and environmental risks in their day-to-day work. Supervisors should ensure that financial institutions manage any material climate-related and environmental risk appropriately. Therefore supervisors should equip themselves to be able to execute these tasks. Supervisors often set an internal strategic roadmap, raise awareness on the topic and build capacity within their organisations and in the wider context of other financial system stakeholders. Investment is needed to up-skill supervisors, by raising awareness and providing the rationale for the work, a framework that can be used, and a range of tools to assist in embedding the supervision of climate-related and environmental risks in their daily business. To ensure participation throughout the organisation and involve experts who dive deeper into the impact on financial risks, supervisors have created different working level structures. Overall, experience shows that addressing climate-related and environmental risks requires adequate resources and that commitment from the top of the organisation is a key driver for advancing the agenda. Building the organisational capability required

to supervise the risks stemming from climate change and environmental degradation is a multi-year endeavour.

2.1 Commitment from the Board of Directors

In order to generate support for action it is crucial that a supervisor's Board of Directors is fully on board and provides a clear steering.²⁹ This requires that the Board is well informed about how climate-related and environmental risks are relevant to the work of prudential supervisors. Informative memoranda and research papers, produced internally, by peer organisations or other external parties, may be an effective way to set out the relevance of climate-related and environmental risks to the economy and the financial system. This work can provide a framework for thinking about these risks, describing the work being undertaken by other public and private bodies (e.g. the NGFS, the Sustainable Insurance Forum/IAIS, the World Bank, the International Monetary Fund, standard-setting bodies, national and international industry associations, academic and civil society organisations, etc.), and highlighting how these risks do or could impact the solvency and liquidity of financial institutions.

Research papers can focus attention on specific climate-related and environmental risks that are particularly relevant to the national economy and financial system (e.g. drought, flooding, wildfires and water scarcity).³⁰ They may describe how these events can impact the solvency and liquidity of supervised financial institutions and the stability of the national financial system as a whole, to demonstrate to the Board the necessity of addressing climate-related and environmental risks in supervision and other areas of work.

2.2 Developing a strategy/roadmap

Preliminary work on evidencing the risks and other exploratory work can be followed by the development of a strategic roadmap for addressing climate-related and environmental risks. Roadmaps are often integrated into

²⁹ "Board of Directors" refers to the body that strategically leads a supervisor. It is acknowledged that there are also cases where this function is allocated to a single board member.

³⁰ See Box 1 for examples of evidence of economic damage stemming from environmental degradation beyond climate change.

existing supervisory planning and are taken into account when defining actions over the short, medium and long term. These roadmaps help to organise the work and clarify roles and responsibilities, and **should be supported and endorsed by the Board** and senior management. It might also be useful to update the roadmap on a regular basis. See Box 3 for examples for internal strategic roadmaps.

Roadmaps may cover the following subjects (not necessarily in this order):

- the rationale for embedding consideration of climate-related and environmental risks within supervisory activities, clearly explaining the link between these risks and the authority's mandate
- internal communications
- the creation of dedicated organisational structures
- research, analysis and procurement of new analytical tools
- the development of policy, including participation in international forums and cooperation with other institutions and authorities

- the publication of key external policy communications
- training of operational supervisors
- the embedding of consideration of climate-related and environmental risks within supervisory activities
- the development and publication of supervisory expectations

The internal roadmap may also be a part of a wider strategic roadmap, defined jointly with the other financial system stakeholders (See Box 4). These may include other national supervisors and regulators, the Ministry of Finance or other relevant ministries, the stock exchange, and industry trade associations in banking, insurance and capital markets. This will enable all authorities to work together to ensure that the transition towards a more inclusive and sustainable model is supported by all elements of the financial sector, according to a shared, coordinated, and progressive vision aimed at maintaining financial stability.

Box 3

Examples of internal strategic roadmaps

Reserve Bank of New Zealand (RBNZ)

The RBNZ set up a *Climate Change Strategy* to contribute to the "Government's objective of a sustainable, productive and inclusive economy". The Strategy includes the following steps:

• **Monitoring and managing the Bank's impact on climate:**

- Calculate its carbon footprint;
- Establish a target for reducing or mitigating its future carbon emissions.

• **Understanding and incorporating the impact of climate change on the Bank's core functions:**

- Consider the impact of climate change policies and private sector adaptation to climate change on inflation and labour market outcomes as per the mandate of monetary policy;
- Analyse the potential impact of climate change on future capital and migration flows, and the implications for the New Zealand economy and financial system

- Undertake more in-depth analysis of the potential implications of climate change for financial stability;
- Engage with regulated entities to understand how climate-related risks are being addressed within the sectors that we regulate;
- Monitor the development and operation of capital markets to identify any impediments to the efficient provision of finance for 'green' investments.

• **Providing leadership as an institution:**

- Support other agencies in New Zealand in achieving their own objectives with respect to climate change by engaging in cross-agency work streams and contributing knowledge and resources, as appropriate;
- Facilitate and encourage engagement across the financial sector to ensure that information flows freely and widely;
- Work with other central banks and policy makers, both globally and within the Pacific region, to ensure that the financial sector contributes effectively to efforts to manage and mitigate climate risks; and .../...

- Engage with other regional central banks to explore opportunities to develop the green bond market in the Asia-Pacific region (e.g. through the EMEAP ABF fund programme).

Hong Kong Monetary Authority

In May 2019, the Hong Kong Monetary Authority (HKMA) presented its three-phased approach towards *green and sustainable banking*:

- Phase I: developing a common framework to assess the “Greenness Baseline” of individual banks. The HKMA will also collaborate with relevant international bodies to provide technical support to banks in Hong Kong to better understand the green principles and methodology in undertaking the baseline assessment;
- Phase II: engaging the industry and other relevant stakeholders in a consultation on the supervisory

expectation or requirement on Green and Sustainable Banking, with a view to setting tangible deliverables for promoting the green and sustainable developments of the Hong Kong banking industry;

- Phase III: after setting the targets, implement, monitor and evaluate banks’ progress in this regard.

Banco de Portugal

Banco de Portugal published its *commitment to sustainability and sustainable finance* in March 2020, which recognises the importance of climate risks to the central bank and supervisor, defines areas of attention, and references a number of planned and ongoing initiatives in the areas of climate risk evaluation and mitigation, adoption of sustainable practices, external cooperation and governance.

Box 4

Example of a financial system-wide strategic roadmap

Bank Al-Maghrib - *Feuille de route pour l’alignement du secteur financier marocain sur le développement durable*

On the sidelines of COP 22, Bank Al-Maghrib coordinated the elaboration of the roadmap of the Moroccan financial sector for sustainable development. It foresees the actions and the measures to be put in place for the coordinated and progressive alignment of this sector (i.e. banking, insurance and capital markets) in relation to the issues of sustainable

development and the emergence of green finance. The roadmap concerns the following five major themes:

- Governance, environmental and social risks
- Products / financial instruments dedicated to sustainable development
- Promotion of financial inclusion as a alternative use – vehicle for sustainable development
- Capacity building in the field of sustainable finance
- Transparency and market discipline.

2.3 Embedding the work within the organisation through dedicated structures

Climate change and environmental degradation are expected to have far-reaching impact, in both breadth and magnitude, and may therefore touch on many different aspects of the mandates of supervisors, and will require the involvement of many different departments and experts. Mandates may cover various classes of financial institutions, including banks, insurers, pension schemes, investment

firms, asset managers, mutual funds, financial market infrastructures and securities issuers. Supervisors with a macro-prudential mandate also need to ensure a financial stability response to these risks. This paragraph sets out the operational models that a supervisor can adopt to start embedding the assessment and mitigation of financial risks stemming from climate change and environmental risks within the organisation.

Options for operational units include networks, internal hubs and dedicated units. An organisation’s approach may

also evolve over time. For example, the establishment of a dedicated unit may be followed by the formation of a network, to be embedded throughout the organisation once the work starts, or vice versa if a dedicated unit is not deemed necessary at the outset. Committing some resources to this activity on a full-time basis could be considered.

Depending on the level of formalisation, a dedicated budget may also be allocated to the hub/network/dedicated unit, or it may draw its resources from the existing sectoral budgets. The Greek interdisciplinary Climate Change Impacts Study Committee, for instance, is working on climate-related issues using a dedicated budget.

The ultimate goal is to combine the varied expertise of the organisation to gain a holistic vision, facilitate synergies, and provide a coherent and consistent approach to climate-related and environmental risks throughout the organisation. It is also vital to develop and define policy positions, both internally and in relation to the work of regional and international bodies.

The internal network approach

One way to cope with the complexity of the climate-related and environmental risk agenda is to establish flexible internal structures such as internal networks, which serve as information-sharing and coordination structures. An internal network can report to the Board, a steering committee or a senior representative. Such networks may be in charge of either specific aspects (e.g. policy, research, or supervision) or all of the various implications for the supervisor. In the latter case, departments participating in the network may include a wide range of business functions (e.g. supervision, policy, research, market operations, risk assessment, legal, communications, macroeconomics, analysis). As networks are staffed with resources working for different departments, often not all of the resources work full-time on the climate-related and environmental risk agenda.

The set-up of an internal cross-sectoral network structure facilitates the coordination of all climate-related work within the organisation. The network may be configured in a number of different ways and more thought will need to be given to the optimal structure. See Box 5 for examples.

Box 5

Examples of an internal network approach

The **Central Bank of Malaysia** has set up a network of about 30 staff members from cross-functional divisions to implement the Bank's plan on sustainable finance. The network includes 17 departments including Islamic Banking and Takaful, Financial Development and Innovation, Development Finance and Inclusion, Banking and Insurance Supervision, Risks Specialists, Prudential Policy, Financial Surveillance, Economics, Monetary Policy, Investment, Centralised Services (including Hospitality and Facility Management) and Finance department.

Also, the **Monetary Authority of Singapore (MAS)**, **Banca d'Italia**, **Banco de España** and the **Dubai Financial Services Authority (DFSA)** have also set up cross-departmental workgroups. The objective for each

of these groups is to combine diverse expertise across the institution to gain a holistic vision, facilitate synergies, and provide coherent answers within all the dimensions of the climate change phenomenon. This will also guarantee transversal support for the definition of the institutions' policy positions on international fora. At Banca d'Italia the working group reports to the Board, while at MAS it reports to a steering committee chaired by the Managing Director of MAS. The Banco de España group is chaired by the Deputy Governor's Office and the Financial Stability and Macroprudential Policy Department. In the case of the DFSA, the Managing Directors of all key departments are involved and contribute to the working group, including Bank and Insurance Supervision, Conduct, Investment Funds and Capital Markets Oversight.

Hub & spokes model

Another potential configuration is the “hub & spokes model”, consisting of a strategic central team (the hub) working full-time on climate-related and environmental risks and a spoke in each division (See Box 6). In this design, the hub owns the overall climate risk strategy and coordinates climate work across the organisation. Each spoke may consist of several individuals that may be either dedicated

to climate-related risk work full-time, or – more likely – have a portion of their time dedicated to this work. Each spoke may find it beneficial to have its own regular local meeting to keep momentum and ensure coordination. The hub & spokes can meet on a regular basis (e.g. 3-4 times a year) to update each other on national and international developments in the sector, to coordinate the work and to identify priority areas for future work.

Box 6

Examples of a climate hub

The climate hub model was implemented by the **Bank of England** after climate work had been underway for a period of three years. The hub started with four individuals and has since doubled in size; some of the spokes have grown significant ‘specialist’ groups, particularly in banking and insurance supervision.

Likewise, **BaFin** has set up an internal network of more than 30 experts from across banking, insurance and

securities supervision. The network is coordinated by a centralised hub that represents BaFin’s views in relevant domestic and international fora.

In a similar vein, the **ECB** has a central project management office (PMO) that convenes all banking supervision business areas to coordinate the incorporation of climate-related risks into the ECB’s supervisory approach. The PMO also represents the ECB in international fora.

In some jurisdictions, where several supervisors are involved, coordination through an external forum may be beneficial. This may be limited to supervisors or may be broader, by

for example including the national legislator, government departments, or experts from other fields. See Box 7 for an example.

Box 7

Example of coordination involving external experts

The **Bank of Greece**, for instance in 2009 established an interdisciplinary scientific Climate Change Impacts Study Committee, which brings together distinguished experts from various domains of knowledge (physics, climatology, environmental economics, agronomy, forestry, transport engineering, sociology, medicine, biology, hydrobiology, etc.). The Committee has been systematically engaged in the study of the economic, social and environmental

impact of climate change, implementing research projects in a wide range of areas, including the economics of climate change, and disseminating research results through various events and activities. The Committee also advises on the design of mitigation and adaptation policies and cooperates with educational institutions and other organisations in addressing the challenge of climate change in Greece.

The dedicated unit approach

A different approach to coping with complexity could be the creation of a **dedicated unit** as the main source of general expertise on green finance and climate risk, with a

mandate to coordinate issues related to sustainable finance across all sectors. In this design the centralised team works full-time on climate-related and environmental risks and issues. See Box 8 for examples.

Box 8

Examples of dedicated units

This is the case for example at the **Bank of Thailand**, which set up a Sustainable Banking Team as part of the Financial Institutions Strategy Department, and also at the **Bank Al-Maghrib**, which created a unit dedicated to green finance in March 2019. The latter is in charge of carrying out studies and analysis on climate-related and environmental risks incurred by financial institutions; contributing to the work of regional and international groups on climate-related and environmental risks; proposing and deploying preventive/corrective actions to mitigate climate-related and environmental risks, and coordinating the implementation of the roadmap for sustainable finance in the financial sector. Recently, **the Banque de France** also set up a Sustainable Finance Unit, hosting the NGFS Secretariat as well as developing and coordinating the Banque de France's expertise regarding sustainability and, especially, climate-related and environmental topics.

In addition, the **European Banking Authority (EBA)** has established an internal horizontal dedicated project team on sustainable finance and a dedicated Network on Sustainable Finance with European national supervisors.

The **European Insurance and Occupational Pensions Authority (EIOPA)** has established an internal inter-departmental committee on sustainable finance, which is responsible for monitoring EIOPA's sustainable finance action plan, which covers dedicated projects across prudential, conduct, financial stability and supervisory teams, and share information across departments. A dedicated Sustainable Finance Project group, composed of representatives of Member States deals exclusively with sustainable finance projects, while existing groups are responsible for specific projects on sustainable finance.

2.4 Raising awareness of climate-related and environmental risks

Despite the increasing public awareness of climate-related and environmental risks, the link between these risks and financial risks is not always obvious as they will increasingly materialise over the medium and long term. Yet, the magnitude and nature of the future impacts of climate change will be determined by actions taken today. In light of their critical role, supervisors may consider the deployment of specific training and capacity building with regard to climate-related and environmental aspects.

Awareness should be raised internally and externally across the financial system and among the public. These parallel actions will reinforce one another, thus contributing to timely capacity building by all stakeholders whose contribution is essential to achieving the final objective of managing these new risks.

2.4.1 Raising awareness and building staff member capacity

The results of the NGFS survey show that supervisors often use a two-phased approach for effective training

and capacity building within the organisation. Firstly, it is necessary to raise awareness and provide a framework and rationale. Secondly, it is essential to train supervisors to ensure they have the practical skills, tools and materials necessary to assess relevant risks and guide the dialogues with the supervised institutions.

Training sessions may benefit from external contributions by climate and environmental experts, representatives from international organisations and public authorities, or individuals from other supervisors or the financial sector.

Particular attention should be devoted to training staff belonging to the climate and environmental policy networks or dedicated units, who could in turn lead the training of other staff. In this regard, it is particularly useful to allow them to attend some of the numerous events hosted by international organisations, regulators, academia, non-governmental organisations (NGO's), financial industry and corporates. As climate-related and environmental risks are relevant to a wide range of activities within supervisors/central banks, all staff should at least gain a level of basic knowledge.

