Institute of Risk Management

Climate Change Risk Management Guidance

IRM Climate Change Special Interest Group Report

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Foreward

Neil Cantle MA FIA MIoD CERA
Principal, Milliman

The effects of climate change are complex and uncertain. There are risks and for some there are opportunities. Having the ability to identify and manage these is crucial. For many years, pioneers in the climate change domain faced the challenge of having to invent the methods and tools they needed to identify and manage the risks associated with climate change.

With scarce data and limited modelling capabilities, they struggled to make headway. But they persevered, and slowly but surely, glimmers of good practice are emerging.

As public sentiment has swung behind the need to do more, regulators, such as the Bank of England, have also taken measures to encourage firms to step up, requiring them to embed climate change considerations into their risk and governance frameworks. For risk professionals the topic can feel rather daunting, as climate change touches the whole organisation and interacts with many existing initiatives and activities, such as Environmental, Social and Governance goals or sustainability targets. Over recent years, a number of industry and academic bodies have emerged with the aim of building on the early work done, to help risk managers and their firms adapt their organisations as the economy transitions to net-zero carbon emissions.

To contribute to that effort, the Institute of Risk Management's Climate Change Special Interest Group came together with a desire to identify and share best practices, to specifically help risk professionals navigate the complexities of climate change impacts on their organisation. This practitioners' guide is a first step in compiling a set of practices that risk professionals can use to identify, assess, manage, monitor and communicate the effects of climate change on their organisation.

Milliman is therefore pleased to support the production of this guide and would like to thank Martin Massey as Chair of the Special Interest Group and the members of the Group's working party for their efforts in researching and contributing the content provided in this first report. In combination with a second report, to be issued subsequently, this guide should be an essential resource for risk management professionals looking to engage with climate change related risk.

Stephen Sidebottom,
Chair, Institute of Risk Management (IRM)

This is the first time the IRM has published a guidance report focused solely on climate change for risk managers. This marks an important formal recognition of the importance of Environmental, Social and Governance (ESG) issues to global business and the pivotal role that risk managers will have in helping to address the climate crisis.

Effective action for risk managers means understanding the implications of climate science for your business and acting to create a new status quo where acting, instead of waiting to see what happens, is the default position. This means getting to a place where sustainable forward-looking climate change risk mitigation measures are built into business plans now.

I'd like to formally thank the IRM's Climate Change Special Interest Group: Chair, Martin Massey MIRM, Bogdan Pletea IRMCert, Darren Munday CFIRM, Iain Felstead, and Neil Cantle from Milliman (sponsors) for their contributions to this vital piece of work. I also look forward to the ongoing series of activity around this important topic in the lead up to COP26 and beyond, and the second report being published in 2022.

Introduction

The effects of our changing climate pose one of the biggest areas of uncertainty that we face, whether as individuals, organisations or societies. With this in mind, the Institute of Risk Management (IRM) Climate Change Special Interest Group (SIG) was formed in late 2019 with the main objectives of producing thought leadership, organising events and building engagement with the broader IRM membership, SIG members and other stakeholders.

One of the group's first projects was to develop this practitioner's guide to help risk managers and boards integrate climate change risk management into an organisation's existing Enterprise Risk Management (ERM) framework. The SIG established a working group to review existing best practices from leading practitioners, latest research and literature and incorporate personal experiences on the subject, all of which have been compiled into this guide. This includes identifying and reporting climate change risks to boards and supporting strategic decision making. This is both a major challenge and a big opportunity for risk managers. The integration of emerging risk information and analysis will provide several benefits, including an improved risk appetite framework and risk mitigation strategies across most areas of an organisation's risk profile. The focus has also been to support risk managers and SIG members across all sectors, not just financial services.

Climate change is such a large, complex and continually evolving subject. We cannot possibly hope to cover everything in a single practitioner's guide. We have therefore assumed that organisations already have a robust ERM framework in place. The focus of this guide will be to provide background information, practical tools and pragmatic approaches that are enduring and will help risk leaders embed climate change risk management into their organisations. We intend to consider further work that will either signpost current best practice/thought leadership or develop 'value add' tools that will help risk leaders align their approach to the specific context in which they operate.

To develop this document, the Climate Change SIG established a subgroup to examine and investigate the existing literature and contribute their personal experiences of the subject to create the main body of this text.

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A framework for considering climate change risks

We have identified seven key areas that require attention to enable the development and execution of a climate change risk management strategy in any organisation. Each area of focus has been used as a key section within this guide. We start by identifying the key risks and opportunities being driven or otherwise associated with climate change risk landscape covering physical, transition and liability risks which can be found in Section 1 and includes the development of a risk taxonomy and a 'risk radar' shown in Figure 9.

Figure 1: IRM climate change risk framework

We then look at a toolbox of techniques and approaches that help us analyse and understand your own organisation's exposure and response. These areas of focus are not necessarily linear as different aspects will be more or less important for different types of organisations at different times. This IRM report will cover four sections (Part A), with three more sections (Part B) covered in a separate report.

Part A

1. Climate change risk landscape (Section 1)
2. Stakeholder insights and research (Section 2)
3. Materiality assessments (Section 3)
4. Strategic positioning (Section 4)

Part B

5. Governance (Section 5)
6. Mitigation and resilience planning (Section 6)
7. Risk appetite considerations (Section 7)

Section 1: The climate change risk landscape

Climate change is unlike any other environmental problem, any other public policy problem and is characterised by a combination of four unique issues:

- **Its global nature**
- **Its long-term nature**
- **The fact that it is potentially irreversible**
- **The almost overwhelming uncertainty surrounding its progression and effects**

Climate change is a global trend as temperature and sea levels rise and contribute to amplifying certain global risks such as extreme weather events and altering the relationship between them. The leading cause of climate change has been the increase in the concentration of atmospheric Green House Gas (GHG) emissions including carbon dioxide which has led to a range of major impacts including an increase in storms and floods, heatwaves and droughts, as well as impacts on human health, biodiversity, ocean acidification and food supply.

The Covid-19 pandemic provides us with an indication of what a fully-fledged climate crisis could entail. Both can be considered "Grey Swans". Experts have been warning about these threats for years and both indicate that the world at large is generally ill-prepared to deal with either. What has been encouraging is how scientists and health professionals have been collaborating and reinventing how they work. Integration of scientific knowledge into risk management is also crucial to building resilience to climate risk.

The impact of climate change poses a financial stability risk to the global financial system and various national, international and industry bodies, driven by the Financial Stability Board representing the G20 countries, are working together to achieve long-term regulatory alignment. Although it is easy to feel overwhelmed by the complexity of the problem there is a range of solutions developing which include the need to replace fossil fuels with cleaner, renewable energy like wind and solar power.

During the pandemic, there has been discussion of a 'tilt to green' in future investments[1]. It is argued that organisations that are "front-runners"- that adjust to future structural changes and put sustainability at the heart of their strategies more rapidly - may be able to reap the potential benefits that it will bring. These will include; enhanced brand image, employee engagement, innovation, new sources of revenue, enhanced relationships with stakeholders and operational resilience.

Climate change and ESG

Environmental, Social and Governance (known as ESG factors) are rapidly becoming the single most important business driver of the decade. Although this guide will be focusing on climate change it is important to understand the relationship and relevance to the wider ESG issues that are set to become increasingly prominent features of financial regulation and supervision globally.

It is important to recognise that Climate Change accounts for only 1 of the 10 ESG key issues as set out by the MSCI ratings per Figure 2. These rating factors have been designed to measure a company's resilience to long-term, industry material ESG risks.

[1] Enterprise-Risk-Summer-2020-Web.pdf – Feature "Tilt to Green"

3 Pillars	10 Themes	37 ESG Key Issues	
Environment	Climate Change	Carbon Emissions Product Carbon Footprint	Financing Environmental Impact Climate Change Vulnerability
	Natural Resources	Water Stress Biodiversity & Land Use	Raw Material Sourcing
	Pollution & Waste	Toxic Emissions & Waste Packaging Material & Waste	Electronic Waste
	Environmental Opportunities	Opportunities in Clean Tech Opportunities in Green Building	Opp's in Renewable Energy
Social	Human Capital	Labor Management Health & Safety	Human Capital Development Supply Chain Labor Standards
	Product Liability	Product Safety & Quality Chemical Safety Financial Product Safety	Privacy & Data Security Responsible Investment Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing	
	Social Opportunities	Access to Communications Access to Finance	Access to Health Care Opp's in Nutrition & Health
Governance	Corporate Governance*	Board* Pay*	Ownership* Accounting*
	Corporate Behavior	Business Ethics Anti-Competitive Practices Tax Transparency	Corruption & Instability Financial System Instability

Figure 2: MSCI 37 ESG key issues
(Source: MSCI website: Morgan Stanley Capital International)

Organisations also need to identify the wider ESG risks and opportunities and in doing so seek to address the following questions that are often used as a basis to develop an organisation's ESG profile (we discuss this in more detail within Section 4).

- **What are the most significant ESG risks and opportunities facing your company and its industry?**
- **How exposed is your company to those key risks and opportunities?**
- **How well is your company managing key risks and opportunities?**
- **What is your company's overall strategy, and how does it compare to its global industry peers?**

Many years ago, legendary investor Warren Buffett wrote the following, which is still valid today, about how organisations need to consider a range of business drivers and stakeholders to improve performance. "Today our world is changing faster than ever before: economic, geopolitical, and environmental challenges abound. However, taking shortcuts is not the pathway to achieving sustainable competitive advantage, nor is it an avenue toward satisfying customers. In times such as these, a company must invest in the key ingredients of profitability, people, communities, and environment."[2]

The main impacts of climate change

The main effects of climate change include an increase in storms, floods, wildfires, heatwaves and droughts, as well as impacts on human health, biodiversity, ocean acidification and food supply. The most important and notable impacts have been the increase in storms and floods which in the last decade have been responsible for 75 % of all global insured catastrophe losses (with wildfires also becoming an increasing concern), see Figure 3.

[2] "Johns Manville 2011 Sustainability Report" JM.com. Johns Manville, 03/2012. Web.

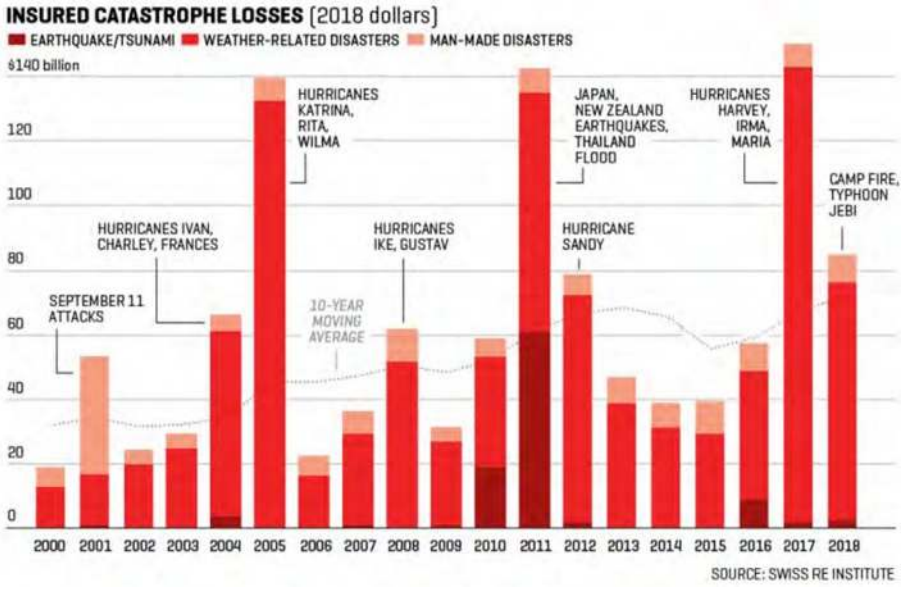

Figure 3: Increasing trends in catastrophic weather-related disasters

Hurricane Katrina in 2005 cost the US economy $105 billion and it taught us that disaster risk reduction and crisis management plans must be people-centred and engage all sectors of society. A progression of these climate change effects is the impact on corporations. In 2020 Pacific Gas & Electric, a US energy company, has been heralded as the first 'climate change bankruptcy' when they filed for bankruptcy in the face of liabilities from wildfires of $30 billion.