In addition to training, the following tools may be used for internal outreach activities:

- a) leveraging the sponsorship of a senior executive;
- b) organising internal informative seminars or roundtables with internal and external speakers on the relevance of climate-related and environmental risks to the target audience's activity; on the work being undertaken by other public and private bodies; and on regulatory initiatives in the area of climate-related and environmental risks or sustainable finance in general. These could take the form of targeted seminars for heads of supervisory departments, or supervisors in specific sectors, or wider informative events open to all staff;
- c) using internal communication channels (e.g. intranet, journals, newsletters) to improve knowledge of others' work within the institution and to share relevant publications on climate-related and environmental risks, progress updates on work underway by relevant national and international authorities, regulatory developments, and relevant internal work;
- d) inviting climate-related and environmental risk experts to attend divisional meetings; and/or
- e) providing regular briefings and updates to relevant senior officials and committees on the green finance work.

The focus should be on the financial risks stemming from climate change and environmental factors to demonstrate that the problem is already relevant to the national financial system in the short-to-medium term and sits firmly within the authority's mandate. As set out in Chapter 1, many external publications are available that demonstrate the financial impact of climate change today.

2.4.2 Knowledge building and cooperation

Knowledge sharing is a key driver for capacity development, both at the initial stage and ongoing. It provides space for a mutually beneficial learning process that strengthens the individual and collective capacity of experts and policy makers to lead and take charge of their own development process. The momentum regarding climate-related and environmental risks is growing exponentially, with many

international organisations, financial standard setting bodies and financial institutions stepping up. Knowledge sharing and keeping knowledge up to date with international and national developments are therefore critical:

- internationally – by participating in groups/organisations³¹ that act to raise awareness and build tools to understand the new climate-related and environmental risks; and
- internally by:
 - regularly updating on the work of international organisations;
 - briefing on the regulatory developments in the area of climate-related and environmental risks or sustainable finance in general;
 - noting the possible consequences for both supervisors and supervised entities; and
 - establishing links across departments to share knowledge and build capacity across divisions/sectors.

As resources may be limited, it can be helpful and cost effective to share knowledge and experiences with other authorities within and outside the NGFS and consider setting up opportunities for technical assistance to build capacities.

2.4.3 Raising awareness among financial institutions

One of the first priorities for supervisors is creating a sufficient level of awareness³² and encouraging a dialogue on climate-related and environmental risks with and within the financial sector. The dialogue will evolve depending on both the authority's and the financial system's preparedness. Care should be taken in selecting and prioritising which financial institutions to engage with, bearing in mind the objectives of the engagement.

The process usually starts with a **targeted bilateral dialogue** with the largest banks and insurers. These financial institutions are usually internationally active or belong to international groups, and therefore are often engaged in or endorse the main industry initiatives on sustainable finance³³. Many of these financial institutions include some climate change information in their financial statements or

31 E.g. NGFS, IAIS, SIF, IOSCO-SFN and groups within the BCBS, FSB, EBA, EIOPA.

32 For example by distributing research studies on the relevance of climate-related and environmental risks for the national economy and financial system or for specific parts of them.

33 For example, Green Bond Principles, Equator Principles, Principles for Responsible Investment and Principles for Responsible Banking.

disclose some elements of the TCFD framework. In addition, financial institutions with a specific sustainability purpose can be important sources of information. Topics to discuss include governance, risk appetite, key strategies in managing climate-related and environmental risks, initiatives to build capacity, disclosures, adoption/benchmarking exercises with international standards, quantitative and qualitative data collection and the elaboration of risk analysis tools.

Once a dialogue has started and supervisors have gathered their first set of evidence, informative meetings addressing a wider spectrum of entities may be organised. It can be useful to organise **meetings system-wide** to share knowledge between different categories of stakeholders (e.g. different types of financial institutions, small/large financial institutions, frontrunners/laggards) and to present to industry on the ongoing public sector national/regional/global developments to industry. These events may take the form of conferences, workshops, thematic seminars, roundtables or symposia. Participants may include financial institutions and external organisations, such as other national authorities and financial regulators, government ministries (including ministries of finance), regional institutions, international bodies, development banks, the scientific community (including academia and meteorological agencies), rating agencies and non-governmental organisations.

In advance of meetings or events with financial institutions, it may be useful to run a **formal survey** among them. This will help supervisors raise awareness of the relevance of climate-related and environmental risks and collect information on the state of play in the industry; it helps to deepen the understanding of the risks that financial institutions bear in the system. A list of potential questions is included in Box 16 in Chapter 3. Supervisors may need to tailor them to specific institutions and the context of their own jurisdictions, taking into account factors such as firm size and complexity. Surveys generally seek information on the way in which financial institutions consider these risks in their governance, strategy, risk management, capital adequacy assessments, and disclosures.

A selection of questions can also be used by frontline supervisors and risk experts in bilateral conversations or on-site visits to supervised entities and could ensure a consistent supervisory approach. Periodic high-level

dialogues with representatives of the financial industry (e.g. CEOs) may be used to convey the latest insights on assessing and mitigating climate-related and environmental risks. An effective practice is to ask banks and insurers to nominate responsible individuals from the relevant departments (e.g. risk/finance) to lead the dialogue.

Supervisors may also wish to support the financial industry by facilitating the creation of a joint task force or other forum. This may have the objective, for example, of providing a platform for constructive dialogue between financial institutions and non-financial companies concerning climate-related disclosures or for technical support for climate-related and environmental risk assessment. See Box 9 for examples of structuring a dialogue with industry and other stakeholders.

Once the awareness raising and risk identification phases are complete, supervisors usually move on to integrating climate-related and environmental risks into supervision and to setting supervisory expectations, as set out in Chapters 3 and 4. Bilateral and multilateral dialogues between supervisors and industry may continue as part of, or in addition to, ongoing supervisory engagements.

2.4.4 Raising awareness among the wider public

Shaping public responses to climate change is fundamental to coping with the related risks. Informed individuals become informed investors, which can help the financial system direct funds towards sustainable activities and products or reduce exposures to physical and transition risks.

Awareness about climate-related and environmental risks can be raised within the financial industry, at relevant public authorities and among the **general public** using a wide range of tools. For example by means of speeches or interviews given by Board or staff members, the publication of research papers, updates on policy developments, dedicated articles within the Financial Stability Review and/or documentation of activities in the annual report. In order to better focus and convey the message, all relevant material could also be published on a dedicated page on a public website.

Box 9

Examples of structuring a dialogue with industry and other stakeholders

The **TCFD Consortium of Japan** was established with support from the Japan Financial Services Agency, Ministry of Economy Trade and Industry, and Ministry of Environment. It aims to facilitate a constructive dialogue between investors and companies around climate-related financial disclosures. <https://www.fsa.go.jp/en/news/2019/20190521.html>

In May 2019, the HKMA launched the **Centre for Green Finance ("CGF")** under the HKMA Infrastructure Financing Facilitation Office, to serve as a platform for technical support and experience-sharing for greening the Hong Kong banking and finance industry. <https://www.iffa.org.hk/>

In 2016, DNB established the **Sustainable Finance Platform**, to promote and increase awareness of sustainable funding in the financial sector. In it, the financial sector, supervisors and government ministries work in tandem to take sustainability initiatives. The platform's members can decide to establish a working group dealing with a specific theme and present their findings to the full platform (e.g. Mobilising sustainable finance, Sustainable Real Estate, Biodiversity, Carbon pricing, etc.). The platform discusses the findings during its bi-annual meetings, adopts positions and publishes definitive reports. <https://www.dnb.nl/en/about-dnb/co-operation/platform-voor-duurzame-financiering/index.jsp#>

The German ministry of finance and that of the environment set up a **Sustainable Finance Advisory Committee** in 2019 to develop a strategy and proposals on how to enhance Germany's role as a sustainable finance location.

BaFin and Deutsche Bundesbank support the committee with technical advice in the role of observers.

In March 2019 the BoE and Financial Conduct Authority established the **Climate Financial Risk Forum** with the objective of building capacity and sharing best practices across financial regulators and industry to advance financial sector responses to the financial risks stemming from climate change. It brings together senior representatives from across the financial sector, including banks, insurers, and asset managers.

In 2019, a public-private initiative called the *Dubai Sustainable Finance Working Group* was established to further collaborative efforts to strengthen sustainable finance initiatives. In addition, in January 2020, the DFSA, alongside other financial regulators, ministries, securities exchanges and bodies in the United Arab Emirates, signed the *Guiding Principles on Sustainable Finance*, which create a common platform and provide a roadmap for further detailed initiatives and measures in this sphere.

The **MAS** is supporting the industry by setting up **Centres of Excellence in Singapore** to contribute to Asia-focused climate research which can be applied in the financial sector. These Centres will be established through collaborations between leading international research institutes and universities and Singapore's local universities. The Centres will support the development of innovative green finance solutions, deepen understanding of climate risks, and enhance climate risk management in Singapore. The Centres will also train and groom talent in green finance.

3. Identifying and assessing climate-related and environmental risks

Recommendation 3 – Identify the exposures of supervised entities that are vulnerable to climate-related and environmental risks and assess the potential losses should these risks materialise.

To identify exposures that are vulnerable to climate-related and environmental risks, supervisors are recommended to assess different determinants of physical risk (e.g. climate sensitivity of sectors, geographical location, tenor) and transition risk (e.g. policy sensitivity, tenor). When doing so, supervisors are recommended to identify potential data gaps and determine their approach to gathering quantitative and qualitative data. To estimate the magnitude of the exposure to these climate-related and environmental risks, supervisors are recommended to develop methodologies such as scenario analysis and stress testing. Furthermore, supervisors are recommended to develop key micro risk indicators to monitor climate-related and environmental risks.

To provide supervisors with best practices for identifying and assessing climate-related and environmental risks, this Chapter sets out the practices of NGFS members who have pioneered in this area. To determine the exposure of their financial sectors to climate-related risks, supervisors have adopted a variety of approaches. The more granular approaches typically require large amounts of balance sheet and climate-related data. As most existing reporting requirements do not yet yield sufficiently detailed quantitative information to perform such analyses, some supervisors have developed prudential reporting templates on an ad-hoc basis. Supervisors have also surveyed the financial sector in a more qualitative manner, taking stock of how financial institutions incorporate climate-related and environmental risks in their governance, strategy, risk management and disclosure practices.

This Chapter begins by describing the process of conducting a climate-related and environmental risk assessment.

Subsequently, the Chapter presents the methodologies developed by supervisors to identify, assess and monitor the exposure of financial institutions on both an individual and an aggregated basis to these climate-related and environmental risks. Finally, the Chapter highlights information which supervisors could gather for the purpose of their risk identification exercises and assessments. As the efforts of supervisors have largely focused on climate-related risks, and to a lesser degree on other categories of environmental risks, the examples given in this Chapter are primarily related to the former.

3.1 Climate-related and environmental risk assessment

Supervisors are generally moving through the following phases when assessing macro- and microprudential climate-related and environmental risks: preparatory phase, analytical phase, and concluding phase. These steps are not linear but make up an iterative cycle. At the beginning of the process, in the preparatory phase, the material risk on which the team should focus will be determined. Interviews, surveys and quantitative and qualitative data requests are needed to learn from different internal and external stakeholders (e.g. financial institutions, climate and environmental specialists, scientists and peer supervisors). This helps identify material risks, determine transmission channels and design extreme but plausible scenarios, and possibly also identify data gaps. In the next phase, analytical work must be done to determine the climate exposure of financial institutions and conduct vulnerability assessments or execute sensitivity analysis/stress tests. In the concluding phase, the focus is on developing a story line, formulating the supervisory response and presenting the report to the different stakeholders. See Box 10 below for a more detailed description of how to conduct a climate-related and environmental risk assessment.

The results from the NGFS survey show that in some cases it has taken approximately one year and a dedicated team fully supported by senior management to produce a report on climate-related and environmental risk assessment for a financial sector from scratch. However, peers have increasingly developed examples and practices which may facilitate the process, because the targeted outcomes are clearer.

Conducting a climate-related and environmental risk assessment

I. Preparation phase

- a. Set-up a project organisation consisting of a core project team, a steering group, and a broad network of different specialists
- b. Develop a project plan
- c. Set-up interviews with financial institutions, environmental specialist, scientists and other experts
- d. Develop a qualitative survey for financial institutions
- e. Develop a quantitative data request (template covering physical and transition risks)
- f. Determine which climate-related and environmental risks are material in their jurisdiction
- g. Determine how these risks are transmitted through the economy to the financial sector

II. Analytical phase

- a. Assess quantitative and qualitative information
- b. Determine the climate-related and environmental exposures in the financial sector in terms of *financial risks* (credit risk, operational risk, market risk, etc.)

- c. Develop a few extreme but plausible scenarios or set up vulnerability assessments of exposures to the risks
- d. Conduct a stress test or a sensitivity test to estimate the potential magnitude of the risks, and determine losses and impact on prudential ratios and/or other risk indicators

III. Concluding phase

- a. Develop a story line (main findings and conclusions), supported by quantitative and qualitative data and pictures
- b. Determine a supervisory response to the findings of the assessment, including recommendations for supervision, policymakers and financial institutions
- c. Publish a report and organise media events and outreach workshops to share results with internal and external stakeholders
- d. Set the key risk indicators that will help monitor the climate-related and environmental risks

3.2 Analysis of exposures to climate-related and environmental risks

Supervisors conduct exposure analyses to identify and quantify the potential exposures to climate-related and environmental risks at the level of individual financial institutions as well as at the level of the banking and insurance sectors. A few supervisors have conducted such analyses and translated their results into a heat map segmented across locations³⁴ and sectors. Such a heat map – if updated on a regular basis – can help supervisors monitor the evolution of exposures over time.

Supervisors have developed various types of analyses to assess the exposure of financial institutions to climate-related and environmental risks. **In these sections, we classify the approaches that supervisors have adopted based on the required data sources.** The data sources that are used determine the precision and level of granularity of these analyses. The determinants used to analyse the exposure to transition and physical risks are set out separately in the following two paragraphs, followed by an overview of key climate risk indicators currently used by supervisors.

³⁴ See, for example: EIOPA, *Financial Stability Report*, December 2018, p. 54 (identification of the climate-relevance of insurers' investments depending on their locations); EIOPA, *Discussion paper: Insurance sector climate-related transition risks*, 2019.

Determinants of transition risks resulting from climate change

Supervisors usually assess two determinants of transition risk for financial institutions. These are: (1) the policy sensitivity of the exposure³⁵, and (2) the tenor of the exposures. Supervisors are gradually adopting, depending on the availability and granularity of data, more sophisticated approaches to quantify the exposures of financial institutions to climate-related risks.

Supervisors have typically taken the carbon intensity of financial institutions portfolios as a proxy to assess the sensitivity of exposures to transition risk, as carbon-intensive activities are more likely to be affected by policy changes. To measure the carbon intensity of an asset portfolio, supervisors need information on the composition of the portfolio (balance sheet data) and on the carbon intensity of the different constituents (emissions data). GHG emissions may be measured and reported at three different levels (scope 1, 2 and 3 emissions).³⁶ Another example of a measure of policy sensitivity that supervisors have assessed is the energy efficiency of mortgage portfolios in the light of potentially tightening minimum standards.³⁷ See Box 11 and 12 for examples of transition risks assessment and analysis.

To determine the carbon intensity of financial institutions' portfolios, **supervisors have frequently relied on sector classifications as a first step**. Balance sheet data is often readily

available at the sector level, and emissions data can be easily obtained by mapping sectors to a measure of carbon intensity.³⁸ Analyses based on sector classification serve to provide an initial understanding of the exposures of the financial sector to transition risks.

To gain a more detailed understanding of the policy sensitivity of exposures, supervisors can adopt approaches with a higher degree of data granularity.

Analyses that are more granular can cope with differences between individual exposures within the same sector as well as supply-chain impacts (such as exposures to sectors which use fossil fuels in production). Going forward, supervisors could also consider second-order effects. For instance, the EIOPA study mentioned above emphasises that supervisors should consider indirect losses in insurers' investments due to the devaluation of financial counterparties which have high exposures to climate-sensitive sectors. To assess the dynamics of sectors, supervisors could also consider the decarbonisation pathways of countries where the activities of the financial institutions' counterparties are located (as policy measures may have an impact on the transition of these sectors towards more low-carbon activities).

Second, **the tenor of the exposure** (short, medium, long term) also matters. For instance, the longer an activity is in the portfolio of a financial institution, the greater the likelihood that a carbon transition risk may become material before the exposure terminates (e.g. a loan has been repaid).

35 The policy sensitivity refers to the extent of the exposure's reaction to changes in the regulatory framework related to the adjustment towards a low carbon economy (which may be sector or country specific).

36 Methodologies other than proxies have also been used by supervisors. For instance, supervisors have also assessed the alignment of financial institutions' portfolios with different decarbonisation pathways or carbon budgets. Based on such an analysis, supervisors can quantify the exposure gap of portfolios with respect to the target. See, for example *California Department of Insurance (2018) 2° Scenario analysis*. Insurance Companies Operating in California.

37 See for instance: DNB, *Waterproof? – An exploration of climate-related risks for the Dutch financial sector*, 2017 and BoE, *Transition in thinking: The impact of climate change on the UK banking sector*, 2018.

38 See for example Battiston et al., *A climate stress-test of the financial system*, 2017. In this study, the climate policy sensitivity of sectors is chosen based on their greenhouse gas emissions, their role in the supply chain and carbon leakage classification. EIOPA assessed the exposure of the insurance sector to climate-related risks based on the Battiston et al. methodology while using Solvency II item-by-item investment data reported by European insurers as of Q1 2018. Also by the ECB: *Climate Change and Financial Stability*, Financial Stability Review May 2019.

Box 11

Approaches to assessment of transition risk based on policy sensitivity of exposures (carbon emissions)

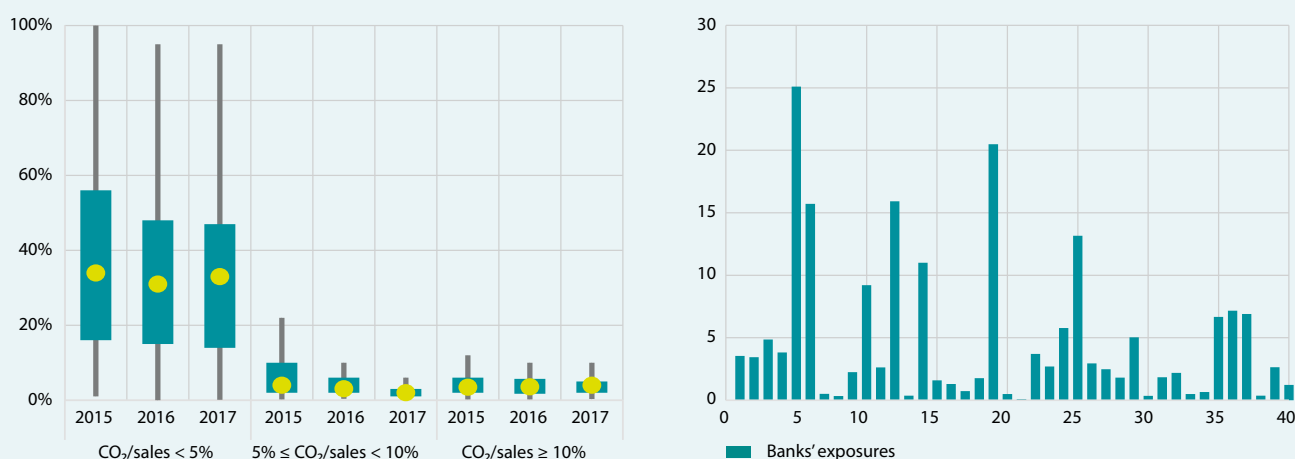
Level of granularity	Approach	Data need (balance sheets)	Data needs for FIs (climate-related)	Examples
Low	Sector classification	Use internationally recognised classification system (i.e. ISICS, NACE, GICS).	Average carbon intensity per sector	DNB, <i>Waterproof? – An exploration of climate-related risks for the Dutch financial sector</i> , 2017, p. 35; ACPR, <i>French banking groups facing climate change-related risks</i> , 2019, chart 8; NBB, <i>Climate related risks and sustainable finance</i> , in NBB FSR 2019, chart 2 p. 114; EBA, <i>Risk assessment report</i> , 2018, p. 25.
Medium	Firm-level data	Single-name exposures	Carbon emissions data from individual firms	ECB, <i>Climate change and financial stability</i> , 2019.
High	Activity-level	Revenue streams from single-name exposures	Carbon intensity of business activities	EIOPA <i>sensitivity analysis</i>
High	Value-chain	Sector exposures	Input-output tables (embedded emissions)	DNB, <i>An energy transition risk stress test for the financial system of the Netherlands</i> , 2018. ¹

¹ In the DNB report, only the upstream part of the value chain is considered.

Box 12

Example of exposure to transition risk analysis

In its *Financial Stability Review*, the ECB conducted an assessment of the exposures of financial institutions against the 40 firms with the highest carbon emissions. This is an example of an analysis on the basis of single-name exposures and the carbon intensity of their activities. The ECB concluded that exposures to transition risks may be significant for some banks.



Sources: Thomson Reuters, ECB supervisory statistics (large exposures) and ECB calculations.

Notes: Carbon intensity is calculated as the ratio of a firm's total carbon emissions to its total sales. Altogether, 76% of the firms in the sample belong to the most carbon-efficient group (carbon emissions/sales < 5%), 9% to the mid-range, and 15% to the most carbon-intensive group. The carbon emissions refer to Scope 2 emissions (emissions arising from purchased energy, heat or steam consumed by the firm). The carbon accounting standard has been developed and made available by the Greenhouse Gas Protocol and the Carbon Disclosure Project.

Determinants of physical risks resulting from climate change

Physical risks have the following determinants: (1) the sensitivity of sectors to climate hazards or long-term changes and (2) geographical location. Also, the tenor of the exposures is a determinant, as long-term exposures are more vulnerable to these physical risks. Some supervisors have also considered how financial institutions can transfer these risks to other financial institutions or counterparties.

First, physical climate hazards and long-term changes in climatic patterns may influence the performance of sensitive activities by causing damage to assets and operations (lost CAPEX), disrupting business operations (lost OPEX), increased underwriting risks (through unexpected increases in insurance claims pay-out related to natural catastrophe risks or liability insurance policies), or through reputational or liability issues such as increasing competition for water use (see Box 14). **Sensitivity to physical climate hazards may need to be mapped out in a granular manner against different sectors and industries**, e.g. using NACE or GICS codes.

Due to the highly context-specific and location-specific nature of physical climate hazards, **information about the specific locations of activities, insured lives or properties, assets and their collateral are required to assess the exposure of financial institutions to physical climate risks.** To assess the physical risks in their jurisdiction, some supervisors have developed indicators. For instance, De Nederlandsche Bank (DNB)³⁹ designed a vulnerability index based on different variables that takes into account both the effects of climate change, and a country's economic resilience. DNB updated an indicator used by Standard & Poor's to determine country risk resulting from climate change⁴⁰. **Supervisors have adopted approaches with different degrees of sophistication**

and data granularity (see Box 13). Whereas an assessment at the country level can provide a heat map of physical climate risks, supervisors are well-advised to develop more granular approaches to better determine the magnitude of the risks. These approaches demand availability of highly granular climate and balance sheet data and are expected to become more mainstream as disclosure frameworks evolve.

Finally, supervisors could consider in their exposure analyses the interaction between the different actors of the financial system, in particular between the banking and insurance sectors. Some supervisors have shown that insurance coverage can have an impact on the exposure of the banking sectors to climate-related risks. However, banking supervisors should also consider the protection gap (i.e. the economic losses generated by catastrophes that are not covered by insurance), which even in developed markets is significant.⁴¹ Indeed, credit losses for banks could be bigger if these losses are uninsured. On average, over the last 10 years, only about 30% of catastrophe losses were covered by insurance. That means that about 70% of catastrophe losses – or USD 1.3 trillion – have been borne by individuals, firms and governments.⁴²

Supervisors could reflect more broadly on how financial institutions are able to mitigate the impact of these risks on their portfolios by transferring them, emphasising the need to consider the interaction between the different players in the financial sector and get a more precise view of the ultimate bearer of these risks. For instance, if insurers raise premiums or restrict coverage in response to increasing physical risks, ultimately, the risks which they initially borne would be (at least in part) transferred to households, companies and lenders. Affordability and insurability are thus likely to become an increasing concern in a climate change context.⁴³

39 DNB, *Waterproof? – An exploration of climate-related risks for the Dutch financial sector*, 2017, p 9 and 10.

40 The indicator is based on the following three parameters: (1) The Notre Dame University Global Adaptation Index (ND-Gain Index). This index comprises a total of 36 variables, which in determining the impact take into account both the effects of climate change, and the economic resilience of countries. (2) The percentage of the population that live in areas where elevation is below 5 metres, as an indicator of the vulnerability to rises in sea level and flooding. This is derived from World Bank data. (3) Agriculture as a percentage of gross domestic product, derived from World Bank data.

41 ACPR, *French banking groups facing climate change-related risks*, 2019. EIOPA, *Staff Discussion Paper on the protection gap for natural catastrophes*, 2019.

42 Swiss Re, *Closing the protection gap, Disaster risk financing: Smart solutions for the public sector*, 2018 and *Natural catastrophes and man-made disasters in 2018: "secondary" perils on the frontline*, 2019

43 EIOPA *Staff Discussion Paper, Protection gap for natural catastrophes*, 2019.

Box 13

Approaches to physical risk assessment (based on the geographical location of financial institutions, their exposure, and their collateral)

Level of granularity	Approach	Data need (balance sheets)	Data needs (climate-related)	Examples
Prerequisite	<i>Sector classification (publicly available information)</i>	<i>Use of internationally recognised classification system (i.e. ISICS, NACE, GICS).</i>	<i>Sensitivity to physical climate hazards per sector</i>	
Low	Country-level <i>(publicly available information)</i>	Country exposure	Vulnerability to physical climate impacts per country (i.e. ND-GAIN country index)	DNB, <i>Waterproof? – An exploration of climate-related risks for the Dutch financial sector</i> , 2017, Figures 1 and 2. ACPR, <i>French insurers facing climate change risk</i> , 2019, p. 8. NBB, <i>Financial Stability risks related to climate change in NBB FSR 2018</i> , Chart 2, p. 145.
Medium	District-level <i>(publicly available information)</i>	Location-specific exposures (i.e. coordinates of facilities, assets)	Vulnerability to physical climate impacts per district	BoE, <i>flood risk mortgages</i> , Box 6 <i>Banca d'Italia flood risk working paper</i> , 2018. ¹
High	Facility-level <i>(counterparty disclosures)</i>	Location-specific exposures (i.e. coordinates of facilities, assets)	Vulnerability to physical climate impacts per geographical location	DNB <i>Values at risk?</i> Section 4.1 <i>BdF, Responsible Investment Report</i> , 2018, p 25.
High	Value chains (both upstream and downstream) <i>(counterparty disclosures)</i>	Data on physical climate risk exposure of the value chain / location-specific data for vulnerable producers, suppliers, aggregators and distributors etc.	Vulnerability to physical climate impacts per geographical location	Future work Counterparty disclosures (will require further progress in setting expectations for disclosures)

¹ Faiella and Natoli, "Natural catastrophes and bank lending: the case of flood risk in Italy", Occasional paper no. 457, Oct. 2018.

Box 14

Example of exposure to physical risks analysis

DNB performed an assessment of the exposures of Dutch financial institutions to extreme water stress regions globally. To that end, DNB established for the 2,000 largest businesses the level of water stress at the geographical locations of their 900,000 business facilities. This is an example of an assessment on the basis of facility-level

data using water stress as an indicator of vulnerability to physical climate impacts. DNB concluded that water stress does pose a risk, as roughly 20% of the financial sectors' exposures are located in extremely water stressed regions. DNB, *Values at Risk? – Sustainability risks and goals in the Dutch financial sector*, 2019.

Figure. **Facilities of listed businesses in the equity portfolios of Dutch financial institutions***

Bronnen: DNB, Four Twenty Seven, World Resources Institute.

* The colours of the dots indicate the water stress level for the facility, ranging from green, signifying low water stress, to red, signifying extremely high water stress.

Key climate risk indicators

Based on the exposure analysis exercises, **supervisors are starting to define “key risk indicators” to monitor the development of climate-related risks posed to the financial institutions they supervise.**⁴⁴ The indicators currently used by supervisors are:

- the carbon-intensive sectors to which regulated financial institutions are exposed;
- the countries vulnerable to climate change (according to the ND-GAIN Index or Standard & Poor's methodology) in which their activities are located;

⁴⁴ In Europe, supervisors are awaiting guidance from the ECB and the ESRB, which are jointly developing a pilot risk-monitoring framework for climate-related systemic risks in the financial sector, including the development of risk indicators.

- the energy label distribution within the commercial real estate portfolio of a financial institution; and
- the exposure of financial institutions and households to flood risk.

3.3 In-depth assessment of climate-related risks

Beyond monitoring exposures to sectors and geographies, supervisors are developing approaches to determine the precise magnitude of the risks and the quantitative impact of different climate pathways. The findings of the NGFS survey suggest that there is a need for tools suited to the distinct features of climate-related risks, such as: the short, medium, and long time horizons of the expected impact (primary and secondary); the uncertain timing of policy and technological-development-related events; the breadth and complexity of transmission channels and feedback loops. The conventional approaches, which are mostly backward-looking methodologies based on historical data, appear to not be suitable to evaluate risks posed by non-linear and unprecedented disruptions caused by climate change, so more progress on developing new frameworks for analysis is needed.

The NGFS survey results show that a small number of supervisors have already developed analytical tools and models to estimate climate-related risks. In addition, the NGFS also presented in its *technical supplement* the existing toolbox for supervisors with regard to modelling approaches (including the strengths and weaknesses of different economic models), scenario development and stress testing exercises, and it has provided guidance on these tools to which supervisors can refer.

A few supervisors are currently developing or have already elaborated a framework for assessing the resilience of their financial sectors to climate-related scenarios. Scenario analysis enables supervisors to explore the impact of different possible climate change pathways in four dimensions: financial institution-specific risks, financial system-wide risks, macroeconomic risks and risks to central banks' own balance sheets. It offers a flexible methodological framework that can reflect emerging issues not considered in more traditional forecasting analysis. To help conduct

such an exercise, the NGFS will publish a set of standardised scenarios, alongside a scenario analysis guide. Most publicly available climate scenarios are primarily intended for policy evaluation and research. The absence of specific scenarios for central banks' and supervisors' increases the difficulty of assessing forward-looking macroeconomic and financial risks. The NGFS scenarios aim to address this limitation by integrating climate variables with macro-financial variables needed for analysis.