Research by the Intergovernmental Panel on Climate Change (IPCC)

An important source of information on impacts from climate change is the IPCC. Their recent publication titled "Special Report 2018: Global Warming of 1.5 °C - Summary for Policymakers" highlighted the climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth that are projected to increase with global warming.

The IPCC states that climate models project robust differences in regional climate characteristics between present-day and global warming of 1.5°C and between 1.5°C and 2°C. These differences include increases in mean temperature in most land and ocean regions (high confidence); hot extremes in most inhabited regions (high confidence); heavy precipitation in several regions (medium confidence); and the probability of drought and precipitation deficits in some regions (medium confidence).

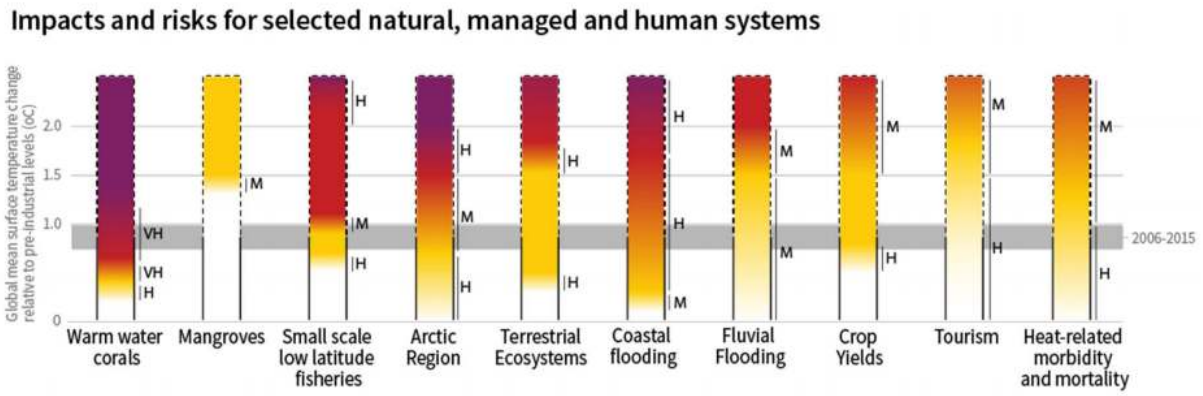

Figure 4: Intergovernmental research - climate-related impacts

Key Figure 4:

Purple indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks

Red indicates severe and widespread impacts/risks.

Yellow indicates that impacts/risks are detectable and attributable to climate change with at least medium confidence.

White indicates that no impacts are detectable and attributable to climate change

Key drivers and expectations

In recent years, the World Economic Forum's top risks have been dominated by environmental risks. In their survey for the 2020 report, climate change counted for three of the top five global risks:

- **Extreme weather event**
- **Failure of climate-change mitigation and adaptation**
- **Biodiversity loss and ecosystem collapse**

Organisations must address a growing number of critical drivers of change and expectations, including new international and national legislation and regulation and the voluntary disclosure approach led by the Task Force for Climate-Related Disclosures (TCFD). Other major drivers include increasing public concerns and pressure from lobby groups, activists, regulators and investors.

The main change driver is the Paris Agreement from 2018, see Figure 5, an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) with long-term goals to keep the increase in global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the rise to 1.5 °C. This translates to cutting emissions significantly year-on-year to reach net-zero CO2 emissions by 2050. The key question is how societies worldwide put in place the steps outlined under the agreed global action plan.

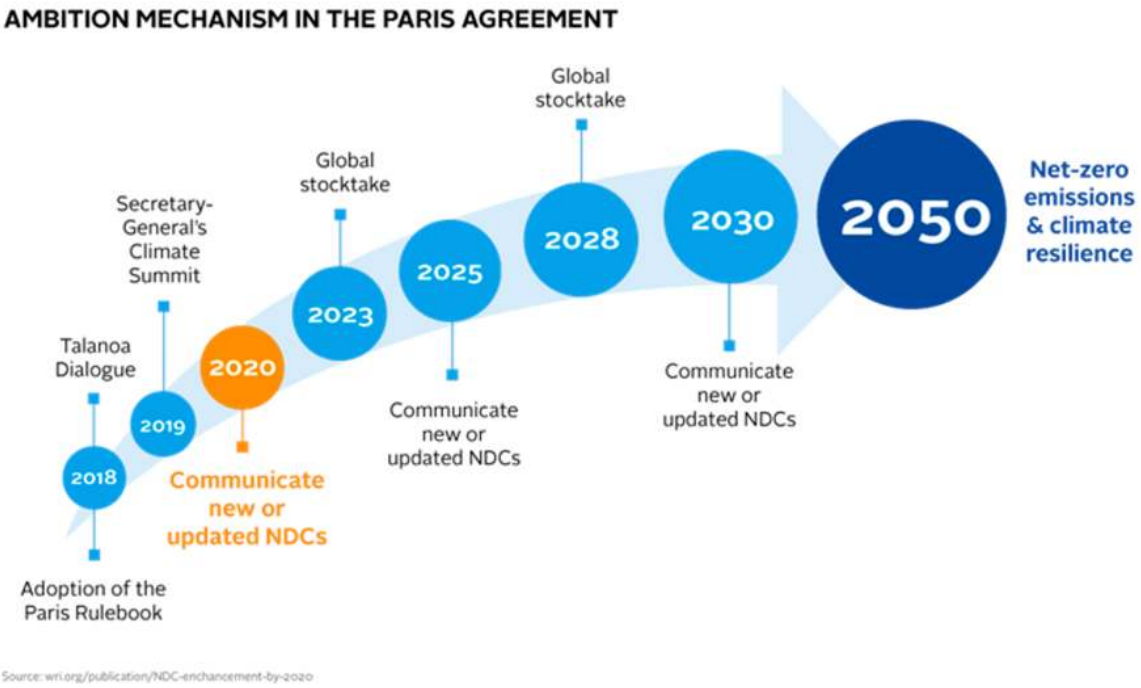

Figure 5: The Paris agreement and emissions targets

The agreement sets out energy pathways consistent with nationally determined contributions (NDCs) from signatory countries that need to report on their efforts and progress to the international community. Every five years the international community will take stock of collective progress towards the Paris Agreement's long-term goals ('ambition mechanism'). We will explore stakeholder expectations in more detail in Section 2.

Climate change and society's responses

These drivers and expectations have led to a step-change in momentum and action by governments and organisations worldwide. There is a recognition and realisation that climate change is not just a matter of the future - understanding it is fundamental to understanding the past and understanding risks faced now. For example, Microsoft hit the headlines recently with its pledge to become "carbon negative" by 2030 and to remove all carbon emitted since the company was founded in 1975 by 2050.

They have set up a new $1 billion Climate Innovation Fund to stimulate and accelerate the development of carbon removal technology. Concerning the energy sector, BP's boss Bernard Looney has pledged to achieve net-zero emissions by 2050. In his words, "the world's carbon budget is finite and running out fast"[3]. To meet the targets, energy companies need to reduce existing production over time, develop technologies to capture carbon and invest more heavily in renewables such as wind farms and solar power. A sample of government and organisational responses and targets and set out in Figure 6 below.

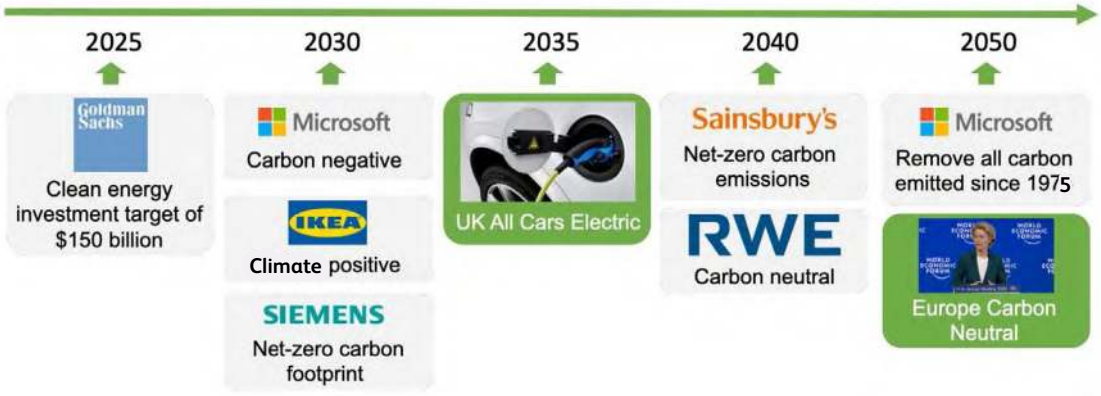

Figure 6: Government and organisational responses – Examples to meet Net-Zero emissions goals – (Source IRM Climate Change SIG).

The role of risk management

Risk managers, through collaboration with a range of stakeholders, will need to play an increasing role in supporting organisations in identifying, assessing and managing their climate-related risks and opportunities and integrating them within existing ERM frameworks. This integration of emerging risk information and analysis will provide several benefits including an improved risk appetite framework and risk mitigation strategies across most areas of an organisation's risk profile.

> At the inaugural meeting of the IRM Climate Change SIG there was a panel discussion of how risk managers are currently addressing climate changes. Giorgis Hadzilacos from the UK Prudential Regulatory Authority stated that: "When it comes to climate risk assessment, time is of the essence. It is better to get it approximately right now rather than perfectly right later. As an industry it is not the first time we have dealt with a complex problem – asbestos, Cyber, GDPR are some examples from the recent past. Take a complex problem and break it down and communicate it to your stakeholders - it can gain traction and become more manageable."

[3] BP Website Press release setting ambition for net zero by 2050 February 2020

Developing a climate change risk taxonomy

Whilst it is also important to treat climate-related risks as drivers of existing risks and map climate-related risks to their existing risk categories, it is also important to develop a taxonomy that can be discussed externally and used internally within organisations to ensure that all risks and opportunities are addressed and that there is a consistent approach and understanding.

A new climate risk taxonomy developed initially by the Financial Stability Board and adopted by many regulators such as the Australian Prudential Regulatory Authority (APRA), see Figure 7 below, is now being widely adopted to provide a clear delineation of the financial risks associated with climate change namely, Physical, Transition and Liability risks.

Figure 7: Climate change risk taxonomy (Source APRA[4])

Physical risks include direct damage to assets and indirect impacts of supply chain disruption. Physical risks can be event-driven (acute) or longer-term shifts (chronic). For example, the intensity and frequency of wildfires, often driven by drought, are becoming an increasing concern particularly for Australia, southern Europe and parts of the US including California. Other noted examples relate to property portfolios for banks and insurers that will become increasingly susceptible to climate risk from acute or chronic perils: flooding; storms; mudslides; water level rise.

Transition risks relate to financial risks that arise as a consequence of transitioning to a lower-carbon or "green" economy. These risks arise from two related transformations in regulatory policy such as carbon taxes; and technology and market disruption that will include innovation in renewable energy. Transition risks are developing as governments support and subsidise low-carbon industries and regulate and tax high-carbon ones. They are also developing as the public attitudes and preferences change.

Liability risks stem from the potential for litigation if entities and boards do not adequately consider or respond to the impacts of climate change. This may include the potential breaching of directors' duties. In February 2020, the government's decision to allow plans for a third runway at Heathrow Airport was ruled unlawful by the UK Court of Appeal because as it did not take climate commitments into account. This was the first judgment in the world to be based on the Paris Agreement and will have an impact both in the UK and globally by inspiring challenges against other high-carbon projects.

Specific legal challenges could arise from:

- **Failure to mitigate GHG emissions**
- **Failure to adapt to the physical impacts of climate change**
- **Failure to adapt investment strategies**

[4] Australian Prudential Risk Authority (APRA) - climate_change_awareness_to_action_march_2019.pdf

- **Failure to disclose climate-related risks**
- **Failure to comply with environmental regulatory obligations**
- **Failure to take climate commitments into account.**

Climate change risk frameworks

There are many sources of climate-related risk frameworks, with one of the most comprehensive ones being developed by the TCFD. The Task Force encourages organisations to undertake both historical and forward-looking analyses when considering the potential financial impacts of climate change, with a greater focus on forward-looking analyses as the efforts to mitigate and adapt to climate change are without historical precedent[5]. Their assessment framework is set out in Figure 8 below and we will cover scenario analysis in more detail in Section 3.

Figure 8: TCFD guidance

> "In order to bring climate risks and resilience into the heart of financial decision-making, climate disclosure (reporting) must become comprehensive; climate risk management must be transformed, and sustainable investing (returns) must go mainstream."
>
> Mark Carney UN Special Envoy on Climate Action & Finance and UK Prime Minister's Finance Adviser for COP26

Developing an organisational climate change risk radar

Developing a 'risk radar' is one of the key tools of risk management and a fundamental principle of resilience. The ability to anticipate problems and see things differently will help an organisation develop an early warning system and seize new opportunities. The risk radar is a key diagnostic tool used to help identify an organisation's key risks[6].

It can be traced back to the insurance industry that developed the Risk Universe concept – the list of risks the organisation faces or might face and the analogy of an "iceberg" is often used, where most risks are hidden below the surface. The original objective was to help assess and understand what risks from an organisation's risk profile can be insured and which are uninsurable.

[5] Recommendations of the Task Force on Climate-related Financial Disclosures – June 2017.
[6] AIRMIC – Roads to Resilience 2013.

The concept also led to the development of metrics to measure the total cost of insurable risk. The risk radar is a key tool in ERM to support the design of a corporate risk register to manage an organisation's top risks.

The Climate Change SIG Committee reviewed the physical, transition and liability risks and opportunities associated with climate change and adapted it with a traditional risk management risk radar. We feel that this schematic should enable risk managers to better articulate and inform senior management about the risks of climate change that pervades many organisations' entire risk profile and risk categories.

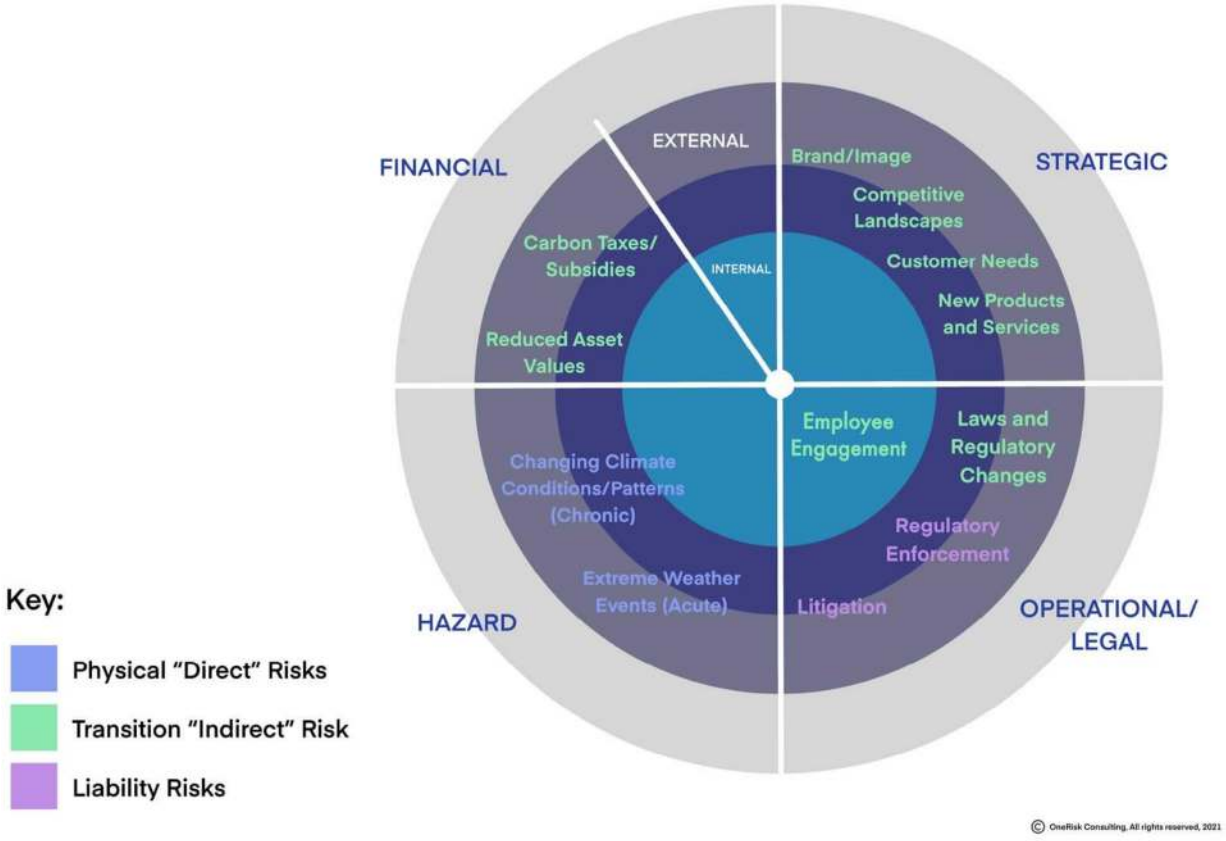

Figure 9: Climate Change Risk Radar Conceptual Framework

Conclusion

Based on the context and understanding of the business environment, managers need to translate external trends and drivers into identified risks and assess the impact and severity to the organisation. Accuraterisk identification is critically important as it underpins the risk management process and determines those risks to which management will seek to allocate resources for mitigation.

An organisation will need to align climate risks and opportunities to its risk categories that cover the risk profile of the organisation. The above highlights the risks and opportunities aligned to the three main climate risk types and split between strategic, financial, operational/legal and hazard.

Section 2: Stakeholder insights and research

It is also important to separately identify and manage emerging climate risks and trends such as government legislation and technology shifts that can be better managed through an enterprise risk management framework based on future time horizons. We will cover this in greater detail in Section 3 when we discuss the development of climate scenarios.

By identifying and proactively addressing risks and opportunities, all enterprises protect and create value for their stakeholders, including owners, employees, customers, regulators, and society overall. The rationale is that one of the greatest dangers to any organisation is not recognising a threat until it is too late. It is no longer acceptable that an organisation finds itself in a position whereby unexpected events that could have been anticipated cause financial loss, disruption to normal operations, damage to reputation, loss of market presence or cause loss of human life.

There is an expectation from key stakeholders, including regulators, that risk management frameworks will need to address risks from climate change and therefore organisations will need to enhance their frameworks and risk maturity. This extends from identifying and reporting climate change risks to boards to supporting strategic decision making. This is both a major challenge and an opportunity for risk managers.

In July 2020 Sam Woods, the Deputy Governor for Prudential Regulation and Chief Executive Officer of the UK Prudential Regulation Authority, wrote to all CEOs of financial institutions. His letter stated: "Climate change represents a material financial risk to regulated firms and the financial system. Whilst the Covid-19 pandemic is a present risk and an understandable priority for firms, minimising the future risks from climate change also requires action now. We continue to work on understanding and mitigating these risks".[7]

The letter, although directed at financial services organisations, is a good reference for risk managers from all industries in providing guidance. One of the key comments under the heading "risk management" is that risk leaders should seek to consider the far-reaching breadth and magnitude that climate change represents, distinguishing between financial and non-financial risk management, corporate responsibility (particularly in respect to reputational risk), customer behaviours and legal risk.

In this section, we, therefore, guide how to develop a climate 'risk radar' for identifying both risks and opportunities through the use of stakeholder mapping.

Stakeholder insights and mapping

In developing an organisation's climate risk radar, it is important to seek out information from outside the organisation, for example by using PESTLE analysis covering Political, Economic, Sociological, Technological, Legal and Environmental issues. A PESTLE analysis describes a framework of macro-environmental factors used in the environmental scanning component of strategic management, to gain insights in respect of global trends such as climate change. One of the main benefits of doing this is to build consensus amongst a range of stakeholders about future threats and opportunities and how to tackle or profit from them.

- **Threats: What is emerging on the horizon which could adversely affect future commercial or other defined success factors?**
- **Opportunities: What trends and directions do data and information gathering reveal and indicate as areas of potential competitive advantage in the future marketplace?**

Boards need input from risk professionals on the risks from climate change and they need to be able to address and oversee these risks within the firm's overall business strategy and risk appetite. Effective integration into the risk appetite framework and supporting metrics will be of particular importance.

[7] PRA – Sam Woods Deputy CEO PRA - Letter to CEOs July 2020

In developing an organisation's risk radar different tools and techniques can be used to identify risks and opportunities. In this section of the guide, we provide a generic list of stakeholders that should be considered.

Organisations will need to identify risks and opportunities that emanate from stakeholder expectations and then align them with their strategic objectives, core operations and processes. As we have seen with the pandemic, one area of focus will be to ascertain whether the company has the right level of insurance coverage in terms of risk transfer. This will be covered in more in Part B of the guide.

Developing a stakeholder map (internal and external stakeholders)

Stakeholder analysis is often considered the first step in strategic planning activities on an organisational level. The concept of stakeholder awareness and the need for analysis is prevalent among project management principles[8].

An approach to climate change-related risk based on stakeholder expectations has many advantages. It facilitates a full and thorough validation of the core processes of the organisation (strategic, operations and compliance) concerning the environment/climate change expectations that each stakeholder places on each core process. An important aspect of managing an organisation is balancing the various stakeholder expectations. There are dangers inherent in achieving this balance, and a risk identification procedure based on analysis of stakeholder expectations is the most robust way of ensuring that these dangers are recognised, analysed and minimised.[9]

Stakeholder expectations are shifting and there is a strong customer and investor focus today on corporate purpose, fulfilling regulatory requirements and pledging to meet emissions targets. It is becoming increasingly apparent that, as well as profit, ESG ratings and performance are also going to be important drivers for stakeholders including lenders, pension funds, insurers, shareholders, regulators and consumers.

Range of stakeholders

Organisations will have a wide range of stakeholders, some of whom may indeed be unwanted as far as the organisation is concerned. ISO Guide 83 suggests that the term 'interested party' is preferred, but stakeholder is an acceptable and commonly understood alternative. ISO Guide 73 defines a stakeholder as, a 'person or group concerned with, affected by, or perceiving themselves to be affected by an organisation'. For organisations in different sectors, the range of stakeholders will be different.

For government agencies, the general public will be a major stakeholder. Specific groups within the general public will be stakeholders in different agencies, depending on the purpose of each particular agency. For organisations that have significant environmental interests or exposures, a different range of stakeholders would need to be considered. For some energy companies, environmental pressure groups are key stakeholders.

The SIG has researched the main internal and external stakeholders and the reasons why they would be interested in an organisation's approach to climate change. From this, a general climate change stakeholder map has been developed and is shown in Figure 10.

[8] Stakeholder analysis a pivotal practice of successful projects, Smith, Larry W. (Project Management Institute 2000)
[9] Fundamentals of Risk Management, Paul Hopkin

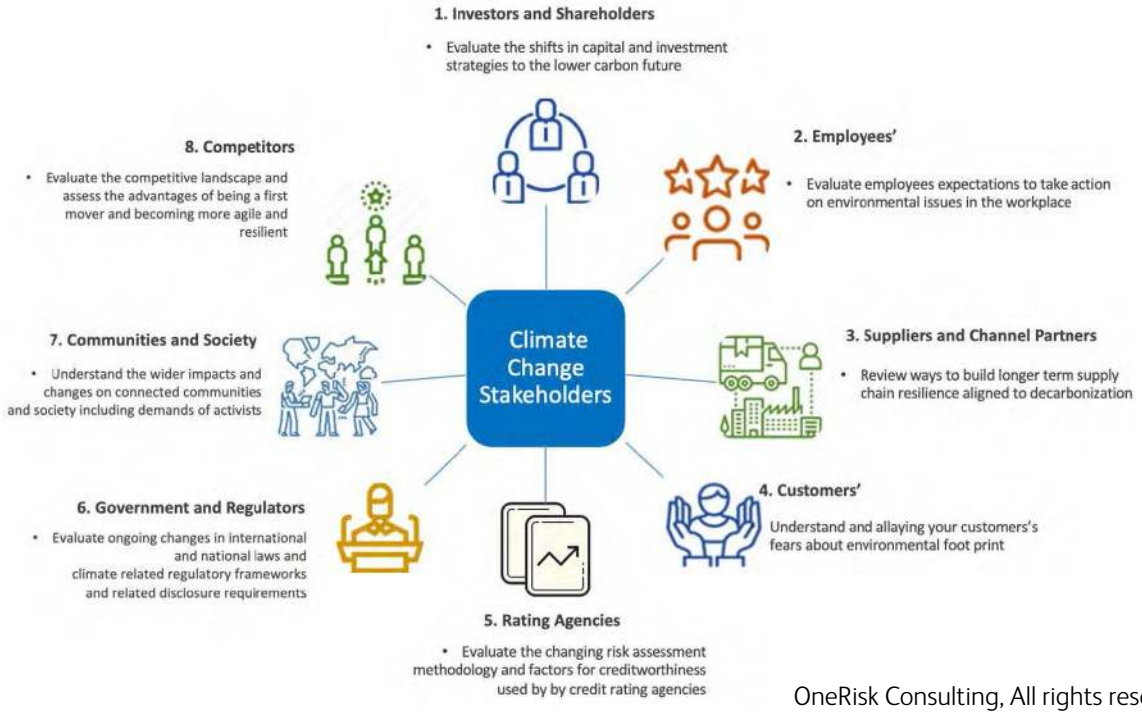

Figure 10: Climate change stakeholder map

1. Investors and shareholders

Organisations need to evaluate the impact of shifts in capital and investment strategies on the lower-carbon future. In early 2021, Larry Fink, the CEO of BlackRock, one of the world's largest asset managers, expressed a clear conviction that climate change will drive a fundamental reshaping of finance and, therefore, BlackRock's strategy.[10]

Despite the pandemic, 2020 proved to be a landmark year for investor action on climate change and investments pouring into sustainable funds. With regulators and clients increasingly calling for change, asset managers are broadening their remit beyond energy-carbon industries such as oil.