Scenario analysis usually distinguishes between macro-, micro and hybrid approaches (see Box 15). Within the top-down – macro – exercise, supervisors have mostly used macroeconomic models to translate the effects of transition risks on the economy and financial system. To convert the impact of each scenario into sector-specific losses, supervisors can use the indicators they have developed for the purpose of their exposure analyses exercises (as DNB did, using its transition risk vulnerability factors developed by means of an input-output analysis⁴⁵). Indeed, a prerequisite for scenario analyses is the ability to identify sectors, companies, households and sovereigns vulnerable to climate-related risks. Subsequently, supervisors can translate these sectoral effects (changes in returns on equity and bond prices due to changes in credit risk spread, etc.) into impact on the exposures of financial institutions. As such, the exposure analysis exercise mentioned above can supplement these forward-looking assessments. In bottom-up – micro – exercises (Bank of England; ACPR-BdF ongoing work), the supervisors also define top-down scenarios and the associated macro-financial variables. However, participating financial institutions (such as banks and insurers) are responsible for quantifying the change in the value of their assets or liabilities rather than the supervisor. This analysis can be done at varying levels of granularity – e.g. at the national, sectoral or counterparty level depending on the risk materiality. Exposure analysis is also useful here to provide financial institutions with an indication of how different sectors, companies, households and sovereigns will be impacted. These top-down assumptions can be revised once the first round of bottom-up modelling is provided by participating financial institutions, in order to capture system-wide impacts and interactions as part of a second-round (consider the Bank of England stress test, for instance). Scenario analyses that have been completed to date, as well as those under

45 DNB, *An energy transition risk stress test for the financial system of the Netherlands - Occasional Studies 1607*, 2018

Box 15

Differences in stress test exercises

- *Macro approaches* assess the impact on financial portfolios by using high-level proxies for risk. The climate scenarios are first translated into economic variables such as GDP, unemployment, interest rates, and real estate prices and aggregate financial market variables such as sovereign risk, credit spreads and financial market indices. These inputs can be used to estimate an adjusted risk profile (e.g. change in probability of default, loss given default, market prices) and revalue financial exposures.
- *Micro approaches* assess the potential impact from climate variables on counterparties from a granular level. This first involves identifying the location and characteristics of the underlying exposure (household or company activities). Micro models (e.g. cash flow models, natural catastrophe models) are then used to estimate the vulnerability of exposures to physical or transition risks. This analysis can take account of the ability and strategy of the counterparty to respond to these pressures over time. This counterparty-level information is then used to revalue the associated financial exposures (mortgage, equity, sovereign bond) based on the adjusted risk profile.
- *Hybrid approaches* meet somewhere in the middle. For example, a macro model can be downscaled to sectoral level using climate risk variables (such as the level of emissions) as a proxy for risk. Similarly, a micro-level assessment can be complemented with macro scenario variables to capture wider macroeconomic channels.

development, tend to focus more on transition risk. There is, however, work underway to combine physical and transition risks in a coherent framework for the NGFS scenarios. At least two supervisors have conducted a scenario analysis for physical risk⁴⁶. Both physical and transition risks will feature in the ACPR/BdF (2020) stress test and in PRA's 2021 Biennial Exploratory Scenario. Also EIOPA is currently preparing the ground for a framework for scenario analysis of climate-related risks for insurers' own risk and solvency assessments.⁴⁷

Supervisors are combining new approaches with existing methodologies. For instance, within its stress test exercise, DNB used its corporate credit risk module - derived from its top down stress-testing model for the Dutch banking sector - to evaluate credit risks per sector while integrating new indicators on climate risks. Some supervisors do not modify their stress testing methodologies significantly, but rather calibrate the model inputs to reflect climate-related factors. For instance, the Norwegian FSA modelled a fall in

oil prices as a proxy for transition risk in their usual stress testing exercise.⁴⁸ One supervisor, Bank Negara Malaysia, has also initiated bottom-up sectoral scenario analysis: financial institutions are required to conduct stress testing on prescribed severe but plausible flood and pandemic scenarios over a one-year time horizon. Furthermore, supervisors may build on existing tools to assess natural catastrophe risks that are available in the insurance sector. These could potentially be tailored to investigate risks on the asset side of financial institutions, or investigate more severe scenarios on the liability side of insurers.

Approaches can be either static or dynamic. For instance, the Bank of Greece has conducted an exercise which is closer to a counterfactual analysis than a scenario-based analysis as it compares two static states of the economy, one being impacted by climate-related change.⁴⁹ This is different from analyses aiming at comparing dynamic evolutions of the impact of climate change. For example, in the Bank of England's 2021 Biennial Exploratory Scenario, participating

⁴⁶ See DNB's assessment of the resilience of the Dutch financial sector to flood, DNB, *Waterproof? An exploration of climate-related risks for the Dutch financial sector*, 2017, and the climate scenario in the PRA's 2019 General Insurance Stress Test, which asked insurers to quantify the impact of physical risks in three scenarios.

⁴⁷ EIOPA, *Discussion Paper on Methodological Principles of Insurance Stress Testing*, 2019.

⁴⁸ The Norwegian Financial Supervisory Authority, *Risk Outlook June 2019*.

⁴⁹ Bank of Greece, *The environmental, economic and social impacts of climate change in Greece*, 2011.

firms submit management actions indicating how the financial firm would respond to the 'static' scenario. This information is used to revise the assumptions in the second round of the exercise to explore system-wide effects.⁵⁰

3.4 Data needs

The more sophisticated types of exposure analysis as well as in-depth risk assessments of both transition and physical risks require large amounts of data. To measure transition risks accurately, there is a need for firm-by-firm carbon data, on for instance carbon emissions for a large group of corporates, as well as energy consumption or efficiency data for real estate. Carbon-emissions data are available only for some of the larger listed companies. Furthermore, while financial institutions may have data on energy consumption or efficiency of real estate available in their systems, this information is typically not directly accessible by supervisors. To measure exposures to physical risks, there is, first of all, a need for location-specific data for a large group of corporates as well as real estate exposures. Analyses that are more sophisticated would require knowledge of the geographical locations of corporates' individual business facilities, their activities and size, and levels of coverage by insurance policies. Secondly, exposure analysis of physical risks requires climate and environmental vulnerability data. These could entail, for example, a score for the probability of flood risks for any given geographical location. Given the localised nature of physical risks, such data is needed at high resolution and for a wide variety of climate-related and environmental risk drivers. Such data is increasingly becoming available, but are often fragmented and not directly available to supervisors, and they often also require specific expertise.

To obtain access to reliable climate and environmental data, supervisors rely on external data sources from environmental agencies as well as other public and private data providers. To that end, several supervisors have joined forces with other agencies to obtain access to the data sources required and receive expert input

on the analysis performed. For balance sheet data supervisors have a variety of resources. They can rely on publicly disclosed data, and supervisory reporting data as well as requests to financial institutions on an *ad hoc* basis.⁵¹ Although supervisors can typically rely on the supervisory reporting data for less sophisticated analyses, the more sophisticated exposure analysis and the in-depth assessments usually require *ad hoc* data requests to financial institutions. As **climate-related and environmental disclosure frameworks** evolve, financial institutions and supervisors alike are likely to obtain more direct access to the quantitative and qualitative data they need. However, as disclosure frameworks typically are in place only for the larger and listed corporations, data gaps may still persist for smaller and non-listed companies and for financial assets other than corporates. Supervisors are thus likely to still require substantial numbers of additional data sources to gain a comprehensive view on climate-related and environmental risk exposure of the balance sheets of the financial institutions they supervise.

3.5 Qualitative assessment

The majority of supervisors have performed a qualitative survey of at least a selection of the financial institutions they supervise in terms of the impact of climate-related risks, and a small number of supervisors surveyed them in terms of environmental risks. Surveys generally seek information on the way in which financial institutions consider these risks in their strategy, governance, risk management, scenario analyses and disclosures. Such surveys help supervisors raise awareness as well as develop a deeper understanding of the risks that financial institutions in their jurisdictions bear. The example survey presented in Box 16 below lists key qualitative information concerning climate-related risks which supervisors have typically requested from financial institutions. Central banks and supervisors may need to tailor this to institutions and their own jurisdictions, taking into account factors such as size and complexity.

⁵⁰ Bank of England, *The 2021 biennial exploratory scenario on the financial risks from climate change*, 2019.

⁵¹ ACPR, *French banking groups facing climate change-related risks*, 2019, p12: ACPR collected data on financial institutions' exposures to physical and transitions risks. Banks' submissions partly relied on reporting and were based on the NAVE rev. 2 sectoral breakdown.

Box 16

Examples of qualitative information which supervisors could request from financial institutions

General information and familiarity of the institution with climate-related and environmental risks

1. What is your financial institution's overall opinion on the impact of climate change or environmental factors on the whole sector?
2. What is your perception of potential threats/opportunities to your financial institution?
3. Is your financial institution considering its response to key national or international policy initiatives in this area (e.g. FSB Task Force on Climate Related Disclosures, UNEPFI definitions of ESG factors), and their impact on the institution (e.g. the European Commission legislative proposal for establishing taxonomy on sustainable economic activities)?

Strategy and governance

1. Has your board determined how to effectively integrate climate considerations into the board committee structures?
2. What processes are in place to inform the board (and relevant committees) about climate-related risks? What is the frequency of such inputs?
3. How does your board ensure that climate considerations are given sufficient attention across the financial institution (e.g. being discussed in the audit, risk, nomination or remuneration committees?)
4. Are climate considerations incorporated into strategic planning, business models, financial planning and other decision-making processes?
5. Does your corporate strategy include a holistic climate strategy informed by scenario analysis, i.e. climate risk mitigation and adaptation as well as business continuity and opportunities?
6. What are the key climate change drivers that you would consider relevant to your strategy?

Risk management, scenario analysis and disclosure

1. How is your financial institution incorporating the risks from climate change within your risk management framework?
2. Does your financial institution expect that physical risks will affect business performance across different business lines, through impacts on customers, claims or values of assets or collateral? If yes, please explain how, and over what timeframes. If no, please explain why not. How do you expect these risks to materialise over the short, medium, and long term?
3. Does your financial institution expect that transition risks will affect business performance across different business lines, in terms of market demand, impacts on customers, values of assets/collateral or other factors? If yes, please explain how, and over what timeframes.
4. Does your financial institution expect that liability risks will affect business performance across different business lines, in terms of market demand, impacts on customers, values of assets/collateral or other factors? If yes, please explain how, and over what timeframes.
5. How does your financial institution perceive the potential for reputational risks arising from its investment or underwriting decisions in climate-related sectors (i.e. high carbon assets)?
6. Are different climate scenarios being used to inform the assessment of climate change materiality at your financial institution? What types of scenarios is your financial institution seeking to apply? What are the data inputs and key assumptions applied?
7. Are climate scenarios conducted in such a way that the results can be used to inform the company's or board's response to climate issues?

.../...

8. What types of gaps and barriers (information, data, scenarios) might complicate your efforts to undertake scenario analysis?
9. Does your organisation publicly disclose information on the material financial risks and opportunities associated with climate change? If yes, what type of information is disclosed (institution strategy, processes for identifying, assessing, and managing climate-related risks, exposures, impact, metrics; qualitative information only or also quantitative)
10. What are the key challenges that your financial institution has faced in its efforts to enhance disclosure of information relating to climate-related factors?

Role of supervisors

1. What is your financial institution's opinion on the role of the central bank, supervisor or international standard setting bodies with respect to physical and transition risks, and their impacts?
2. What is your financial institution's opinion on the potential guidance from the central bank, supervisor or international standard setting bodies with respect to the identification, assessment, and management of climate-related risks?

To follow up on the surveys, supervisors either provide feedback on the findings to the individual institutions or communicate aggregate findings to the sector at large or a combination of both. Supervisors have developed

different approaches to reviewing the sector's response. The examples in Boxes 17 and 18 serve to illustrate possible avenues for presenting a diagnosis of the sectors as a whole on the basis of individual survey results.

Example of survey results - 1

DNB

DNB studied how financial institutions give direction to their sustainability policies, for which it conducted a qualitative survey containing open-ended questions among the 25 largest financial institutions in its jurisdiction. To present an overview of the findings, the respondents'

answers were scored against 9 predetermined variables that were categorised on a planning-and-control cycle (from policy to commitment, to goals, to monitoring and to reporting). The dark coloured buildings indicate how many of the 25 surveyed institutions had the process in place. Source: DNB, *Values at Risk? – Sustainability risks and goals in the Dutch financial sector*, 2019.

A supervisor's survey results regarding the integration of sustainability aspirations into operational management

Example of survey results - 2

ACPR

To present the results of its analysis of the French banking sector response to climate change-related risks, the *ACPR* distinguished between “advanced” and wait-and-see institutions.

(i) Governance bodies dealing with climate-change-related issues with a risk-based view are typical advanced institutions. These institutions are taking into account the objective of reducing the carbon footprint of their credit portfolios when designing their strategic orientations. They have updated their sectoral policies to limit the institution’s exposure to transition risk. They have developed metrics to monitor their implementation, such as the carbon footprint of their balance sheet. These orientations can

be translated into limits to the total credit provided to specific sectors (mainly in the coal industry). These institutions are also in the process of integrating those risks into their internal risk management framework (risk classification and risk appetite framework).

(ii) Wait-and-see institutions still prioritise the corporate and social responsibility (CSR) approach over the risk-based approach. Challenges stemming from climate change are addressed mainly from a reputational risk perspective or indirectly through sectoral policies usually elaborated by their CSR division. These sectoral policies aim to avoid investments in sectors that contribute to major environmental harm. Besides, ESG criteria are integrated in the credit risk assessment of their counterparties, which can include climate-related indicators.

4. Setting supervisory expectations

Recommendation 4 – Set supervisory expectations to create transparency for financial institutions regarding the supervisors’ understanding of a prudent approach to climate-related and environmental risks

Supervisors are recommended to clarify to financial institutions what is expected of them. Initiatives are underway in a number jurisdictions to set these supervisory expectations, and these have typically covered the following five areas:

- **Governance:** To effectively manage climate-related and environmental risks, supervisors expect financial institutions to clearly define and assign responsibilities within existing governance arrangements.
- **Strategy:** Supervisors expect financial institutions to be aware of potential changes in their business environment and to adopt a strategic approach to cater to climate-related and environmental risks. For most financial institutions this requires a longer term view than the typical business planning horizon of three to five years, while short and medium term risks, in particular stemming from the energy transition, also need to be duly considered.
- **Risk management:** Supervisors expect financial institutions to have policies and procedures in place to identify, assess, monitor, report and manage all material risks. Supervisors also expect financial institutions to incorporate climate-related and environmental risks in their processes and procedures for, for example, credit, market, liquidity, operational and insurance risks, to develop adequate metrics for their internal monitoring, external reporting, and management of their operations.
- **Scenario analysis and stress testing:** Given the forward-looking nature of the risks and the inherent uncertainty associated with climate-related and environmental risks, supervisors expect financial institutions to develop methodologies and tools (e.g. scenario analysis and stress testing) necessary to capture the size of climate-related and environmental risks.

- **Disclosure:** Supervisors expect financial institutions to disclose information and metrics on the climate-related and environmental risks they are exposed to, their potential impact on the safety and soundness of the institution and how they manage those risks. The NGFS encourages supervisory expectations concerning disclosures to be in line with the TCFD recommendations.

This Chapter elaborates on the five topics mentioned above as well as the process for setting supervisory expectations. Generally, supervisors have not set new legally binding requirements.⁵² Instead, some supervisors issued (i) a clarification of how existing legal requirements may be applied in the context of climate-related risks, and/or (ii) a set of good practices. These will serve the purpose of guiding the supervisory dialogue on these matters going forward.

It is generally recognised that both supervisors and financial institutions are in the early stages of the journey towards sound management of climate-related and, even more so, environmental risks. Therefore, supervisors are generally of the view that guidance will be refined over time as expertise and regulation develop and capabilities improve. However, setting expectations is an important step, given the need to urgently start integrating climate-related and environmental risks in financial institutions’ decision-making and risk management processes.

4.1 Developing supervisory expectations

This paragraph discusses the process of developing supervisory expectations. The exact nature of the documents, the precise legal status and internal governance processes depend on national regulatory and supervisory frameworks. For example, supervisors have published their expectations in policy statements, supervisory statements, guidance and good practices documents.

Process

Supervisors typically require approximately 8-12 months for developing their expectations. While process requirements will vary from jurisdiction to jurisdiction, supervisory expectations generally require a round of consultations to

⁵² A few countries have published regulations, e.g. China, Brazil, Indonesia. In Indonesia, for instance, non-compliance with the regulation of the Indonesian Financial Services Authority (OJK) can result in a financial penalty being imposed on banks.

seek input from interested parties, and therefore publication could follow a two-stage approach. A draft is first published in a consultation paper, following which responses are received. The responses to the consultation may be received in written format and may be proactively elicited through industry roundtable discussions to encourage and facilitate feedback by, and dialogue with supervised financial institutions.