The pandemic has served to raise awareness of corporate fragilities. "Rather than drive investor attention away from climate change, the pandemic has cemented interest, with many investors fearing the economic fallout seen during the pandemic could be replicated if the world fails to halt global warming"[11].

Regulators such as Mark Carney, former head of the Bank of England, have also warned of significant investment risk from "stranded assets" - where investors have holdings that become unsellable because of climate change.

2. Employees

Addressing social issues like climate change is increasingly becoming an employee expectation, especially among the youngest members of the workforce. Gen Z has grown up amid an unending litany of social and political unrest, and place a high value on the ethics, authenticity and social impact of employers today.[12]

Employers need to evaluate the expectations of employees, particularly younger generations, concerning climate change.

It is important to acknowledge that employees may be at a point where there is a blurring of the lines between E and S or ESG.

[10] www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter
[11] Mirza Baig, global head of governance at Aviva Investors FT 2020
[12] Environmental Journal March 2020 UK employees 'speaking up' on climate change in the workplace

Organisations must consider the increased risk of not being able to attract and retain employees if, for example, they are not seen to be aligning with their values and any expectations of greening their operations, as well as being more pro-active in complying with climate change regulations. Other significant and related risks could also extend to strikes and reputational damage leading to lost business.

There have been some specific recent examples. Earlier this year thousands of cleaning workers in Minneapolis marched in what's believed to have been the first union-authorised climate strike in the United States[13]. Their demands ranged from a guarantee of more environmentally friendly cleaning products to funding for a "green technician janitorial training program," which could help them push for more substantial changes during their day-to-day operations rather than wait for top-down measures.

Overall employees are focusing more on working for organisations that align with their values as well as traditional employee concerns around pay, benefits and working conditions.

3. Suppliers and channel partners

Organisations need to review ways to build longer-term supply chain resilience aligned to decarbonisation.

In terms of risk and opportunity, businesses should be accelerating efforts to reduce the carbon intensity of their operations and that of their supply chains, to manage their climate-related investment risks, and innovate to refocus their business models for growth in a decarbonised world. Practical steps can include an evaluation of the vulnerability of suppliers that may be affected for example, by emission regulations and also an assessment of the geographical distribution of the supplier network. There is also the potential for both significant supply and demand shocks. Some supply chains are working incredibly hard to keep up whilst others, such as car manufacturers, are being forced to ramp down.

One of the main impacts will be a shrinking, or shorter, supply chain footprint as companies seek a different cost/resilience trade-off and look to localise production and sourcing. We will also see changes in outsourcing. The supply chain disruptions in the food supply are opening up other potential risks such as food fraud and safety breaches.

4. Customers

One of the key strategic challenges that climate change poses is to understand changing customer behaviours and the potential for reduced or increased demand for goods and services due to shifts in consumer preferences. However, this also creates opportunities, and many organisations are seeking to meet these demand shifts through developing greener products e.g. shift to electric cars in the motor sector.

There are related risks to disclosure and information sharing with customers on specific products where legal challenges may arise in the future. As an example, from the property loan sector, climate change will impact properties in future flood-related zones and there will be increasing potential for customers who are given long-term loans to potentially sue lenders if they suffer financial loss and information known to the lender about the property's potential flood risk exposure was withheld.

5. Rating agencies

An insurer's ERM process comes into play when rating agencies determine what rating to assign the company. Rating agency analysts consider, among other things, how insurers measure risks, how they approach emerging risks, and how they model risk as part of their ERM assessment.

Typically, they ask questions around the performance of the ERM framework and embedding of the framework within the respective organisation that include:

- **Update on developments in your risk management framework in the past 12 months**

[13] Huff Post US „Employees Are Fighting For A New Cause At Work: The Climate Impact" - Updated 20/08/2020

- **Explain your risk appetite and tolerances, the key risk controls you have in place and how these are monitored**
- **What do you consider to be the strengths and weaknesses of your organisation's risk management programme?**

Managing climate change would be seen as an important risk to manage and mitigate along with other key risks. What is different with climate change is the fact that rating agencies have already signalled that the rating of certain industries will decline because climate change will drive a move to a low-carbon economy. Companies that take a long time to adjust could experience a decline in creditworthiness. This "transition risk" is particularly high for financial institutions with large exposure to carbon-intensive sectors such as automotive, oil, and energy as they are vulnerable to climate policies and restrictions.

Yet the Moody's ratings agency's report states that transition towards a low-carbon economy may also present business opportunities for the financial sector.

The world's efforts to hit emissions targets will pose a threat to many more industries' creditworthiness, including some that do not directly emit much carbon, according to the top rating agencies. Moody's Investor Services in its recent environmental heat map states that: "Thirteen sectors with a combined $3.4 trillion in debt have very high or high environmental credit risk as they transition to a low-carbon economy gathers pace"[14].

6. Government and Regulators

The role of Governments is integral with regards to the management of climate change risk. This covers a complex and diverse range of influence but can include:

- **Improving awareness and knowledge of the impacts of climate change risk (by financing basic research and the distribution of information/education to heighten awareness)**
- **Ensuring policies are in place that encourages a transition to clean energy (thus reducing the emissions side of the equation)**
- **Establishing an appropriate regulatory framework (by establishing laws and setting standards) that is aggressively upheld**
- **Providing the regulatory framework for insurance markets (which can cushion the impact of natural disasters through insurance markets or by making disaster insurance mandatory)**
- **Developing an infrastructure that supports stakeholders which reaches across national, regional and local government but which is focused on the reduction of barriers that prevent the consideration of climate change risk management**
- **Controlling the appropriation of funds (by offering subsidies and/or incentives) but also by cutting subsidies/support to polluters and by creating an environment for investment (via the tax system)**
- **Providing public services when there are gaps in provision by the private sector**

Governments cannot be expected to manage climate change risk in isolation but they are a critical component and positively contribute by establishing robust foundations that can support and complement the initiatives undertaken by the other stakeholder groups.

Regulatory oversight

Organisations need to evaluate ongoing changes and trends in a combination of regulatory oversight (covering international and national laws) and climate-related regulatory frameworks.

[14] Moody's Environmental Heat Map December 2020

Global initiatives

Global regulatory forums have been established to support national prudential oversight bodies for climate change and the systemic risks posed. Four of the key ones are TCFD, NGFS and CFRF, each of which is explained overleaf.

Taskforce on Climate-related Disclosures (TCFD)

Recognising the risks that climate change may pose to the financial system, the Financial Stability Board (FSB) at the request of the G20 launched the industry-led Task Force on Climate-related Financial Disclosures (TCFD) to develop recommendations on climate-related financial disclosures. The TCFD has developed a framework to help public companies and other organisations more effectively disclose climate-related risks and opportunities through their existing reporting processes.[15]

The recommendations are structured around four main pillars, governance, strategy, risk management and metrics and targets. The recommendations provide clear guidance for risk managers and boards. Under the strategy, it includes the need to: "Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning where such information is material." Under risk management, it recommends that organisations need to: "Disclose how the organisation identifies, assesses, and manages climate-related risks." We will cover many of these recommendations within the following sections of the guide.

Network Greening the Financial System (NGFS)

A group of central banks and supervisors formed the NGFS to exchange experiences, share best practices, contribute to the development of environmental and climate risk management in the financial sector. They produce regular reports that guide key climate-related topics. A recent publication was on the macroeconomic and financial stability impacts of climate change and research priorities[16].

The PRA and Climate Financial Risk Forum (CFRF)

At a country level, regulators work with industry to establish best practices for climate risk management, conduct surveys and field-test for examples of national requirements. In 2019, the UK's PRA and FCA established the Climate Financial Risk Forum (CFRF). On 29 June 2020, the CFRF published their guide to climate-related financial risk management. [17]

To embed climate risk management recommendations by the TCFD in financial decision-making, the PRA has become the first regulator to publish supervisory expectations over the management of financial risks derived from climate change that includes expectations for risk management. [18]

- **Governance, where firms will be expected to embed fully the consideration of climate risks into governance frameworks, including at the Board level, and assign responsibility for oversight of these risks to specific senior role holders**
- **Risk management, where firms will need to consider climate change in line with their board-approved risk appetite**
- **The regular use of scenario analysis to test strategic resilience**
- **Developing and maintaining an appropriate disclosure of climate risks**

[15] www.fsb-tcfd.org – Final Report – June 2017
[16] www.ngfs.net/en/liste-chronologique/ngfs-publication
[17] www.fca.org.uk/transparency/climate-financial-risk-forum
[18] PRA Supervisory Statement | SS3/19, April 2019

Use of regulatory monitoring tools and AI technology

To assist in monitoring regulatory changes in a consistent way, and to anticipate future regulatory themes and trends coming over the horizon, an increasing number of organisations are starting to use tools that use artificial intelligence (AI) to harvest information from the central bank, regulators, international bodies and other authorities' websites through applying a structured taxonomy.

7. Communities and societies

Organisations need to understand the wider impacts and changes that climate change is bringing to communities and society including the demands of activists. Global public concern increases year-on-year and can be expected to increase further as the physical effects become increasingly apparent. Currently, campaigns are evolving and expanding to also address wider political issues such as inter-generational inequality e.g. Greta Thunberg and school strikes is an example from 2019.

In 2019 millions of people took to the streets uniting across time zones, cultures and generations to demand urgent action on the escalating ecological emergency. It should be expected that increased public engagement will drive action by elected representatives and governments. The Paris agreement "ratchet mechanism" will help enable this to be incorporated into global action plans pledged by individual countries and reputational risks will increase for organisations whose public positions or lack of public positions don't align with these concerns or where their business activities don't align with their public concerns.

New influential movements are forming such as Extinction Rebellion (abbreviated as XR), a global environmental movement with the stated aim of using nonviolent civil disobedience to compel government action to avoid tipping points in the climate system, biodiversity loss, and the risk of social and ecological collapse.

8. Competitors

Climate change affects almost all industries and thus their competitive landscape. Addressing climate risks is sometimes perceived by boards and senior management purely as a cost, or a trade-off with other priorities, but it is now generally recognised that companies that manage and mitigate their exposure to climate-change risks while seeking new profit opportunities will generate a competitive advantage over rivals in a carbon-constrained future. It's not enough to do something; you have to do it better – and more quickly than your competitors[19].

Therefore, it is critical to evaluate the competitive landscape that can influence the organisation's risk profile particularly in areas such as ongoing and future product strategies.

We have seen this across many industries but most notably in the automotive industry. Consumer concerns about national energy security, climate change, local air pollution and the cost of filling up at the pump have been shaping the competitive dynamics within the industry.

Companies in all sectors can reduce their emission intensity at little or no cost by accelerating the switch to renewable energy, improving energy and process efficiency in their operations, and leveraging their buying power to ensure that their suppliers decarbonise.

Companies with the technology and vision to provide products and services that address climate and other pressing issues will enjoy a competitive advantage. Companies that quantify their footprints send a strong message that they recognise the importance of climate change as a business risk and an opportunity.

Calculating the impact of climate risk on cash flows and the cost of capital is critical to understanding an organisation's ability to compete in a carbon-constrained future. These moves will help to futureproof businesses against growing external pressure from the public, regulators and investors.

[19] Competitive Advantage on a Warming Planet – Harvard Business Review – March 2007

One simple technique that organisations can use to assess their position is to map or plot their climate competitiveness against peers using two variables – positioning against risks and preparedness to seize opportunities. In doing so you are likely to uncover ideas on how to move to a position of competitive advantage.

Section 3: Materiality assessment over alternative horizons

Conclusion

Stakeholder mapping is a key management tool for identifying and addressing and climate change risks and opportunities. Stakeholder analysis is often considered the first step in strategic planning activities on an organisational level.

Organisations need to research and understand the internal and external expectations of key stakeholders. As noted, stakeholder expectations are shifting and there is a growing requirement to meet regulatory customer and investor expectations that are driving the climate agenda.

Introduction and Background

In the previous two sections, we have provided a basis upon which organisations can recognise the drivers in order to identity climate change risks and opportunities, through using specific risk management approaches, including the design of a climate risk radar and undertaking an external stakeholder mapping exercise.

In this section of the guide, we explore how organisations can assess the materiality of the risks and opportunities that they have identified through the use of scenario analysis. It is important to remember that the overall the purpose of scenario analysis is to explore several plausible and 'best-available' 'what-if' scenarios, rather than to precisely forecast the future.

Assessing climate change-related risks based on forward-looking information and scenarios is a central component of the TCFD and regulatory recommendations and is arguably the most challenging to implement given the complexity of design decisions such as alternative time horizons and climate pathways. However, these scenarios are strengthened when assumptions made are based on learnings from previous events.

In this section we will cover the following key areas:

A. How to align the development of climate scenario analysis within an existing ERM framework

B. Provide details of a Climate Stress and Scenario Testing Framework that covers six main steps that a risk manager should consider in designing and implementing a framework for assessing the impacts of climate scenarios.

Organisations should start by describing climate related risk scenarios to which they are exposed, how they are expected to manifest, and (if the scenario occurs) the mechanism / path by which the firm, its external environment, and / or its stakeholders would be impacted. Consideration should also be given to the existing internal control environment and the types of remediation that may be required.

Risk managers can therefore play a vital role in driving the scenario selection and design decisions to assess future scenarios in a rapidly changing world.

Alignment to ERM Framework

There is widespread consensus that addressing climate related risks is a critical component of ERM in supporting an organisation in understanding its future risk profile and to have an early warning system in place to improve their resilience.

Broad climate scenario considerations and benefits

Organisations increasingly need to understand the material impact of climate change to provide support for internal decision making including a wider range of metrics that can include changes to profitability, liquidity, capital provisioning, and customer confidence etc.

The main objective of scenario analysis is like modelling any other type of risk and the main benefits are to:

- **Support business decisions and long-term strategic planning**
  - **Understand the vulnerabilities of business plans to make improved decisions for both business and capital planning**
  - **Supplement existing ORSA and ICAAP reporting processes - (financial services organisations only)**
  - **Provide external stakeholders (such as investors or regulators) with a forward-looking view of climate-related risks**
- **Improve operational resilience**
  - **Enable management to react better to occurring risks, implement plans e.g. for triggers and limit breaches and take action as appropriate. In addition, the exercises will improve monitoring with respect to emerging climate risks**
- **Comply with growing regulatory expectations**
  - **Embed climate risk considerations within existing strategic and operational processes**
  - **Climate disclosures, including TCFD**
  - **Regulatory Prescribed Scenarios - 2021 Biennial Exploratory Scenario (BES) UK climate scenarios (Financial services organisations only)**

Whilst is it important to quantify the impacts of climate change, it is also important to recognise how conducting climate scenario analysis is helpful in a broader sense in facilitating greater engagement with, and knowledge transfer across the organisation.

Some of the "softer" benefits include:

- **Deepening the understanding of the driving forces affecting future development of a policy or strategy area**
- **Identifying gaps in understanding and bring into focus new areas of research required to understand driving forces better**
- **Building awareness and consensus amongst a range of stakeholders about the issues and how to tackle them**
- **Identifying and make explicit some of the difficult policy choices and trade-offs that may need to be made in the future**
- **Creating a new strategy that is resilient because it is adaptable to changing external conditions mobilising stakeholders to act**

As organisations start to explore a range of future scenarios it will initially improve internal communication and discussions and help to alert decision makers to "inconvenient truths" and provide a framework to enable firms to inform their future business strategies and risk mitigation activities.

Organisations need to consider a wide range of factors:

- **The timeframe over which the risk could crystallise (and the window to respond / adapt);**
- **The severity of the impact (to the firm, wider environment, and stakeholders);**
- **The anticipated climate change policies from stakeholders e.g. governments; customers, industry bodies, rating agencies, institutional investors etc.**

- **The specificity of impact, e.g. to the organisation, whole of market or specific sector**

Before we discuss how to design robust scenario process within your organisation, we provide below more detail of two of the main challenges that organisations need to carefully consider in designing a robust set of scenarios namely how to address alternative time horizons and setting the base case.

Assessing climate scenarios over different time horizons

One of the most challenging aspects to assessing the impact of climate change is the time horizon. It is important to distinguish between existing risks that will change over time due to climate change and new emerging climate risks that may impact the organisation in the future i.e. when they are expected to crystallise. As an example, it is important to consider the increases in the frequency and severity of 'acute' weather-related events, such as floods and droughts, as well as longer-term 'chronic' shifts in climate, such as increases in average temperatures and sea level rise over different time horizons.

In his Lloyds of London address in 2015 Mark Carney stated that "Climate change is the Tragedy of the Horizon"[20] and that "once climate change becomes a defining issue for financial stability, it may already be too late".

Horizon scanning and three horizons model

The horizon effectively adds another dimension by capturing when the event will happen. The IRM published a guide on Horizon Scanning in 2018 which serves as a good reference. As stated in the guide "horizon scanning can be a good technique for people to look at complexity, challenge assumptions and review multiple ways that events could unfurl, in order to increase the resilience and reliability of their organisations. It is not about trying to predict the future but rather to review options so that evidence-based decisions can be made"[21].

In the IRM guide it refers to the UK Government paper on Futures which, in the opinion of the IRM SIG, comprises best practice to follow if undertaking a detailed horizon-scanning exercise. The UK Futures document describes a Three Horizons Model, shown below, which is now being commonly used by practitioners as a basis to map out their future climate change risks and opportunities.

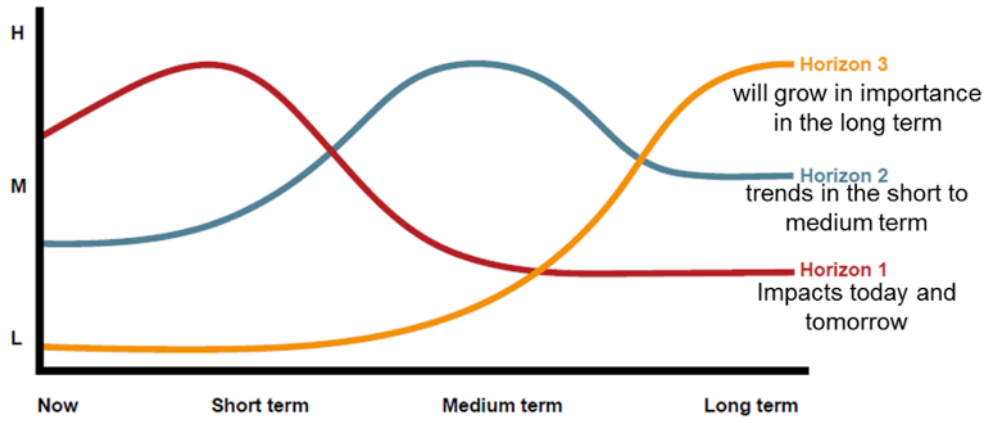

Figure 11: Horizon Scanning – Three Horizons Model

- **Horizon 1: Where you are currently taking action**
- **Horizon 2: Visible trends for strategic consideration**
- **Horizon 3: Little trend information today but planning needed**

[20] Breaking the Tragedy of the Horizon – climate change and financial stability - Speech by Mark Carney at Lloyd's of London, Tuesday 29 September 2015

[21] https://www.theirm.org/media/7340/horizon-scanning_final2.pdf

> Climate Change time horizons

Climate scenarios should be developed over three distinctive time horizons namely short, medium and long-term using a range of approaches and tools.

Regulators, such as the PRA, provide good guidance and explain that the scenario analysis should include short-term assessments, covering the existing planning horizon and longer-term assessments of a firm's exposures based on its current business model. They explain that longer-term exercises are not intended to be precise forecasts, but are qualitative and used to inform strategic planning and decision making. Therefore, organisations should seek to develop approximate assessment criteria to describe each time horizon and an example is shown Figure 12.

Time Horizon	Description
Short - Near-Term 0-3 Years	The emerging risk can be expected to occur within a three year time
Medium or Mid -Term 3-10 Years	The emerging risk can be expected to occur within a greater than three and less than 10 years time horizon
Long-Term Over 10 Years	Extended modelling horizon for climate risks specifically to capture longer term impacts such as policy changes in excess of the normal business planning horizon

Figure 12: Risk assessment time horizons

The Climate Financial Risk Forum Scenario guide[22] issued in June 2020 helps to explain the requirements of scenario assessment by stating that: "This requires leveraging historical data and providing a forward-looking assessment over an extended time horizon, whilst also evaluating the likelihood that extreme climate-related events will become more frequent and severe".

The PRA have also developed a scenario discussion document "The 2021 biennial exploratory scenario (BES) on the financial risks from climate change"[23] which states that financial institutions should help regulators to test the resilience of both the UK banking and insurance sectors to climate risks over a 30 year time horizon. They also go on to say that: "Climate change, and the policies to mitigate it, will occur over many decades. The resulting financial risks will therefore crystallise over a timeframe much longer than the normal horizon for stress testing. To ensure the 2021 BES captures these risks to a meaningful degree, this exercise would use a 30-year modelling horizon (i.e. from 2020 to 2050)."

To make these scenarios credible and tractable, the Bank proposes that the BES examines firms' resilience using fixed balance sheets, focusing on sizing the risks and the scale of business model adjustment required to respond to these risks, rather than testing the adequacy of firms' capital to absorb those risks.

Setting the Baseline

Another key challenge for climate scenarios is how to set the baseline and there are two main approaches that need to be taken into account.

- **"One off Shock" – Assessing the impact of a one-off shock that has not already been captured or considered on the business**
- **Assessing the difference between the central projection and alternative pathways over time**

[22] Climate Financial Risk Forum Guide 2020 - Scenario Analysis chapter
[23] Bank of England Discussion Paper: The 2021 biennial exploratory scenario on the financial risks from climate change – December 2019

The context of developing scenarios is to firstly have a base case and then estimate the impact of these changes over time. Figure 13 illustrates the concept of what the outputs need to consider in terms of incremental expected losses and volatility on the business. As emissions are expected to continue increasing to 2050 (and beyond) there is an expectation that future volatility of events will continue to worsen. This will in turn lead to the increase in frequency and intensity of certain climate perils including hurricanes and floods.

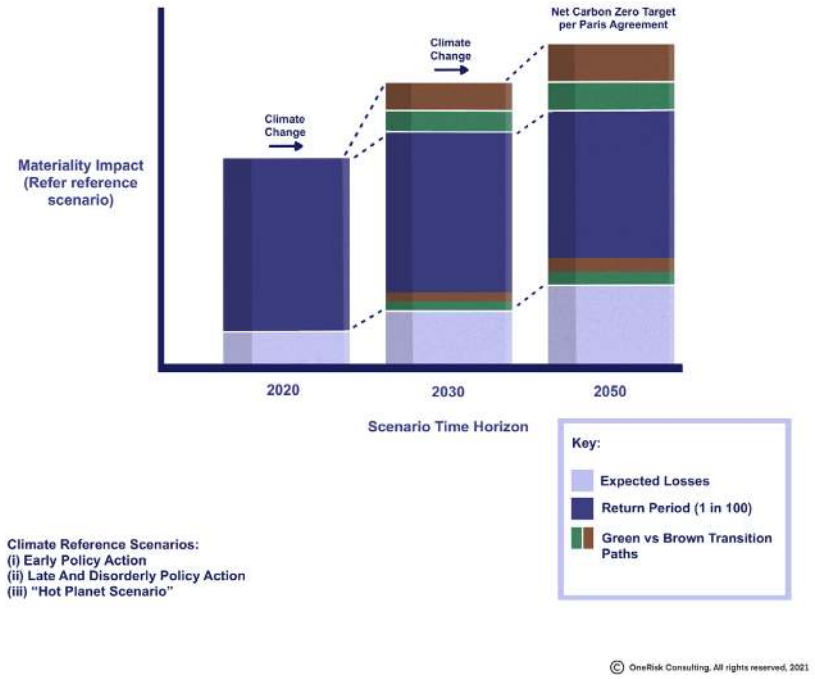

Figure 13: Climate scenario design – Setting the Baseline – Conceptual framework

Climate scenario analysis framework

One of the main challenges for risk managers is to develop a framework that includes a robust process for assessing the impacts of specific scenarios on the organisation.