Risk frameworks

The scope of risks covered by supervisors varies; some consider Environmental, Social and Governance (ESG) risks while others focus on climate-related and/or environmental risks. Supervisors have generally found it helpful to categorise climate-related risks as physical risks or transition risks. Litigation risk may be viewed as a distinct category of climate-related risk or may be grouped under either of the two risk categories.

As set out in the previous Chapters, physical and transition risk channels manifest themselves through the existing risk types, including credit risk, market risk, liquidity risk, operational risk, underwriting risk, strategic risk and reputational risk. Therefore, it is useful for supervisors to engage with a wide range of internal stakeholders when preparing their expectations, including policy and risk specialist colleagues.

Granularity

To date, supervisory guidance in the area of climate-related and environmental risks has been intentionally largely high-level and non-technical. As illustrated in the previous Chapter, this approach reflects the fact that many supervisors and financial institutions are in an early phase of the learning curve. Over time it is expected that supervisors will move beyond setting high-level or general expectations towards being more precise and/or prescriptive. It will take time to do so in a robust fashion, i.e. with a focus on collecting data, finding the right taxonomies, metrics and methodologies, ensuring sound identification and analysis of the risks, contagion channels and mitigating measures, and with full consideration of unintended consequences and limitations on the availability of data. Moreover, it will require coordinated action between supervisors in order to safeguard completion and promote a level playing field.

Proportionality and risks profile

Supervisors recognise that smaller financial institutions might not have the resources or expertise that larger financial institutions may be able to draw on. Specialist consultancy may also be relatively expensive for them. However, the fact that a financial institution is small does not imply that it is exposed to minor climate-related or environmental risks. Depending on its business model, a small financial institution could be highly concentrated in a market, sector or geography that is exposed to material physical and transition risks, which means that it could be extremely vulnerable. Therefore, supervisors may reasonably expect even small financial institutions to conduct their own idiosyncratic analysis of the risks on their balance sheets, making assumptions based on their own risk profiles. This may be most challenging in the area of scenario analysis. Nevertheless, besides a quantitative approach, a narrative-style scenario analysis can be a useful tool for identifying transmission channels.

Proportionality may also be applied in recognising that financial institutions require time to develop and implement good practices. Maturity and plans for future development may be taken into account by supervisors when evaluating a financial institution's management of climate-related and environmental risks.

4.2 Topics addressed in supervisory expectations

This section sets out five topics that supervisors generally expect from financial institutions regarding climate-related and environmental risks. It draws on published supervisory expectations of NGFS members and beyond⁵³, internal and unpublished documents of a number of supervisors, and the work of various regulators.⁵⁴ The intention is not to be prescriptive, but rather to present options that were selected from these sources.

4.2.1 Governance

Sound governance arrangements are fundamental to the functioning of financial institutions and to the financial system more broadly. To effectively manage climate-related

53 *BaFin*, Bank of England, Bank-al-Maghrib, Banco Central do Brasil, Bank of Bangladesh, CBRC and DNB.

54 See, for example: EBA Action Plan on Sustainable Finance; EIOPA, *Opinion on Sustainability within Solvency II*, 2019.

and environmental risks, supervisors typically expect financial institutions to clearly define and allocate responsibilities within existing governance arrangements (see Box 19).

Board-level commitment is vital in order to gain assurance that the work on climate-related and environmental risks has sufficient standing in the organisation, and give the Board the opportunity to respond to the risks strategically and provide the necessary oversight. Supervisors' experience has shown that more and more financial institutions are stepping up their board-level engagement with this topic. Given the importance of the management board in setting the institution's strategy and overseeing its functioning, several supervisors expect financial institutions to explicitly assign the responsibility for managing climate-related and environmental risks to a senior executive, a board member or board committee. The UK's PRA, for example, requires financial institutions to identify someone holding a Senior Management Function (under the Senior Managers & Certification Regime) to hold this responsibility and for this to be detailed in a formal Statement of Responsibility document.

Some supervisors are considering how to integrate climate-related and environmental risks in the fit-and-proper – or suitability – test used when approving appointments of board members, senior management and/or key persons in control/key functions (e.g. Chair of Risk Committee, Chair of Audit Committee, Chief Risk Officer). Also, some supervisors, mainly European ones, have the mandate to assess the extent to which financial institutions' remuneration policies are in line with their long-term business goals as well as their

risk appetite. From that perspective, these supervisors also expect financial institutions' remuneration policies to provide incentives aligned with the strategy and management of climate-related and environmental risks. Supervisors acknowledge that governance arrangements need to be set up in a way that is appropriate within the financial institution's current organisational structure and risk profile. Regardless of the specificities of the organisational structure, supervisors expect financial institutions to have policies, procedures and processes in place that ensure that the various business lines and relevant functions are attributed clear roles and responsibilities within the climate-related and environmental risk management framework. Many financial institutions have set up sustainable finance and/or environmental and social risk management units that deal with generating new "sustainable" business as well as with defining and implementing the necessary policies and processes to ensure that environmental and social risks are properly managed across all relevant business operations.

In light of the increasing significance of climate-related and environmental risks, supervisors expect financial institutions to ensure that the responsible units have adequate resources and expertise, while acknowledging that the required expertise needs to be built up and strengthened. This particularly includes staff training. Supervisors have also encouraged financial institutions to take on board relevant expertise from other stakeholders, such as academics or experts from governmental or non-governmental organisations. Some supervisors discuss skills or knowledge gaps, and their plans to bridge them, with regulated financial institutions.

Box 19

Examples of expectations with respect to governance

Bank of England / PRA – Supervisory Statement – Enhancing banks' and insurers' approaches to managing the financial risks from climate change

The PRA expects financial institutions to have clear roles and responsibilities for the board and its relevant sub-committees in managing the financial risks from climate change. In particular, the board and the highest level of executive management should identify and allocate responsibility for identifying and managing financial risks from climate change to the relevant existing Senior Management Function(s) (SMF(s)) most

appropriate within the financial institution's organisational structure and risk profile, and ensure that these responsibilities are included in the SMF(s)'s Statement of Responsibilities. The PRA expects to see evidence that the board and its relevant sub-committees exercise effective oversight of risk management and controls. Further, the PRA expects the board to ensure that adequate resources and sufficient skills and expertise are devoted to managing the financial risks from climate change.

.../...

BaFin – Guidance Notice on Dealing with Sustainability Risks

The management board is responsible for the business and risk strategy and its communication and implementation within the entity (risk culture), as well as for institutionalising it through established process structures. Accordingly, senior management is also responsible for the strategic considerations (...); of course support may also be provided by experts, e.g. from the risk control function.

The management board is responsible for allocating responsibility for managing risks (...), including sustainability risks, within the organisation. The supervised entity may also take account of external sources when identifying potential sustainability risks. E.g. data providers specialised in sustainability; publications of the Federal Environmental Agency (Umweltbundesamt) or the Potsdam Institute for Climate Impact Research.

Bank of Bangladesh – Guidelines on Environmental & Social Risk Management (ESRM) for Banks and Financial Institutions in Bangladesh

In order to identify, manage and mitigate Environmental and Social (E&S) risks in lending, all banks/FIs need to develop a robust Environmental and Social Management System (ESMS). An E&S Management System is a set of policies, procedures, tools and internal capacity to identify, monitor and manage a Bank/FI's exposure to the E&S risks of its clients. An E&S Management System states a Bank/FI's commitment to E&S management, explains its procedures for identifying, assessing and managing E&S risk of financial transactions, defines the decision-making process, describes the roles, responsibilities and capacity needs of staff in doing so and states the documentation and recordkeeping requirements. It also provides guidance on how to screen transactions, categorise transactions based on their E&S risk, conduct E&S due diligence and monitor the client's E&S performance. The ESMS includes the financial institution's environmental and social policy and designated roles and responsibilities of its staff.

4.2.2 Business models and strategy

Both climate-related and environmental risks are already manifesting themselves, and they are expected to have a material impact on the business environment in which financial institutions operate, either through physical or transition transmission channels, or both. Supervisors typically expect financial institutions to be aware of potential changes in their business environment and to adopt a strategic approach to cater for these risks. In the case of climate change and other environmental pressures, the strategy also requires a longer-term view than the typical business planning horizon of three to five years. More generally, supervisors expect institutions to have the execution capabilities to ensure that the envisioned business strategy is cascaded down to individual business and product lines and operationalised. For the purposes of financial institutions' response to climate-related and environmental risks, this could entail setting and monitoring clear key performance indicators.

Several supervisors also point out the importance of scenario analysis and stress testing with respect to business models and strategy. After all, even though financial institutions will be affected by some combination of physical and transition risks,⁵⁵ there is inherent uncertainty about the way in which the risks will unfold. Supervisors therefore typically expect financial institutions to test the resilience of their business model and capital adequacy against a plausible set of future scenarios. Financial institutions are then expected to feed these insights into the strategy-setting process, so as to ensure reasonable assurance of the viability of the business model going forward.

Further, several supervisors expect to see evidence of financial institutions' business environment analysis, of scenario-analysis and possibly stress tests feeding into the strategy-setting process, risk appetite framework and relevant risk management and compliance processes. Such arrangements ensure that relevant information is acted upon by the responsible units in the institution. See Box 20 for examples with respect to business models.

⁵⁵ NGFS, *A call for action – Climate change as a source of financial risk*, 2019.

Box 20

Examples of expectations with respect to business models

BaFin – Guidance Notice on Dealing with Sustainability Risks (Merkblatt zum Umgang mit Nachhaltigkeitsrisiken)
The business strategies of supervised companies should be fully reviewed for sustainability risks. Potential questions entities may consider, if relevant:

- *Which business areas are exposed to a physical risk? Is the risk material? Should the affected areas be continued, scaled back or adapted? Do sustainability risks require consideration across all business areas and processes on the basis of their materiality, or is it sufficient to focus on particularly exposed business areas and processes? Are impact analyses over a period of several years required for informed decision-making on any (future) management measures that may be necessary? (...)*

- *Which business areas are exposed to a transition risk? Is the risk material? Should the affected areas be continued, scaled back or adapted? Should sustainability requirements be set for third parties and communicated to them? Should stakeholders with material sustainability risks be contacted to discuss how such risks can be mitigated or reduced in the future? What is the policy on exercising voting rights with regard to equity investments?*

Bank-al-Maghrib – Directive des risques financiers liés au changement climatique et à l'environnement
Institutions shall endeavour to develop analytical tools, including simulation and stress testing, to estimate the climate and environmental financial risks incurred in the short, medium and long term and to close their impact on their business model and financial indicators.

4.2.3 Risk management

For the purposes of adequate risk management, supervisors expect financial institutions to have policies and procedures in place to identify, assess, monitor, report and manage all material risks. As set out in Chapter 1, Box 2, supervisors tend to approach climate-related and environmental risks as a driver of established risk categories, such as credit, market, liquidity and operational risks. They therefore expect that these risks are treated within the context of these categories. Some supervisors specifically point to market and operational risks, insurance supervisors put a particular focus on insurance risks (underwriting and pricing risks), while banking supervisors tend to be most prescriptive on credit risk. For example, for credit risks it entails more granular guidance on the consideration of these risks in all stages of the credit granting process (the flow), as well as the monitoring of existing exposures (the stock). See Box 21 for examples.

Supervisors generally attach importance to the development of adequate metrics that enable the risk function to monitor the development of the exposures to these risks, as well as

derive management information to feed the discussions of the management board and make explicit an institution's risk appetite. Some supervisors acknowledge that the data needed for the development of these metrics are not readily available. They therefore encourage institutions to engage with their customers and other parties to develop the data infrastructure that is needed to measure the risks. Estimates may be required in certain circumstances. Supervisors acknowledge that there is no one set of optimal metrics for risk management and decision-making purposes. Financial institutions are therefore expected to develop metrics appropriate for their institution and are already taking action. It is expected that over time there will be some convergence on the most useful metrics and calculation methods.

Lastly, several supervisors expect financial institutions to assess the extent to which climate-related or environmental risks may impact the capital adequacy of the institution going forward. To that end, supervisors point to the use of the capital adequacy assessments of banks (ICAAP) and insurers (ORSA). (see also Chapter 5)

Examples of expectations with respect to risk management

China Banking Regulatory Commission – Green Credit Guidelines

Banking institutions shall develop client environmental and social risk assessment criteria, dynamically assess and classify client environmental and social risks, and consider the results as important basis for credit rating, access, management and exit. They shall adopt differentiated risks management measures concerning loan investigation, review and inspection, loan pricing and economic capital allocation.

Banking institutions shall prepare a list of clients currently faced with major environmental and social risks, and require these clients to take risk mitigation actions, including developing and having in place major risk action plans, establishing sufficient, effective stakeholder communication mechanisms, and finding a third party to share such risks.

Central Bank of Brazil (Banco Central do Brasil) – Resolution on Social and Environmental Responsibility Policy (Resolução sobre Política de Responsabilidade Socioambiental)

The socio-environmental risk management of the financial institutions and other institutions authorised to operate by the BCB should consider:

- I. systems, routines and procedures that make it possible to identify, classify, assess, monitor, mitigate and control the social and environmental risk present in the institution's activities and operations;*
- II. registration of data regarding actual losses due to social and environmental damages for a minimum of five years, including values, type, location and economic sector of the operation;*

- III. prior assessment of potential negative social and environmental impacts of new product and service modalities, including reputational risk; and*
- IV. procedures for adapting social and environmental risk management to legal, regulatory and market changes.*

The actions related to the social and environmental risk management must report to a risk management unit of the institution.

Resolution on Integrated Risk Management (Resolução sobre Gerenciamento Integrado de Riscos):

The structure of the FI's integrated risk management should include the social and environmental risks.

DNB – Q&A Climate-related risks and insurers

Given the potential impact on the asset side of their balance sheets as well as on their technical provisions, we expect insurers to integrate climate-related risks into their Own Risk and Solvency Assessments (ORSA) by analysing and describing the influence of these risks on their risk profile. We expect the ORSA report to present and explain the outcomes of this analysis in the ORSA report. If climate-related risks are not regarded as material, for instance because the insurer is not or could not be exposed to them, then we expect this to be included in the explanation. [...] If the risks are material, we expect the institution to set out a relevant scenario for them in the ORSA. This applies to both physical risks and transition risks.

4.2.4 Scenario analysis and stress-testing

There is inherent uncertainty regarding the precise extent and sectoral and geographic distribution of economic damages and financial losses stemming from climate-related risks, as well as broader environmental risks. Most

financial institutions are likely to be affected by some combination of physical and transition risks, but the way in which the risks will materialise is contingent upon future developments, notably on the total level of policy action and the occurrence of so-called tipping points. Supervisors typically expect financial institutions to develop

methodologies and tools necessary to identify, assess, monitor and manage climate-related and environmental risks. Given the forward-looking nature of the risks, the fact that past experience is not a good indicator of future conditions, and the inherent uncertainty associated with these risks, supervisors typically turn to scenario analysis and stress testing as useful tools to explore different possible futures. Supervisors expect financial institutions to use the insights from these tools on several fronts. The results from such analyses can, for example, inform the business strategy and risk appetite as they provide insight into the resilience of the financial institution's business model in one or multiple plausible future scenarios. Scenario analysis and stress testing can, moreover, aid in the quantification of the risks with the purpose of assessing the capital adequacy from an economic perspective in a forward-looking manner. Scenario analysis and stress testing can be used for both

short-term and long-term assessment, and supervisors, therefore, typically expect their utilisation for both time horizons. See box 22 for examples.

Some authorities have observed that some financial institutions are finding climate scenario analysis and stress testing challenging, as set out in Chapter 3. A proportionate place for financial institutions to start might be with "narrative style" scenarios to think through the channels of risk transmission. Analysis may develop in scope and complexity over time. If a supervisor wants to be able to compare results between financial institutions then it needs to specify not only the scenario, but also provide details of how financial institutions should perform the exercise and what assumptions they should make (e.g. in respect of management actions).

Box 22

Examples of expectations with respect to scenario-analysis and stress testing

Bank of England – Supervisory Statement – Enhancing banks' and insurers' approaches to managing the financial risks from climate change

The PRA expects a financial institution's scenario analysis to address a range of outcomes relating to different transition paths to a low-carbon economy, and a path where no transition occurs. The scenario analysis should, where appropriate, include a:

- *short-term assessment which sets out the financial institution's exposure to the financial risks from climate change within its existing business planning horizon, including, where appropriate, the quantification of these risks; and*
- *longer term assessment of the financial institution's exposure, based on its current business model, of a range of different climate-related scenarios. For example: scenarios based around average global temperature increases consistent with, or in excess of 2°C; and scenarios where the transition to a low-carbon economy occurs in an orderly*

manner, or not. The PRA expects the time horizon of this long-term assessment to be in the order of decades. As with other types of scenario analysis, this is not intended to be a precise forecast, but a qualitative exercise used to inform strategic planning and decision making.

BaFin Guidance Notice on Dealing with Sustainability Risks (Merkblatt zum Umgang mit Nachhaltigkeitsrisiken) *Supervised entities should check whether the existing internal stress tests adequately reflect the material sustainability risks, or if new or modified internal stress tests should be created to address these. Stress tests may include specific sensitivity and scenario analyses to examine the entity's ability to withstand adverse events or scenarios caused by physical and transition risks. Stress tests should therefore also take account of scenarios reflecting plausible future developments, and make greater use of long-term scenario analyses.*

4.2.5 Disclosure

Public disclosure by financial institutions pertaining to climate-related and environmental risks and, more generally, supervisory engagement on Pillar 3 disclosures contribute to market efficiency by ensuring that market participants have adequate insight into the risk exposures, risk assessment processes and capital adequacy of financial institutions. From that perspective, a number of supervisors expect financial institutions to disclose information and metrics on the climate-related and environmental risks they are exposed to, their potential impact on the safety and

soundness of the institution and how they manage those risks. In doing so, authorities tend to refer to existing global or regional initiatives, such as the recommendations of the Task Force on Climate-Related Financial Disclosures. Several supervisors also prescribe certain metrics to be disclosed, such as a portfolio breakdown of environmental risks by business line, geographic location or scope 1, 2 and 3 GHG emissions.⁵⁶ Some supervisors also expect the disclosure of green assets' ratios that show the volume/percentage of green assets in institutions' balance sheets and in their different portfolios. See Box 23 for examples.

Box 23

Examples of expectations with respect to disclosure

Bank of England – Supervisory Statement – Enhancing banks' and insurers' approaches to managing the financial risks from climate change

The PRA expects firms to develop and maintain an appropriate approach to disclosure, reflective of the distinctive elements of the financial risks from climate change. Firms should look to evolve their disclosures to make these as insightful as possible, and in particular should ensure they reflect the firms' evolving understanding of the financial risks from climate change. Firms should recognise the increasing possibility that disclosure will be mandated in more jurisdictions, and prepare accordingly.

The PRA expects firms to engage with wider initiatives on climate-related financial disclosures and to take into account the benefits of disclosures that are comparable across firms. Various initiatives have done work on this area. For example, the 'Taskforce on Climate-related Financial Disclosures' published recommendations in June 2017 and other initiatives have since then provided tools or case studies for organisations making climate-related financial disclosures. The PRA expects firms to consider engaging with the TCFD framework and other initiatives in developing their approach to climate-related financial disclosures.

Bank of Bangladesh – Guidelines on Environmental & Social Risk Management (ESRM) for Banks and Financial Institutions in Bangladesh

A Bank/FI's ESMS should include periodic reporting on the E&S performance of transactions and measures taken to reduce its overall exposure to E&S risk. Bank/FI staff should compile all E&S findings from monitoring clients and aggregate findings at the portfolio level. By analysing this information, the Bank/FI can have a better understanding of its overall exposure to E&S risk through its portfolio. E&S performance reports typically include information on:

- 1. Portfolio breakdown by business line, industry sector and E&S risk category*
- 2. Overall exposure to E&S risk and performance*
- 3. High-risk transactions and E&S due diligence process prior to transaction approval*
- 4. Major E&S risks of individual transactions, including cases of non-compliance*
- 5. Significant E&S accidents or incidents related to a transaction*
- 6. Implementation and changes in the Bank/FI's ESMS*

⁵⁶ See Box 12 for more information about metrics.

4.3 Supervisory activities to follow the publication of expectations

Once supervisory expectations have been set, bilateral and multilateral dialogues between the supervisor and the financial institutions may continue as part of the ongoing supervisory engagement. These dialogues will, on the one hand, provide more transparency about what constitutes, according to the supervisor, the safe and prudent management of climate-related and environmental risks. On the other hand, it could motivate financial institutions to enhance the analytical capacity and development of appropriate tools and techniques.

In order to maximise the benefits of the dialogue, frontline supervisors and supervisory risk experts could be provided with a list of pre-defined questions to collect information during meetings. See box 16 in Chapter 3 for examples of questions to address during bilateral meetings. These questions may be used in bilateral conversations or on-site visits to supervised entities. Banks and insurers may be

asked to nominate responsible individuals from the relevant departments (e.g. risk/finance) to be involved. Periodic high-level dialogue with representatives of the financial industry (e.g. CEOs) may also be used to convey the state of the art with respect to the assessment and mitigation of climate-related and environmental risks.

Supervisors may wish to consider how they will assess the implementation of expectations with respect to financial institutions' management of climate-related risks once they have been published. As part of the expectations of several supervisory authorities, financial institutions are expected to submit a written response to the authority setting out how and when they are planning to implement the expectations. Supervisors are then able to review those plans and discuss them with financial institutions.

On an ongoing basis, supervisors may wish to assess the implementation of expectations by financial institutions by using the tools described in Section 5.3

5. Supervisory and regulatory toolbox

Recommendation 5 - Ensure adequate management of climate-related and environmental risks by financial institutions and take mitigating action where appropriate.

Qualitative and quantitative measures can be taken by supervisors to address climate-related and environmental risks. When doing so, supervisors can rely on their existing supervisory toolbox to take mitigating action. Given that methodologies for climate-related and environmental risk quantification are still being developed, supervisors have taken a number of qualitative measures, for example, requiring the strengthening of risk management and internal control systems, procedures and processes. This Chapter summarises the toolbox that supervisors generally have at their disposal for mitigating measures and sets out a number of qualitative prudential measures. The majority of supervisors have not yet imposed (additional) capital or solvency requirements specifically linked to climate-related and environmental risks. The state of play on capital requirements is described in the Chapter 6.

5.1 Overview of the supervisory framework

Once they have raised awareness, engaged with financial institutions on the outcomes of risk assessments, published supervisory expectations and actively monitored their implementation, supervisors may still find that financial institutions have insufficiently addressed climate-related and environmental risks. Supervisors may therefore conclude that their findings need to be followed up by supervisory measures to ensure that financial institutions manage and respond to those risks effectively. Currently, it is still difficult for supervisors to properly quantify the impact of climate-related and environmental risks on capital adequacy. However, supervisors can already impose a wide

variety of qualitative measures. In particular, they can take measures if supervised institutions insufficiently integrate climate-related and environmental risks into their strategy, governance, risk management, or disclosure frameworks.

As set out in Chapter 1, climate-related and environmental risks are drivers of existing risk categories, such as credit risks, markets risks, operational risks, liquidity risks and underwriting risks. In that light, **the current international standards for the supervision of banks and insurers already provide a basis for taking action if deficiencies by financial institutions are identified.** According to the Basel Core Principles for Effective Banking Supervision, an effective system of banking supervision requires supervisors to develop and maintain a forward-looking assessment of the risk profile of individual institutions and banking groups, proportionate to their systemic importance.⁵⁷ Supervisors are in particular required to use tools such as:

- analysis of financial statements and accounts;
- business model analysis;
- horizontal peer reviews;
- review of the outcome of stress tests undertaken by banks; and
- analysis of corporate governance, including risk management and internal control systems.⁵⁸

Likewise, the IAIS Insurance Core Principles (ICPs)⁵⁹ expect supervisors to use off-site monitoring and on-site inspections to:

- examine the business of each insurer;
- evaluate its financial condition, conduct of business, corporate governance framework and overall risk profile;
- assess its compliance with relevant legislation and supervisory requirements; and
- obtain the necessary information to conduct effective supervision of insurers and evaluate the insurance market.⁶⁰

In terms of enforcement, the IAIS ICPs recommend that supervisors initiate escalating measures to prevent a breach of regulatory requirements by an insurer, respond to any breach of regulatory requirements by an insurer, and enforce

57 BCBS, Core Principles for Effective Banking Supervision, Principle 8, Supervisory approach.

58 BCBS, Core Principles for Effective Banking Supervision, Principle 9, Supervisory techniques and tools.

59 See IAIS/SIF (July 2018), "Issues Paper on Climate Change Risks to the Insurance Sector", Chapter 6, for the applicability of ICPs on climate change risks.

60 IAIS, Insurance Core Principle 9, Supervisory Review and Reporting.

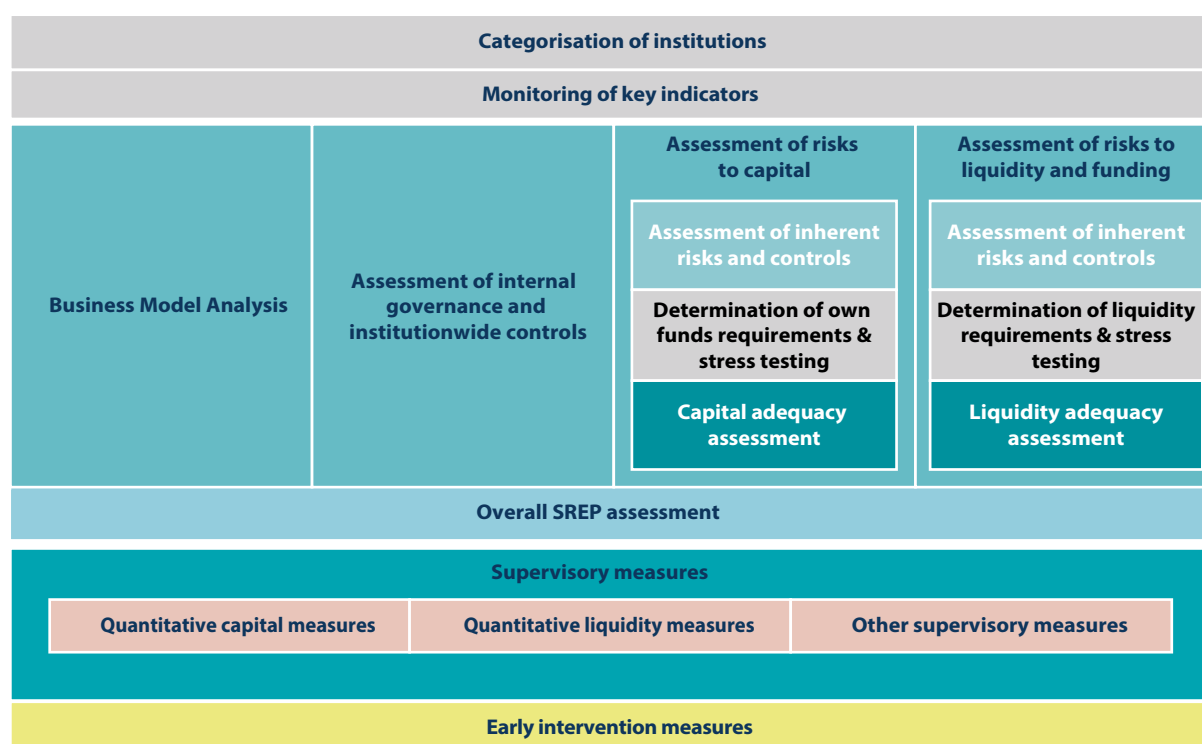
those measures to ensure that the insurer responds to the supervisor's concerns.⁶¹

Financial institutions should be required to take action to mitigate any particular vulnerabilities detected. If not addressed well, supervisors can impose clear prudential objectives on financial institutions, or set out the actions they should take. This may include various supervisory measures as further specified in 5.3.⁶²

5.2 Supervisory review process

Climate-related and environmental risks can be factors of prudential risks and can therefore already be considered to be part of the different elements of the Supervisory Review Process under the Basel framework. Also, the European supervisory review and evaluation process (SREP) in accordance with EBA guidelines⁶³ provides supervisors with a set of tools to examine an institution's risk profile from the perspectives of business model, governance and risk, capital and liquidity. The SREP process is illustrated in Figure 3 below.

Figure 3. SREP process⁶⁴



61 IAIS, Insurance Core Principle 10, Preventive Measure, Corrective Measures and Sanctions.

62 For details, see BCBS, Core Principles for Effective Banking Supervision, e.g. Principle 11, Corrective and sanctioning powers of supervisors; Principle 14; Corporate governance; Principle 15; Risk management process; and IAIS, Insurance Core Principle 10, Preventive Measure, Corrective Measures and Sanctions.

63 EBA, Guidelines on the revised common procedures and methodologies for the supervisory review and evaluation process (SREP) and supervisory stress testing.

64 Figure 3 is taken from the EBA Guidelines on SREP (see previous footnote), p. 11.

From a SREP perspective, climate-related and environmental risks can affect the **business model** of an institution if counterparties (lenders, depositors, investments, insurance holders, etc.) from certain sectors of the economy and/or counterparties operating in specific geographical areas face economic adversity, e.g. due to rapidly developing technology, policy changes or reputational issues. One of the four main SREP elements is an analysis of the business model of an institution, which includes an analysis of the viability of the current business model and the (economic) sustainability of the planned business model considering the three to five-year business strategy. This approach has not been designed to reflect long-term issues (i.e. spanning more than five years), such as climate-related and environmental risks, but it can be considered an important element in the SREP, enabling supervisors to incorporate a longer-term perspective needed for adequately considering the climate-related and environmental risks.

With regard to the assessment of **risks to capital and liquidity/funding**, climate-related and environmental risks are drivers of existing prudential risk categories: **credit risk** may rise when the probability of default or the loss given default of lenders are negatively affected by physical or transition risks. The overall impact on credit risk levels is largely affected by the degree of concentration of credit portfolios⁶⁵. Likewise, **market risk** may increase due to falling market prices or increased volatility. **Operational risk** may be driven by potential reputational damage, legal sanctions or interruption of business continuity. **Liquidity risk** may be impacted on the assets side and on the funding side. In addition to the aforementioned market risks affecting their investment portfolios, insurers may see their **underwriting losses** grow when the increase in frequency and intensity of climate-change-related natural catastrophes exceeds the priced-in expectations⁶⁶. For more details, see Chapter 1 and Box 2.

The SREP should also examine the **governance and risk management arrangements** of institutions and determine whether these also adequately address climate-related and environmental risks. Supervisors may revert to establishing, where appropriate, that institution's governance and risk management arrangements are not adequate to identify, monitor, manage and mitigate its climate-related or environmental risks.

The Basel standard on the Supervisory Review Process and the Insurance Core Principles provide a number of requirements relating to governance and risk management which are of interest in respect of climate-related and environmental risks:

- Supervisors could assess whether the board of directors and senior management have sufficient knowledge about climate-related and environmental risks, their particularities⁶⁷ and their impact on the institution's risk profile.⁶⁸
- Supervisors could assess whether climate-related and environmental risks are adequately addressed in an institution's risk appetite statement and whether consistent risk limits are set in risk management policies, taking into account that those risks are expected to materialise through existing risk categories (credit, market, liquidity, etc.).⁶⁹
- Supervisors could assess, among other things, whether and to what extent climate-related risks are integrated into the duties allocated to the risk management function, compliance function, actuarial function and internal audit, and how they interact with dedicated sustainability teams, if any.⁷⁰

65 For example, the Bank of England highlighted that the top 35 global coal-exposed banks provided USD 75 billion in credit to the coal power industry and GBP 58 billion to the coal mining industry during 2014-2016, while 54% of coal power plants in the EU were loss-making, which could rise to 97% by 2030, Source: BoE (September 2018), "Transition in thinking: The impact of climate change on the UK banking sector", p. 32.