The IRM SIG have reviewed a number of frameworks that are being developed to support the design of climate scenarios and we outline below a six-stage process shown in Figure 14 that organisations can use.

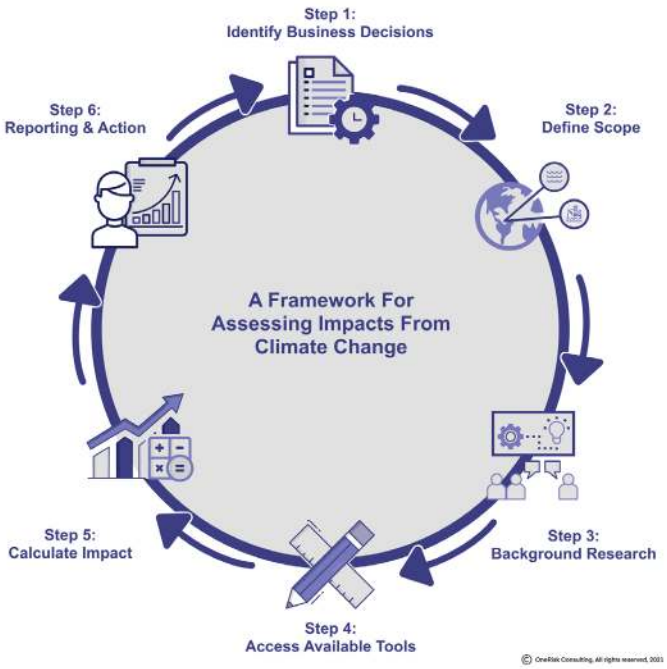

Figure 14: Climate change risk assessment process

We provide a high-level summary of the main requirements that we believe are important for risk managers to consider within each of the stages.

Stage 1: Identify Business Decisions

The first phase of the process should seek to link climate issues to specific organisational threats and opportunities that will help to support business decisions and long-term strategic planning.

Organisations should also endeavour to identify and understand the key drivers of their business performance and look to build these into their scenarios. In designing the scenarios it is important to understand past climate trends and losses, review the current risk profile in detail and then consider emerging climate risk trends.

Scenario analysis can address multiple purposes while focusing on a range of potential stresses and scenarios, and upfront recognition of this diversity encourages the placement of appropriate design elements and controls. Scenario analysis can have important potential applications in a number of areas.

For each area of use, key scenarios must be identified along with a model for analysing the impact of the scenarios. An important point is that the intended use of the analysis should drive the scenario selection and design decisions. By ensuring that objectives are identified and agreed upfront, a common reference point is established for communicating and interpreting results.

As discussed in the design of the emerging risk radar the relevance and prioritisation of the business decisions will depend on the specific risk profile of the individual organisation and industry. Similarly, the appropriateness of the approach will vary depending on factors such as the organisation's climate ambition, which we discuss in Section 4 of the guide.

What makes climate change somewhat unique is the wide-ranging potential business impacts that will need to be considered. They can influence a range of business decisions making and regulatory requirements such as climate disclosures. A list is shown below in Figure 15 that illustrates the need to support a range of stakeholders both internal and external such as rating agencies and customers.

Figure 15: Summary of the main business uses and applications

From an ERM perspective one of the main business decisions will be to review and enhance the organisation's risk appetite framework and consider both changes in new qualitative and quantitative statements and metrics relating to climate change risk.

Another key consideration will include the impact of future changes in concentration and risk aggregation exposures emanating from climate change.

Existing scenario analysis applications, such as inputs within ERM regulatory driven processes (including ORSA or ICAAP for financial services firms), will need to continue with climate change threats being an additional set of inputs required. This process is also applicable to most organisations in assessing the robustness of their solvency or capital position.

Stage 2: Define Scope

This is a critical phase of the process in which the organisation needs to consider the scope of analysis. This will depend on the nature of the business e.g. their industry and economic sectors that the organisation operates in.

Climate change can affect businesses across legal entities, sectors and geographies and thus the scope of a scenario needs to be carefully thought through.

Factors considered might include:

- **the geographic location of the organisation's value chain**
- **the organisation's assets and nature of operations**
- **the structure and dynamics of the organisation's supply and demand markets**
- **the organisation's customers**
- **the organisation's other key stakeholders**

Significant research is therefore required to support the scoping exercise. Key design considerations are discussed in more detail in stage three.

Stage 3: Conduct background research

This stage involves a range of approaches to undertake what is often termed a "deep dive" exercise by risk managers. Detailed research is undertaken into the design of a specific scenario which can include research into relevant previous climate-related loss events or the extrapolation of known trends. Research of future changes in weather patterns of natural catastrophic events will be an important consideration. For financial services firms one of the key areas of focus will be to assess the potential concentration of risk exposures relating to these event types within their business.

Climate scenario types and archetypes

There are many types of scenarios to consider and we provide some specific scenario terminology that should be helpful to risk managers to explain the differences. Risk managers should seek to consider and use a range of scenario types.

Types of scenarios to consider:

- **a "sentiment shock" in (say) 2025 that prompts sudden and significant change**
- **a physical shock, e.g. major adverse weather event, that could occur at any time**
- **long-term incremental worsening of climate**

The scenarios can be categorised into the following broad descriptors:

- **Slow building - risk factors are slow to change but which gain momentum (need to be careful not to ignore the scope for non-linear growth)**
- **De-anchoring - scenarios in which barriers (e.g. regulatory safeguards) are suddenly removed, leading to sharp, sudden changes in the risk factors**
- **Point-in-time - scenarios where the probability over the short-term is low, but it is almost certain to occur at some point**

Even if an organisation chooses to use sophisticated statistical models, they aren't always capable of fully capturing such scenarios, so there is always a need for forward-looking expert judgement to develop them.

Climate Pathways

In constructing scenarios, it is important to factor in alternative scenario pathways that allow for the potential impact of the transition to a low-carbon economy and which utilise published definitions and associated assumptions.

As an introduction to climate pathways it is important to understand that climate-related scenarios have long been used by scientists and policy analysts to assess future vulnerability to climate change. Producing these scenarios requires estimates of future population levels, economic activity, the structure of governance, social values, and patterns of technological change. Economic and energy modelling are also often used to analyse and quantify the effects of such drivers in climate change.

A number of published scenarios are available that outline various plausible pathways to particular target outcomes (e.g., specific temperature increases or CO2 concentration levels). These scenarios have varying assumptions about the likely timing of policy changes, technology adoption, changes in energy mix, and other factors to achieve a climate-friendly economy that may be useful to a company in conducting its own scenario analysis.

The Network for Greening the Financial System (NGFS) has been developing an analytical framework for assessing climate-related risks in order to size the impact of climate-related risks on the economy and the financial stability.[24] The NGFS has concluded that there are two important dimensions to consider when assessing the impact of physical risks and transition risks on the economy and the financial system:

- **The total level of mitigation or, in other words, how much action is taken to reduce greenhouse gas emissions (leading to a particular climate outcome); and**
- **Whether the transition occurs in an orderly or disorderly way, i.e. how smoothly and foreseeably the actions are taken.**

However, they often have limitations for assessing the business implications of climate change at a local or industry sector level.

Regulatory scenario frameworks and climate pathways

Regulators have built on the reference scenarios currently being developed by the NGFS to provide a coherent set of climate pathways and key macroeconomic variables.

The PRA's discussion paper, "The 2021 biennial exploratory scenario on the financial risks from climate change" published in December 2019, provides some good guidance on the approaches required over a 30-year future time horizon. It provides details of discrete climate scenarios aligned to the Paris agreement and variables for consideration. Physical risk examples cited include regional sea level increases, changes in storm patterns, and transition variables include a pathway for the carbon price.

[24] NGFS A call for action Climate change as a source of financial risk, April 2019

The descriptions of the three most common scenario pathways are shown in Figure 16.

Climate Pathway	Description
Early Policy Action	Early and decisive action to reduce global emissions in a gradual way. These actions are sufficient to limit global average temperature increases to below 2 C. Moderate increase in global temperatures leads to higher physical risks.
Late Policy Action	The climate target is still met; but due to late action which could include a steep increase in global carbon process, there is a significant degree of disruption to the economy. Physical risks rise more quickly than in the early policy action scenario and transition risks are severe.
No Additional Policy Solution	Governments fail to introduce policies to address climate change other than those already announced. This leads to reduced level of transition risks but with resulting increases in physical risks.

Figure 16: Common climate pathway descriptions

What is important to recognise is that if governments fail to meet their obligations under the Paris Agreement, then the knock-on effects will mean that organisations will need to become more resilient in the face of increasing chronic changes in weather (e.g. rising sea levels), as well as more frequent and extreme weather events (e.g. flash floods).

Use of Representative Concentration Pathways (RCPs).

A greater consistency of methodology is achieved by aligning the risk management scenarios with future RCP scenarios. RCP is a greenhouse gas concentration (not emissions) trajectory adopted by the Intergovernmental Panel on Climate Change. Four pathways have been selected for climate modelling, which describe different climate futures. The four RCPs are labelled after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values (+2.6, +4.5, +6.0 and +8.5).

The model results are frequently "downscaled" to derive potential local-level changes in climate, which are then used to generate scenarios of impacts from climate change (first order impacts such as flooding or drought, second order impacts such as loss of crop production, and third order impacts such as famine).

Data sources and data availability

The immediate challenge in calibrating a climate change scenario arises from the lack of available data and the difficulty in understanding the wide range of data sources that may need consulting and calibrating, e.g. historical observations, geological records, global climate models, evidence and research from external bodies etc. For the physical risks, data is often fragmented, there are differences in the level and quality of exposure data across regions and the complexities associated with the physical events may not be captured. For transition risk, it is not possible to tell the extent of climate risks already captured in asset valuations and there is a lack of consistency across the markets.

The data for the financial variables are widely available, but the historical data will not give a reliable indication of the future, hence future estimates will be subject to uncertainty. Expert judgement is required for calibrating on a forward-looking basis. However, government reports, academic research, financial reports and public data can help to inform this judgement.

Climate data and use of data platforms

There is an increasing number of data platforms available now providing a good source of climate data. Some organisations have been working on open, transparent data platforms to help provide environmental, climate change and catastrophe risk information to business and wider society that encourages collaboration and crossover around data and services.

Global Climate Models (GCM)

GCM (state-of-the-art numerical weather models) have become an integral tool in meteorological research and help scientists simulate future climates in line with IPCC emission scenarios. Whilst they have not been designed to model scenarios for organsations, their forecasts need to be integrated within predictive tools and techniques.

Example: UK Climate Projections 2018 – UKCP18

One of the sources of data in the UK is the UK Climate Projections 2018[25] which provides the most recent assessment of how the UK climate may change in the future and the research is undertaken by Defra and the Met Office. The information and projections they provide are shown below, in Figure 17, which highlight the climate projections for three greenhouse scenarios for the UK. The graphs on the right highlight the UK precipitation under the mean Winter scenarios for 2050 for levels of likelihood.

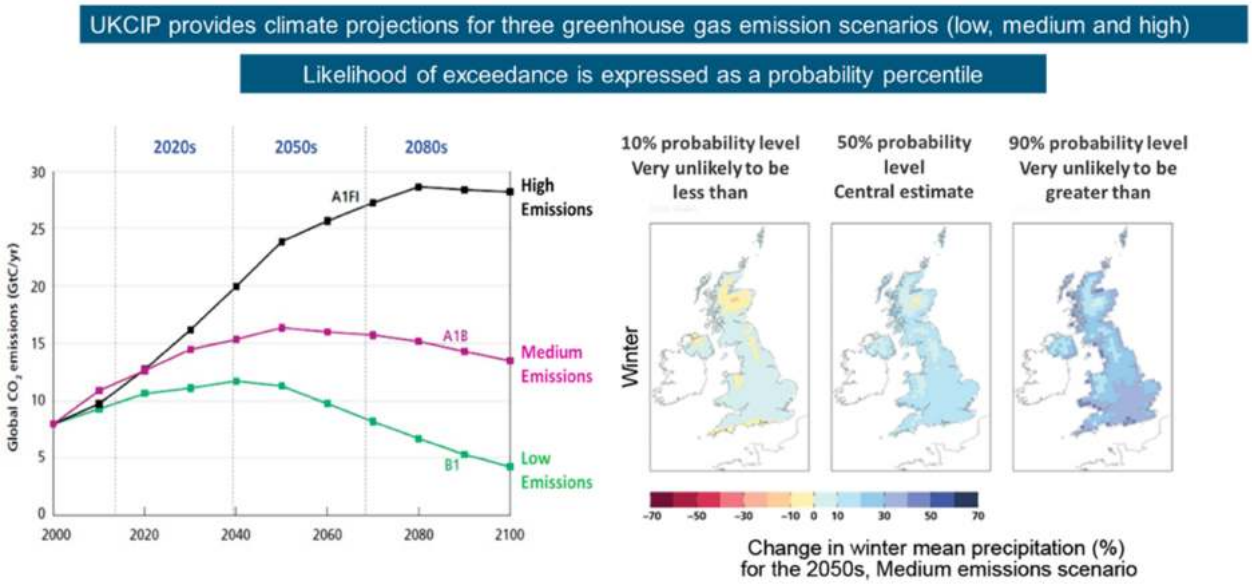

Figure 17: UKCIP climate precipitation projections

The importance of the information is that modelling firms are able to take this information and project low medium and high emission scenarios for flood models, for example, to support the incremental impacts of climate change. These can then be superimposed on an organisation's asset portfolio, which is particularly helpful for lenders and insurers. We will discuss this further in the next step through the use of hazard maps an example of UK flood modelling using flood mapping techniques.

Stage 4: Assess available tools

We now provide a high-level overview of some of the tools and techniques that risk managers can use but want to caveat that this just outlines some of the current methodologies available. These include some quite advanced tools for modelling physical risks, such as natural catastrophe models and hazard mapping techniques.

Firms need to select appropriate impact assessment tools to analyse the change in the chosen risk metrics for a given scenario. It is important to note that whilst there are some robust tools for modelling certain risks there is an expectation that new methodologies and tools need to be developed to help organisations meet the challenges that we have outlined in relation to the uncertainties and complexities involved with modelling transition risks.

[25] UK Climate Projections: Headline Findings – September 2019

Selection considerations

The key considerations for selecting a chosen tool or techniques will, of course, vary depending on the size and complexity of the climate risks facing the organisation, but some are listed below in Figure 18:

Key Considerations	Description
Qualitative And Quantitative Methodologies	Consider traditional risk management assessment techniques as well as bespoke proprietary external vendor modelling techniques.
Stress And Scenario Tests	Use both bespoke scenarios such as future climate events as well as and stress tests across the balance sheet of the organisation.
Appropriateness And Limitations	Tools should be evaluated to make sure they are appropriate for the specific business decision and scope of the analysis. Methodologies should be used with caution and fully evaluated in the context of the scenarios and model's underlying assumptions..
New Innovative Methodologies	Be open to consider new methodologies and tools that are currently being developed, tested and evaluated particularly for evaluation of transition and liability risks.

Figure 18: Main scenario selection consideration

Types of qualitative and quantitative tools

There is a range of tools and techniques that can be considered and again it is important to align the technique to the type of risk and business decision that the organisation is trying to assess. Many organisations are developing assessment capabilities and experimenting with different approaches and engaging in dialogue to promote cross-learning.

It is important to distinguish between the use of qualitative and quantitative approaches and it can be argued that the best approach for climate change will perhaps be a blend of both. It is also important to recognise the pros and cons of using a particular technique and its limitations.

There is a growing number of quantitative assessment tools available for organisations and a range of vendor models and tools available for risk practitioners. It is important to point out that models will give different results for modelling the same risks, many are complex and many are often termed "black box" in design, practioners therefore need to be careful in both using and interpreting the results.

It is important to have tools for physical, transition and liability risks, and we will consider tools under the following groupings.

1. Expert Judgement – traditional qualitative scenario analysis
2. Hazard maps and footprints
3. Probabilistic modelling including catastrophe models
4. Economic scenario generators using econometric modelling techniques
5. New tools and approaches - integrated stress tests

We will provide a quick summary of each main technique.

Expert Judgement – Traditional qualitative scenario analysis

A qualitative assessment typically focuses on understanding what the future world may look like for the organisation, based on a set of assumptions that support a potential path for the emergence of climate change risk. With the less rigid nature of qualitative assessments, organisations can more readily consider a variety of transition pathways and implications of changes in the socio-economic environment on business strategy.[26]

In designing scenarios organisations should seek to provide a high-level commentary, synopsis and assumptions of the scenario that is typically aligned to a specific risk (events) that generated the scenario.

A good starting point is for organisations to explore exposures to climate change risk for both short- and long-term horizons. Traditional risk management tools, such as risk questionnaires and structured interviews, should be considered and used but probably the most useful tool is to set up working groups and run workshops with key internal stakeholders to brainstorm future climate scenarios.

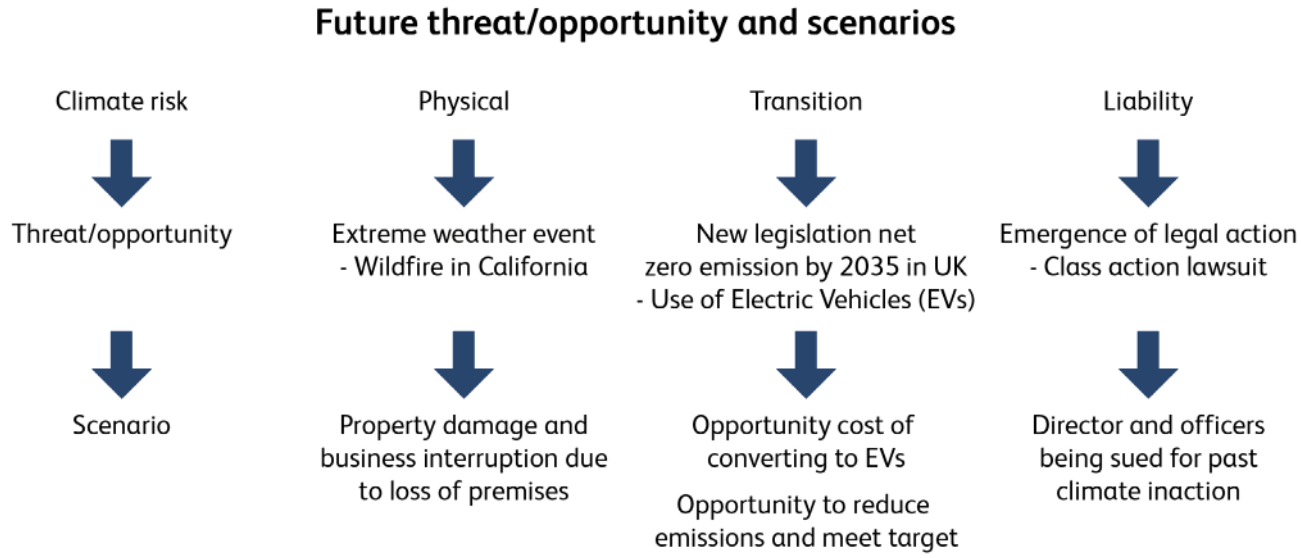

Figure 19: Expert judgement - Design of climate scenarios

These techniques help in a number of ways. Risk managers can facilitate discussions and gain valuable insights from experienced first line risk owners who know the business well. Internal brainstorming will typically help to gain buy-in from the senior management, exchange knowledge and help reach a consensus amongst participants. This approach can be supplemented by external experts who have access to wider industry and global knowledge and insights. In time, as more experience and knowledge are acquired, these assessments can grow in complexity and their ability to generate useful insights is improved.

Developing plausible assumptions

Plausible assumptions will need to be made about future developments, so questions should be asked about:

- **The development of climate policies: Will there be a direct carbon tax imposed? Will there be regulation on efficiency? Will there be explicit disclosures for carbon emissions? How fast can policy changes be imposed?**
- **The rate of technology innovation: How much funding will be given to research and development? Can all energy resources be made more efficient? Can technologies reduce the level of carbon in the atmosphere? How quickly will technology changes be adopted?**
- **Changes in energy mix: How will the proportions renewable and non-renewable energy change? Will all countries increase renewable energy consumption?**

[26] Geneva Association - Climate Change Risk Assessment for the Insurance Industry – February 2021

- **Changes in society: What will be the secondary effects of changes to the way people live and work? How will people's attitude towards climate change alter?**

By developing a set of detailed assumptions, an assessment of the impact on the organisation can then be undertaken linking the qualitative assessment to a quantitative output. Overall this process allows for greater flexibility in considering the potential correlations, interrelationships and understanding of the key drivers of the risk. The benefits of this approach are that it generally means that there is better transparency in respect of the scenarios chosen and enables an organisation to document an appropriate range of plausible, reasonable scenarios.

Hazard maps and footprints

Hazards such as drought, flood, hurricanes or sea-level rise can be assessed with hazard-specific models. These make use of the outputs of climate models to model changes in risk between present day and future conditions. For example, models of future flood risk use estimates of the change in likelihood of extreme precipitation events derived from climate model output.

Some examples below illustrate a range of specific analytical outputs that help organisations. They are often available across all RCPs for 5-year increments from 2025 until 2100 and consist of:

- **Climate Change Index (relative percentage change in flood depths due to climate change).**
- **Climate Change Scores (an easy-to-use scoring system, ranges that summarises future flood depth and frequency information to shows how a property's flood risk may change).**
- **Climate Change Rating (an easy-to-use colour rating that shows how a property's flood risk may change using traffic light colours such as black, red, amber, or green).**
- **Climate Change Pricing Data (financial metrics showing potential changes in the annual cost of flood to a property due to climate change).**

Figure 20 below, shows an example of climate change flood data. In the left-hand map, the current day 1 in 100 year flood hazard map is shown in purple. The extended area in red relates to the additional land which is predicted to be flooded in the future under climate change.

Figure 20: Hazard modelling and mapping and future rating

The data points, in the right-hand map, relate to property locations – the colour relates to the level of risk, with red meaning extreme risk. Some properties which were not currently at risk of flooding are predicted to be at risk in the future. The outputs can help mortgage lenders, for example, predict how flood risk, at the individual property and portfolio level, will likely change over time under different climate scenarios. Increasing flood damage can be correlated to reduced asset valuations and therefore increases in the probability of default on the loan.

Probabilistic modelling including catastrophe models

A number of tools are available to help companies anticipate the frequency and severity of potential future catastrophes before they occur so that they can adequately prepare for their financial or social impact[27].

Catastrophe models are widely used in the insurance industry and have been designed to model many perils that may be impacted by climate change, such as flood and windstorm. Until recently they have focused on present day modelling.

Climate change modelling is inherently uncertain, especially over the longer term, and this uncertainty is impacted by a number of meteorological, financial and social factors. However, despite this, there is an industry need and increasing regulatory requirements to consider the impacts of climate change on physical hazards over short-, medium- and longer-term scenarios. Catastrophe models are one way of doing so. The models are primarily designed to model "acute" physical climate risks but are not designed for "chronic" physical scenarios such as drought and heatwave.

One of the questions that needs to be answered is how will climate change alter the probability of a severe weather event happening next year? Risk managers also need to consider the impact of climate change in respect of the potential shift in the return period. As an illustration a 1-in-50-year event in 2020 may become a 1-in-35-year flood event in 10 years' time. This has many potential implications on the financial costs of risk, and subsequently on risk selection, pricing and more.

Economic scenario generators using econometric modelling techniques

There are a number of sophisticated modelling approaches to simulate possible future states of economies and financial markets based on risk factors to identify unexpected but plausible outcomes.

Most of these models have been applied to assess the impact on investment risk portfolios for investors. For investors, scenario analysis may be applied in different ways, depending on the nature of the asset(s) being considered. For example, some investors may develop energy transition pathways that they believe to be either optimal and/or likely and use those pathways to measure individual potential investments and drive engagement activities.