66 DNB found that the climate-related claims burden from homeowners' insurance policies could increase by 25% to 131% in a 3.5°C scenario by 2085, Source: DNB (2017), "Waterproof", p. 19.

67 NGFS, *A call for action – Climate change as a source of financial risk*, 2019, p. 12

68 Basel Committee on Banking Supervision, Supervisory Review Process, 30.9 and International Association of Insurance Supervisors, Insurance Core Principles 7.

69 BCBS, SRP, 30.8.

70 BCBS, SRP, 30.19 and IAIS, ICP 8.

- Supervisors could assess whether risk policies, procedures and limits cover climate-related and environmental risks, and how they are integrated into the arrangements for existing risk categories.^{71 72}
- Supervisors could assess whether internal stress tests also take account of scenarios reflecting severe but plausible future developments, including physical and transition risks, and make greater use of long-term scenario analyses.^{73 74}

5.3 Potential supervisory tools

Given the distinctive characteristics of climate-related and environmental risks, whose effects will increasingly materialise over a medium to long-term time horizon, certain prudential measures could be taken by supervisors to address these risks – even in the absence of standardised methodologies for risk quantification. Such measures may include, but are not limited to:

- **Discussing the findings with the boards of financial institutions and requiring adequate follow-up on the shortcomings identified:** An efficient way of motivating institutions to implement supervisory expectations with respect to climate-related and environmental risks may be to simply bring these to the attention of the board. As set out in Chapter 4, board-level commitment is vital in order to gain assurance that the work on climate risk has sufficient standing in the organisation so that the board has the opportunity to respond to the risks strategically. Where supervisors find that institutions do not act in accordance with their supervisory expectations, they could raise their concerns with the boards of the respective institutions and require a formal decision by the board on the matter and, where appropriate, regular written progress reports.
- **Requiring financial institutions to strengthen risk management and internal control systems, procedures**

and processes: Based on the experience gained through the supervisory dialogue, Supervisory Review and Evaluation Process (SREP) / Supervisory Review Process (SRP) and other inspections, supervisors may deem it necessary to require institutions to improve their corporate governance, IT systems, internal control systems, and risk management frameworks in order to appropriately cater to climate-related and environmental risks. This may, for instance, relate to the composition and/or functioning of the bodies charged with supervision, management and control, risk-taking units, the design of credit granting or underwriting processes, risk monitoring and mitigation at the portfolio level, or the IT systems and asset/exposure databases. For example, EIOPA mentions in its opinion on sustainability that climate change scenario analysis should be embedded in undertakings' risk management, governance and ORSA⁷⁵. This should enable undertakings to identify and assess the climate-related risks they would be exposed to in a forward-looking manner and inform business planning and strategy.

- **Requiring financial institutions to integrate climate-related and environmental risks into ICAAP/ORSA:** Financial institutions are required to assess and maintain the amounts, types and distribution of internal capital that they consider adequate to cover the nature and level of the risks to which they are effectively or potentially exposed on a continuous basis.⁷⁶ This contributes to better decision-making and risk management as regulatory capital requirements may sometimes be too static and not tailored to an individual institution. Supervisors may review the ICAAP/ORSA strategies and implemented processes with a view to having potential deficiencies rectified by supervised financial institutions. In particular, they could assess whether such risks have been integrated into internal stress tests/ scenario analyses and on which time horizons financial institutions focus.

71 BCBS, SRP, 30.13.

72 For example, limits or exclusions could be applied to companies generating at least 30% of sales from mining, processing or burning fossil fuels. Risk mitigation could comprise a dialogue with the counterparty to raise risk awareness, or a comprehensive action plan to reduce/eliminate climate-related and environmental risks on a step-by-step basis, improve the sustainability rating or comply with particular sustainability standards.

73 BCBS, SRP, 30.2.

74 On the use of climate-related scenario analyses, see also: TCFD (2017), "Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities"; UNEP FI (April 2018), "Extending our horizons - PART 1: Transition-related risks & opportunities"; UNEP FI (July 2018), "Navigating a new climate - PART 2: Physical risks and opportunities".

75 EIOPA, *Opinion on sustainability within Solvency II*, 2019, p. 16-17.

76 BCBS, Core Principles for Effective Banking Supervision, Principle 15: Risk management process; IAIS, Insurance Core Principle 8: Risk Management and Internal Controls.

• **Requiring financial institutions to reduce the level of risk, ultimately imposing limitations on carrying out certain categories of transactions or operations or, alternatively, guiding financial institutions towards adjusting their business models before the risk could materialise.** Financial institutions are by definition exposed to risks and they are required to manage those risks that are relevant to them. If supervisors find that the level of risk driven by climate-related and environmental factors is excessively high, they could require institutions to reduce such risks by applying measures such as⁷⁷:

- risk mitigation tools (guarantees by third parties, reinsurance or other forms of protection);
- setting more stringent limits on risk concentration⁷⁸;
- limiting or prohibiting them from carrying out certain categories of activities (e.g. financing customers/ subscribing securities from a specific territory or economic sector/or underwriting particular types of risks);

- prescribing the deleveraging of certain risks; and
- requiring business model adjustments within a longer-term perspective.

• **Setting limitations to the distribution of profits or other assets:** Financial institutions could also be prevented from distributing profits so as to build up own funds in excess of minimum capital requirements, or be required to implement a specific provisioning policy with a view to catering for transitional or physical risks that may materialise in the medium term.

Supervisors may also consider imposing a capital add-on as a result of the SREP/SRP. Furthermore, they might consider advising policy-makers to modify regulations for capital requirements. The current state of play, challenges and options regarding capital requirements are set out in the next Chapter.

77 BCBS, Core Principles for Effective Banking Supervision, Principle 11: Corrective and sanctioning powers of supervisors.

78 BCBS, Core Principles for Effective Banking Supervision, Principle 19: Concentration risk and large exposure limits.

6. Mitigating actions by means of financial resources

This Chapter sets out the current state of play of NGFS members with a supervisory mandate regarding capital requirements to mitigate climate-related and environmental risks. This is an area that is still very much under development, making this Chapter less guiding and more exploratory compared to the previous Chapters in this Guide. Most supervisors have not yet imposed additional capital requirements via the supervisory review process (Pillar 2). Within the framework for minimum capital requirements (Pillar 1), fundamental issues remain to be analysed. For example, the transmission channels and loss potentials of such risks as well as potential specific risk profiles of different groups of assets and exposures need to be better understood. The same holds true for the question as to what extent the current framework already captures the new risk drivers. A harmonised and sufficiently granular classification framework and a robust and internationally consistent climate and environmental disclosure framework would greatly facilitate the analyses of potential risk differentials.⁷⁹ After all, banks and insurers need robust capital buffers that are appropriate to the risk levels of their exposures.

6.1 Overview of current practices

Pillar 2:

Within the context of climate-related and environmental risks, the imposition of capital requirements for banks or (re) insurers under the supervisory Pillar 2 framework is an area that is still very much under development. Most supervisors within the NGFS are of the opinion that it is too early for imposing Pillar 2 capital requirements, either because the focus is currently placed on raising awareness, because supervisory expectations have not been communicated yet or because quantitative evidence and/or assessment methods for risk quantification are still lacking. In Europe, some banking supervisors are awaiting the standards which are being developed by the European Banking Authority (EBA). Some supervisors have pointed out that generic provisions regarding taking into account all material risks are already in place and that these would technically also cover climate-related and environmental risks. Nevertheless, some were of the opinion that supervisors might want to consider capital add-ons only as an *ultima ratio*, i.e. after taking qualitative measures such as supervisory dialogues or requests for strengthening risk management systems. Some supervisors however have started to look closer into the credit risks of energy efficiency of mortgages (see Box 24).

Box 24

Exploratory work on energy-efficiency and credit risk

The **Central Bank of Hungary (MNB)** has launched a programme based on the hypothesis that “green” housing loans carry lower credit risks than non-energy efficient housing loans due to the higher remaining income of borrowers resulting from lower utility costs. Based on this hypothesis, the MNB will be testing a preferential capital requirement programme under Pillar 2 of the banking regulatory framework between 2020 and 2023. The capital requirement discount is set at 5% of the relevant discount base in the case of renovation as well as in the case of building or purchasing a property with a “BB” energy rating, and 7% in the case of building or purchasing a property with at least an “AA” rating. The discount base is defined as the gross exposure of green mortgages and personal loans

disbursed over the duration of the discount programme at the end of the year in question. The definition of “green property” is based on the report of 18 June 2019 of the Technical Expert Group on the EU Taxonomy and thus on the national building code definitions for “Nearly Zero-Energy Buildings” (NZEB). To minimise unintended consequences for financial stability, the discount cannot exceed 1% of the total risk exposure amount (TREA) of banks. In other words, banks can obtain a maximum reduction of 1 percentage point of the SREP capital requirement. Banks also must comply with a complementary green reporting requirement. Based on the data from the reports, MNB hopes to be able to test the initial hypothesis of lower credit risk of green housing loans. .../...

⁷⁹ This is in line with NGFS recommendations 5 and 6 on disclosure and taxonomy, NGFS, *A call for action – Climate change as a source of financial risk*, 2019.

A recently published **Bank of England paper** (Staff Working Paper No. 852, “Does energy efficiency predict mortgage performance?”) concludes that mortgages against energy-efficient properties are less frequently in payment arrears. While the energy efficiency of a property is considered a relevant predictor of mortgage payment arrears, the study points out that there is a set of factors, such as the financial literacy of lenders, which is not controlled for.

The **National Bank of Belgium** has encouraged financial institutions in its thematic article (“Climate-related risks and sustainable finance, results and conclusions from a sector survey”)(Financial Stability Report 2019) to start gathering data on energy efficiency on their real estate exposures as this could potentially be an important driver of transition risk. Buildings are an important contributor to GHG emissions, and policy measures may be directed towards improving the energy intensity of buildings, which could severely impact the valuation of buildings not meeting these standards, and hence the collateral value of mortgage loans.

Pillar 1:

In terms of setting Pillar 1 capital requirements, most supervisors have not yet required more explicit integration of climate-related and environmental risks. The reasons for this include their lack of discretion or power to determine Pillar 1 capital requirements, which is frequently vested in the legislator, and forthcoming international standards, e.g. from the Basel Committee. Furthermore, more analysis is needed in relation to what extent the current framework already captures the new risk drivers. For the European context, reference can be made to the legislative mandate⁸⁰ given to the EBA to assess whether a dedicated prudential treatment of exposures associated with environmental and/or social objectives would be justified, due in June 2025. EIOPA has already conducted an analysis, identifying the need for further granular data and noting the absence of evidence for risk differentials.⁸¹ Some supervisors are planning or are in the process of developing eligibility criteria for distinguishing between assets with high and assets with low climate-related and environmental risks with reference to international taxonomies and best practices.

Challenges:

The main challenges to fully integrating climate-related and environmental risks into capital requirements identified by supervisors are highly interconnected issues: lack of data and methodologies for quantifying risks and calibrating prudential requirements, lack of a risk-oriented taxonomy or common definition of “green” and “brown” assets and, as a result, lack of evidence of a risk differential between “green”, “non-green” and “brown” assets.⁸² The insignificance of risks stemming from climate change and the energy transition in the available historical data, as well as the reliance on backward-looking models pose significant analytical challenges. Furthermore, the divergence between the materialisation of climate-related risks and the time horizons of institutions’ risk management or the prudential framework can play a role, as the latter is calibrated on a one-year basis. This underlines the need for financial institutions to respond on a strategic level. On the other hand, most non-life insurance undertakings have the option of repricing their contracts every year, which mitigates the loss potential of future risks because higher insurance pay-outs can be balanced out by higher premiums.

80 Article 501c of the Capital Requirements Regulation II.

81 In its Opinion on sustainability within Solvency II, EIOPA stated that the current calibration of the standard parameters for the natural catastrophe risk module of the standard formula did not explicitly include climate change risks and therefore recommended a recalibration every three to five years. EIOPA is currently analysing the appropriateness of integrating climate-change considerations in the calibration of the capital requirements for the natural catastrophe underwriting risk.

82 The NGFS has surveyed banks on potential specific risk profiles of “green” and “brown” assets – see NGFS Status report on Financial Institutions’ Practices Regarding Climate related Financial Risks, 2020.

Box 25

Examples of EU and Chinese taxonomies

In December 2019, the **European Council and the Parliament** agreed on a text of the proposed “Regulation on the Establishment of a Framework to Facilitate Sustainable Investment” (generally referred to as the “Taxonomy”). The Taxonomy defines which economic activities can be classified as environmentally sustainable.

To be eligible, activities must contribute substantially to at least one of the following six environmental objectives: climate change mitigation; climate change adaptation; sustainable use and protection of water and marine resources; transition to a circular economy; pollution prevention and control; protection and restoration of biodiversity and ecosystems. In addition, qualifying activities must not cause significant harm to any of the other five environmental objectives (this may prove problematic for e.g. certain forms of low-carbon energy generation which nevertheless produce hazardous and non-recyclable waste), must comply with robust and science-based technical screening criteria which the Commission will lay down in delegated legislation, and in addition also comply with minimum social and governance safeguards.

¹ See *Taxonomy: Final report of the Technical Expert Group on Sustainable Finance*, March 2020.

Beyond straightforward “green” activities, the Taxonomy also accommodates certain transition-friendly activities which currently lack a technologically and economically feasible low-carbon alternative as well as so-called “enabling activities”.

In March 2020 the Technical Expert Group published its final report containing recommendations relating to the overarching design of the Taxonomy, as well as guidance on how companies and financial institutions can make disclosures using the taxonomy¹.

China had introduced three green taxonomies by the end of 2019, including the guidelines for green loans by the China Banking and Insurance Regulatory Commission (2012), the green bond catalogue by the PBOC (2015) and the catalogue of green industries by the National Development and Reform Commission of the People’s Republic of China (2019).

Suggestions for potential solutions to these challenges – apart from straightforward actions such as creating a taxonomy⁸³ or reducing data gaps – include increased international cooperation and integrating climate-related and environmental risks in international standards.

6.2 Options for mitigating risks by means of capital requirements

The following section describes how capital requirements could potentially be used as a tool for mitigating risks through Pillar 2 or 1.

6.2.1 Pillar 2

Principle 3 – as set out in the Basel Committee’s standard on the Pillar 2 supervisory review process – provides that supervisors should expect institutions to operate above the minimum regulatory capital ratios and should have the ability to require institutions to hold capital in excess of the minimum for additional risks not already covered under Pillar 1.⁸⁴

One reason for institutions to hold a buffer beyond the required Pillar 1 capital requirements is that it may be costly to raise additional capital, especially if this needs to

⁸³ NGFS, *A call for action – Climate change as a source of financial risk*, 2019, p. 34.

⁸⁴ BCBS, SRP, 20.3.

be done quickly or at a time when market conditions are unfavourable.⁸⁵ As set out in previous publications by the NGFS, the potential risks to the financial system stemming from the transition to a carbon-neutral economy are greatest in scenarios where the redirection of capital and policy measures such as the introduction of a carbon tax occur in an unexpected or otherwise disorderly way.⁸⁶ In such scenarios, assets of institutions that are directly or indirectly associated with the extraction, processing, combustion or use of fossil fuels somewhere in the value chain, or which are not sufficiently energy efficient, may suddenly and significantly decrease in value or even become so-called “stranded assets”. This may affect lending, and investment as well as trading portfolios and result in the depletion of capital. Taking into account that a disorderly scenario may abruptly affect entire jurisdictions or even occur on a global scale, market conditions for raising additional capital are likely to be unfavourable at such times. However, as climate action is evolving differently around the globe, it is difficult to foresee whether and when such a scenario might occur.

Another reason for holding capital on top of Pillar 1 requirements is that there may be risks, either specific to individual institutions, or more generally to an economy at large, that are not fully taken into account in Pillar 1 regulatory capital requirements.⁸⁷ According to the Basel Committee, there are three main areas that might be particularly suited to treatment under Pillar 2: (1) risks which are not fully captured by the Pillar 1 process; (2) those risk factors that are not at all taken into account by the Pillar 1 process (e.g. interest rate risk in the banking book, business risk and strategic risk); and (3) risk factors external to the bank (e.g. business cycle effects).⁸⁸ Indeed, climate-related and environmental risks fall into each of the three aforementioned categories. As will be shown in the following section, those risks drive prudential risk categories, but are so far not fully captured by the associated Pillar 1 capital requirements which are supposed to back

these risk categories. For example, physical climate risks can cause a lender to default, but the future impact of climate change is not yet reflected in the risk weights for credit risk. In addition, as has been set out in Section 5.2, climate-related and environmental risks can also drive business and strategic risks for institutions which are not included in Pillar 1. Lastly, such risks are traditionally viewed as external to the bank and therefore not properly reflected in Pillar 1 calibrations.

In the insurance sector, the Insurance Core Principles published by the IAIS call for supervisors to require insurers to undertake an Own Risk and Solvency Assessment (ORSA).⁸⁹ One of the outputs of an ORSA exercise is the determination of how much economic capital an insurer needs, based on its assessment of its own risks. This is a useful tool for capturing risks that are not covered in so-called Pillar 1 or standardised capital frameworks, such as climate risks. An FSI study⁹⁰ found that insurance supervisors view ORSA as an important supplement to regulatory capital requirements that are not currently calibrated to capture climate risks. One advantage of ORSA in a climate change context is that it requires insurers to consider the impact over a longer time horizon than typically allowed for in regulatory Pillar 1 capital requirements for insurers.

Supervisors may set trigger and target capital ratios or define categories above minimum ratios (e.g. “well capitalised” and “adequately capitalised”) to qualify the capitalisation level of an institution.⁹¹ Where supervisors have the discretion to do this under national law, they may find those options particularly interesting if they find that climate-related and environmental risks are not adequately embedded in minimum requirements. As has been set out in Section 5.2, the SREP covers the analysis of the business model of an institution as well as the assessment of its governance and risk management, risks to capital and risks to liquidity and funding. Most importantly, each of

85 BCBS, SRP, 20.42.

86 NGFS, *A call for action – Climate change as a source of financial risk*, 2019, p. 16.

87 BCBS, SRP, 20.42.

88 BCBS, SRP, 10.5.

89 See EIOPA's Technical advice on the integration of sustainability risks and factors in Solvency II and the Insurance Distribution Directive, 2019, p. 29, in which EIOPA advised the European Commission to specifically require undertakings to include in their ORSA the assessment of potential future changes in their risk profile, due to the effect of sustainability risks, including climate change.

90 See FSI Insights No. 20 Turning up the heat – climate risk assessment in the insurance sector

91 BCBS, SRP, 20.43. In Solvency II, the Solvency Capital Requirement defines the regulatory amount of capital which the (re)insurer is required to hold above the minimum capital requirement.

these blocks may result in such an overall SREP assessment which justifies a capital add-on for the institution. In other words, supervisors should consider climate-related and environmental risks in each block of the SREP process. This means that a Pillar 2 capital add-on may also be due to the finding that an institution has no adequate governance or risk management arrangements to control climate-related and environmental risks even if such risks cannot yet be precisely quantified.

6.2.2 Pillar 1

In contrast to Pillar 2, Pillar 1 does not leave room for supervisory discretion. Nevertheless, some members of the NGFS also contribute to setting international standards, e.g. as members of the Basel Committee on Banking Supervision (BCBS). The BCBS has recently established a high-level Task Force on Climate-related Financial Risks, which will, among other things, review the extent to which climate-related financial risks are reflected in the existing Basel framework, and identify effective supervisory practices to mitigate such risks. Furthermore, many NGFS members have an advisory role in the implementation of Pillar 1 capital requirements in their jurisdictions. Against this background, supervisors play an important role in ensuring that capital requirements adequately reflect new and potentially material risk drivers such as climate-related and environmental risks.

Pillar 1 requirements are calibrated as such that they reflect the risks associated with a certain portfolio. This risk-based approach is essential to ensuring the safety and soundness of individual financial institutions as well as the financial system as a whole.

Current Pillar 1 requirements⁹² contain various mechanisms to reflect climate-related and environmental risks. For example, in the “Internal Ratings Based Approach” (primarily used by large banks) used to measure credit risk, the risk weight for each exposure is determined by the bank itself in accordance with procedures approved by the supervisor. Quantitative models based on historical data are combined with qualitative approaches that add a forward-looking

perspective (e.g. the financial sustainability of the business model of a borrower). In the “Standardised Approach” (primarily used by small and medium-sized banks), corporate exposures are given a risk weight according to an external rating where available or a standard risk-weight of 100%. The Standardised Approach is deliberately kept relatively simple.

Likewise, the IAIS Insurance Capital Standard provides for the calculation of regulatory capital requirements via a pre-defined standard method or via internal models which are supposed to reflect more accurately the individual risk profiles of insurers that apply such models.⁹³

This structure of Pillar 1 to a certain extent ensures that climate-related and environmental risks and opportunities are reflected in Pillar 1 capital requirements as soon as they are fully reflected in external ratings and banks’ internal models respectively. For each individual exposure, this could lead to higher, lower or unchanged capital requirements depending on how it is affected by climate-related and environmental risks.

However, we must be mindful of the limitations inherent in Pillar 1: capital requirements under Pillar 1 are generally calculated for a one-year horizon.⁹⁴ As climate-related and environmental risks, in particular physical risks, are expected to make their full impact in the medium to long term, Pillar 1 requirements, as currently designed, by definition do not capture the full loss potential stemming from such risks. While this is true for all longer-term risks, supervisors should assess the need of supplementing minimum regulatory capital in Pillar 1 by additional Pillar 2 measures to adequately address climate-related and environmental risks. This also underlines the need for a strategic response from regulated financial institutions to mitigate the risk.

Indeed, most participants in EIOPA’s survey argued that the longer-term climate trend was not relevant to the one-year time horizon of the natural catastrophe risk module.⁹⁵ In addition to the limited time horizon, potential overreliance on historical data⁹⁶ could hinder the accurate reflection of

92 As proposed by the Basel Committee on Banking Supervision (national implementation might differ in some respects).

93 See IAIS, Risk-based Global Insurance Capital Standard, Version 2.0, par.7 and 9.2.

94 See for example, BCBS, *Finalising post-crisis reforms*, 2017, p. 92 (par. 215) or Art. 101(3) of Directive 2009/138/EC.

95 EIOPA, *Opinion on sustainability within Solvency II*, 2019, p. 46, 47.

96 See for example, BCBS, *Finalising post-crisis reforms*, 2017, p. 92 (par. 217),

future climate-related and environmental risks in Pillar 1 capital requirements. For example, EIOPA notes that the capital requirement for natural catastrophe insurance risks is based on catastrophe models calibrated using historical data.⁹⁷

To improve the coverage of climate-related and environmental risks in Pillar 1, their integration into internal models and external ratings is key. In particular, methods

adding a forward-looking perspective to backward-looking analyses based on historical data are indispensable. In addition, an alternative to extending the time horizon underlying the calibration of regulatory capital requirements to more than one year could be reviewing the calibration more frequently in order to ensure that the increasing importance of physical and transition risks is well reflected. However, this approach could result in greater uncertainty and volatility in the setting of capital requirements.

Box 26

Adjustment factors for “green” or “brown” assets: a prudential perspective

One proposal that has been debated is the introduction of adjustment factors in Pillar 1 capital requirements depending on the “greenness” or “brownness” of an asset. The assumption behind this proposal is that there might be a risk differential between “green” and “brown” assets that could be expressed in capital requirements by decreasing those for “green” assets and/or increasing those for “brown” assets. However, from a prudential perspective such an approach seems problematic.

In general, targeting “brown” assets would seem to have a better theoretical foundation than targeting “green” ones because, on average, transition risks might affect “brown” assets more severely. However, it is important to note that transition risk is a function of many variables. For example, a “brown” company that is sufficiently capitalised, has a strong management and a credible long-term strategy might manage the transition well. At the same time, “green” companies can face transition risks, too, e.g. because their

business model might be based on new technologies that have yet to be proven at scale.

Clearly, more evidence-based analysis is needed to determine whether distinct risk profiles of certain groups of assets exist and what drives them (see the NGFS Status report on Financial Institutions’ Practices Regarding Climate related Financial Risks, 2020).

Irrespective of these open analytical questions, the potential role for adjustment factors seems very limited from a prudential perspective. Given that different risk profiles of individual assets should ultimately be fully reflected through the established mechanisms of Pillar 1 (e.g. internal models and external ratings), adjustment factors could lead to double-counting of climate-related risks and opportunities, thereby distorting capital requirements.

97 EIOPA, *Opinion on sustainability within Solvency II*, 2019, p. 16, 47.

7. Looking forward

The numerous examples and references in this guide reflect the current state of play and clearly demonstrate that supervisors are stepping up their efforts to address climate-related and environmental risks. In order to continue deepening and accelerating our efforts to integrate these risks into supervisory practices, a collective mobilisation of the resources of supervisors, as well as the support of regulators and standard setters, is needed. **Capacity building and knowledge sharing within the NGFS membership** will contribute to some of the necessary efforts.

Going forward, based on the findings in this guide and the experiences to date, the NGFS is planning to work on the following issues:

- **The NGFS will continue to leverage and update the best practices identified** within its membership to help central banks and supervisors, as well as the relevant stakeholders, to better assess and mitigate climate-related and environmental risks.
- A persistent challenge for supervisors **is the need for more and better-quality climate-related and environmental data and methodologies** for improving the assessment, quantification and mitigation of climate-related and environmental risks. **Therefore, the NGFS will look further into the necessary metrics to enable supervisors to improve climate-related and environmental risks assessments.**

- The NGFS will also **further investigate the transmission channels through which environmental risks materialise as a source of financial risk.** Those risks materialise along specific transmission channels, which differ from those relevant to climate-related risks.

Other areas for future work, which do not fall directly within the remit of central banks and supervisors, are disclosure and taxonomy. While progress is being made, **the NGFS reiterates the recommendations made in its Comprehensive Report 2019 on achieving robust and internationally consistent climate-related and environmental disclosure and support the development of a taxonomy** in which economic activities (i) contribute to the transition to a green and low-carbon economy and (ii) are more exposed to climate-related and environmental risks (both physical and transitional).

Finally, the recommendations of the NGFS are non-binding but aim to contribute to the development of an **international approach that is as harmonised as possible.** International standard setting bodies can further strengthen globally coordinated action, by reviewing and clarifying the extent to which climate-related and environmental risks are incorporated in the existing international regulatory frameworks and make changes where needed to effectively mitigate the risk. The BCBS and the IAIS are already undertaking work in this area⁹⁸ and the NGFS stands ready to support this work where needed.

⁹⁸ IAIS - Media release TCFD Recommendations, 2020 and 2020-2021 Public Roadmap; BCBS, press release: Basel Committee publishes stocktake report on climate-related financial risk initiatives, 30 April 2020.

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List of acronyms

ACPR	The Autorité de contrôle prudentiel et de résolution is the supervisory authority for banks and insurance companies in France.
BaFin	The Bundesanstalt für Finanzdienstleistungsaufsicht is the financial regulatory authority for Germany.
BCBS	The Basel Committee on Banking Supervision (BCBS) is the primary global standard setter for the prudential regulation of banks.
BdF	The Banque de France is the central bank of France.
BoE	The Bank of England is the central bank of the United Kingdom.
CEO	Chief Executive Officer.
COP	The Conference of Parties is the supreme decision-making body of the United Nations Framework Convention on Climate Change.
DFSA	The Dubai Financial Services Authority is the independent regulator of financial services conducted in or from the Dubai International Financial Centre (DIFC), In Dubai, United Arab Emirate.
DNB	De Nederlandsche Bank is the central bank of the Netherlands and prudential supervisory authority.
EBA	The European Banking Authority is an independent European Union Authority which works to ensure effective and consistent prudential regulation and supervision across the European banking sector.
ECB	The European Central Bank.
EIOPA	The European supervisory authority for occupational pensions and insurance is an independent European Union Authority in charge of the supervision of insurance and occupational pensions.
ESG	Environmental, social and governance criteria are used by responsible investors and can be financially material.
EU	The European Union.
FSI	The Financial Stability Institute was jointly created by the Bank for International Settlements and the Basel Committee on Banking Supervision. Its mandate is to assist supervisors around the world in improving and strengthening their financial systems.
GDP	The Gross Domestic Product is the total value of goods and services produced by a country in a year.
GHG	According to IPCC ⁹⁹ the Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself and by clouds.
GICS	The Global Industry Classification Standard is an industry taxonomy developed by MSCI and Standard & Poor's for use by the global financial community.
HKMA	The Hong Kong Monetary Authority is Hong Kong's central banking institution.
IAIS	The International Association of Insurance Supervisors is the international standard-setting body responsible for developing and assisting in the implementation of principles, standards and other supporting material for the supervision of the insurance sector.
ICAAP	The Internal Capital Adequacy Assessment Process is a set of activities and processes that must be undertaken by regulated financial institutions in compliance with the Basel II regulatory framework.
ICPS	The Insurance Core Principles developed by the International Association of Insurance Supervisors provide a globally accepted framework of principles, standards, and guidance for the regulation and supervision of the insurance sector.

99 IPCC, Special Report: Global Warming of 1.5°C, Glossary, 2018.

IEA	The International Energy Agency is an autonomous agency, whose primary mandate is to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its member countries and beyond.
IRENA	The International Renewable Energy Agency is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy.
ISIC	The International Standard Industrial Classification of All Economic Activities is a United Nations industry classification system. Wide use has been made of ISIC in classifying data according to kind of economic activity in the fields of employment and health data. It is maintained by the United Nations Statistics Division.
MAS	The Monetary Authority of Singapore is Singapore's central bank and integrated financial regulator.
MNB	The Magyar Nemzeti Bank is the central bank of Hungary.
NACE	The Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE (for the French term "Nomenclature Statistique des Activités Economiques dans la Communauté européenne"), is the industry standard classification system used in the European Union.
NGFS	Network of Central Banks and Supervisors for Greening the Financial System.
NGFS Comprehensive Report 2019	NGFS first Comprehensive Report, <i>A call for action – Climate change as a source of financial risk, 2019</i>
NGFS Survey	A survey that was done among 34 NGFS members with a supervisory mandate conducted in July 2019 to collect information on members' initiatives and practices regarding climate-related and environmental risks.
NNB	The National Bank of Belgium is the central bank of Belgium.
OECD	Organisation for Economic Co-operation and Development.
ORSA	Under Solvency II the Own Risks and Solvency Assessment is an internal process undertaken by an insurer or insurance group to assess the adequacy of its risk management, and current and prospective solvency positions under normal and severe stress scenarios.
PBOC	The People's Bank of China is the central bank of the People's Republic of China.
PRA	The Bank of England prudentially regulates and supervises financial services firms through the Prudential Regulation Authority.
RBNZ	The Reserve Bank of New Zealand is the central bank of New Zealand.
SIF	The Sustainable Insurance Forum is a network of leading insurance supervisors and regulators seeking to strengthen their understanding of and responses to sustainability issues for the business of insurance. It is a global platform for knowledge sharing, research and collective action.
SREP	Supervisors regularly assess and measure the risks for each bank. This core activity is called the Supervisory Review and Evaluation Process. It summarises all the supervisor's findings of a given year and gives the bank "homework".
TCFD	The Task Force on Climate-related Financial Disclosures is a private-sector led task force, chaired by Michael R. Bloomberg with support from the Financial Stability Board, which provides a global standardised framework on climate disclosures.
UNEP FI	The United Nations Environment Programme – Finance Initiative (UNEP FI) is a partnership between UNEP and the global financial sector created in the wake of the 1992 Earth Summit with a mission to promote sustainable finance.

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