Other investors may consider how climate-related scenarios relate to the future performance of particular sectors, regions, or asset classes. The results may show that some portions of a portfolio are set to benefit from a particular scenario, while others face a loss in value. Such results, while not conclusive, can be a useful additional factor in determining where to prioritise risk management activities and where to consider making additional allocations.

The UN Environmental Programme (UNEP) issued a comprehensive investor guide about scenario based methods for climate risk assessment and developed in respect of TCFD[28]. Their report issued in 2019 details the results of the UN Environment Programme Finance Initiative (UNEP FI) Investor Pilot on TCFD Adoption. This was a collaborative effort to explore, enhance and apply a methodology for assessing the impact of physical and transition risks and opportunities on the portfolios of institutional investors.

Investors look into the carbon intensity of investment portfolios, considering the implications of physical and transition risks. There are many tools available for the investment community which can help to assess the impact of an investment strategy of an organisation. The focus has been on potential re-pricing of carbon-intensive financial assets, and the speed at which any such re-pricing might occur.

Many of these tools are stochastic models that use future econometric models and integrated assessment models to predict the future economic conditions. The UNEP FI report states that climate risks can be incorporated into different financial modelling methodologies.

[27] Catastrophe modelling and climate change – Lloyds 2014
[28] UNEP FI Changing Course October 2019

It is important to decide whether to use macroeconomic methodologies (that go from macroeconomic impacts to asset class impacts), bottom-up methodologies (that go from asset-level cash-flow impacts to asset class impacts), or whether to combine the two approaches. Figure 21 provides an output of a top-down approach that enables an organisation to assess the climate-adjusted growth expectations of an investment portfolio.

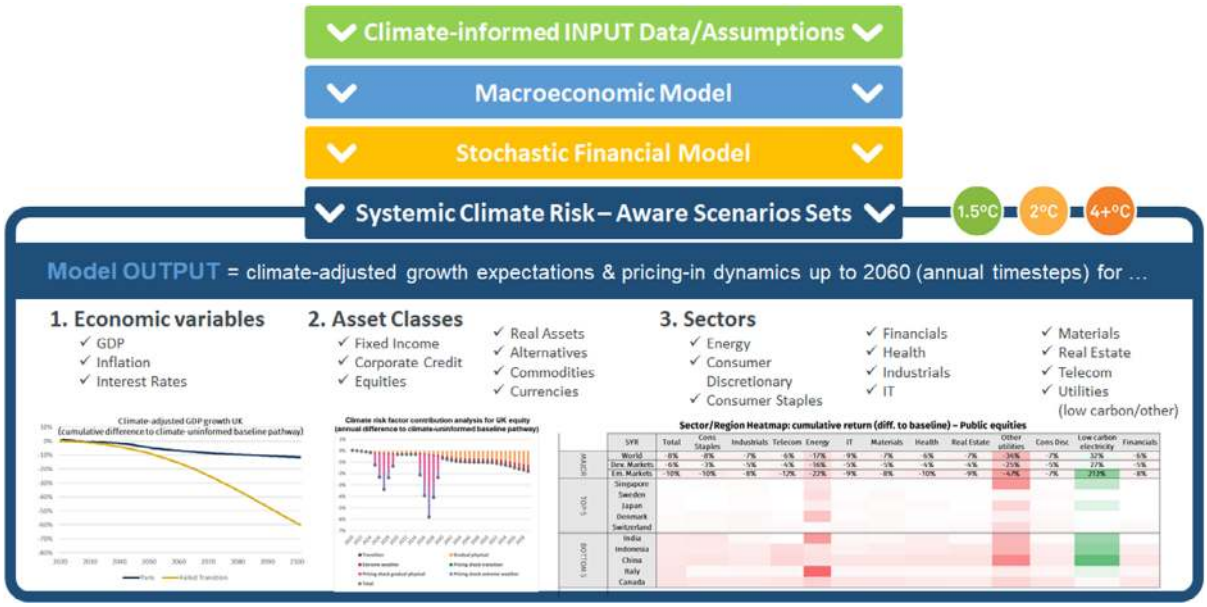

Figure 21: Example: Economic scenario generators using econometric modelling techniques[29]

New tools and approaches - Integrated Stress Tests

There is a growing need for organisations to stress test the impact of climate change on their current and future business models which does requires sophisticated methodologies.

There is a recognition that organisations need to identify new tools and approaches to measure and understand climate risks, in order to help organisations in "sizing" the risks they are facing and to help ensure a proportionate and coordinated response.

Many organisations are considering and adopting a more integrated and holistic stress testing approach that can assess a range of impacts of physical, transitional and liability climate risk developments by assessing key climate triggers and drivers. This integration would be able to support a wider number of business decisions in areas such as risk appetite, pricing, reserving, risk aggregation/exposure management, new product development, etc.

Stage 5: Calculate the impact

With the increasing awareness of climate change risk, organisations should be seeking to introduce climate scenarios into their existing scenario analysis programmes (in order to incorporate the potential financial impacts into their financial metrics). This is facilitated further if climate risk considerations are included within their risk appetite statements and key risk indicators.

An organisation should seek to measure the aggregate impact of climate scenarios into their income statements and balance sheet as well as other key financial metrics, such as risk-weighted-assets ratios or regulatory capital buffers.

Defining meaningful metrics can be challenging. The metrics used in communicating the outcome of an exercise should be driven by the decision they are meant to inform, and their familiarity.

[29] Example methodology courtesy of Ortec Finance

Physical scenarios are often aligned to an extreme, or "tail", event with a return period such as a 1 in a 100 year event i.e. the loss event will occur once every 100 years or have a 1 % chance of occurrence in a single year.

Metrics will vary by industry and business needs. As an example, insurers may choose to focus on measuring the impact of climate-related financial risks on claims and premiums that drive the profits and losses across their lines of business. Banks may need to assess how climate-related financial risks are to be factored into their measure of risk-weighted asset ratios in order to inform their capital reallocation processes. The quantification of risk may involve reviewing the credit risk profile of customers, changes in counterparty ratings, repricing of collateral and underlying assets, etc.

For example, a mortgage bank would be interested in assessing the potential impact of floods on its mortgage portfolio, quantifying physical damage with metrics that feed into the expected loss models. Likewise, a bank with an oil & gas portfolio would assess how potential carbon price movements may affect the credit risk profile of corporate borrowers and therefore the calculation of loan provisions. For smaller firms, it may be more sensible to start with one aspect of this analysis and build up expertise over time.

Stage 6: Reporting and action

Organisations will ultimately need to describe the methodology used for selecting their scenarios – that will include the rationale for choosing the underlying assumptions for each scenario regarding how a particular pathway might develop, for example. It will be important for an organisation to disclose and discuss this information, including the sensitivity of various assumptions to changes in key parameters, so that investors and other stakeholders have a clear understanding of the scenario process – not only the outcomes each scenario describes, but the pathway envisioned by an organisation that leads to that outcome (i.e., the how and why of those outcomes).

In terms of internal reporting it will be important to consider developing bespoke climate risk dashboards that can be used to report risk assessments across the short term, medium and long-term time horizons to Boards.

Communicating the quantitative and/or qualitative loss results to decision makers is arguably the most important stage and could take the form of a recommendation to 'act' or 'monitor' based on the results presented. The results will need to include a clear indication of the extent to which loss estimates can be relied upon, and appropriate caveats will be necessary to manage the risk of misinterpretation. For instance, 'these results are intended to illustrate loss sensitivity to climate change and do not constitute a prediction or forecast'.

Emerging Climate Risk Radar – Mapping of Business Decisions

As we have highlighted earlier, what makes climate change somewhat unique is the wide range of emerging risks and opportunities that organisations need to consider over different time horizons and the potential business impacts that will support decision-making and regulate requirements such as climate disclosures.

In Figure 22, is a schematic that aims to help risk managers present the range of emerging climate threats and opportunities internally at senior risk management and Board Risk Committees based on a high-level initial evaluation that can act as a basis for discussion and to agree areas that need to be assessed further in terms of better understanding the impact on the organisation. Some threats and opportunities will be difficult to model but remain important to contextualise in terms of initial impact and velocity.

The approach maps out the risk and opportunities against a specific business decision which in term is evaluated against a materiality assessment of low, medium or high impact. This process can be supplemented by the more detailed risk assessment process that we have outlined.

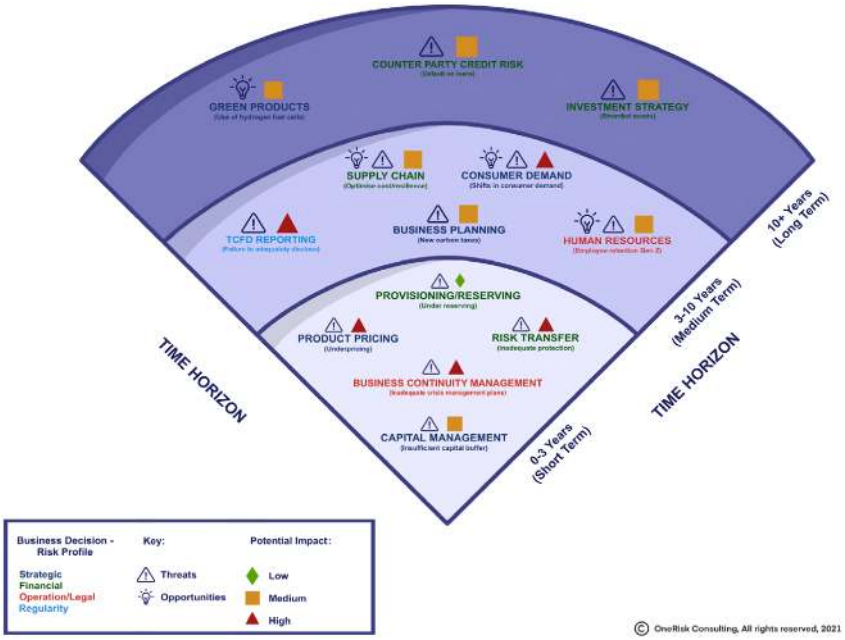

Figure 22: Initial Emerging Climate Risk Framework

Figure 22 highlights the types of output that will be helpful to risk managers in articulating regular updates to management about prioritising resources to undertake more detailed research and "deep dives". It can help to prioritise analysis of particular climate scenarios and can be used as a dynamic initial reporting tool. It can be updated easily to integrate new climate threats and opportunities and flag changes in the perceived threat or opportunity level.

It is important to clearly communicate the level of confidence in the modelling outputs for the specific risk. The process will be iterative and it will be important to share and discuss the outputs with stakeholders across the organisation. Successful use of the framework should ultimately lead to specific actions being taken by the firm.

Reporting and disclosure complement each other in improving decision making and evidencing that an appropriate process was followed in order to achieve the objective(s).

Over time, organisations should seek to improve reporting and improve disclosure through documenting:

- **Management's assessment of the resiliency of strategic plans to climate change**
- **The range of scenarios used to inform management's assessment, including key inputs, assumptions, and analytical methods and outputs (including potential business impacts and management responses to them)**

Conclusion

Risk managers need to play an increasing role in driving the scenario selection and design decisions to assess future climate scenarios in a rapidly changing world. As we have discussed, organisations should carefully consider the key parameters, assumptions, and other analytical choices.

Scenario analysis is not just about long-term planning but also about supporting improved business decision making in the short-term such as risk selection, pricing, reserving, risk transfer, risk appetite, etc. that we will explore in more depth the further sections of the guide.

In conclusion it is important to remember that the overall purpose of scenario analysis is to explore several plausible and 'best-available' 'what-if' scenarios, rather than to precisely forecast the future.

Section 4 - Strategic positioning & roadmap

Whilst many firms are enhancing their approaches to managing the risks of climate change, the focus has been primarily on the financial aspects and few have embedded a truly holistic, integrated strategic approach.

Climate change presents several distinctive elements (which are non-linear, irreversible and over extended time horizons) which, when considered together, present firms with unique challenges. The dynamic and interconnected nature of climate risk, in addition to limitations in data sets and methodologies, will require firms to adopt an iterative approach. Perhaps one of the most important considerations will be the adoption of a proactive approach to assessing the resilience of a firm's business strategy and to be able to adapt quickly to climate change.

The breath and complexity of climate change presents firms with challenges when assessing the actual and potential impacts on the strategic position of the firm. This may require firms to re-purpose and re-evaluate business strategy and financial planning over the short, medium and long-term. This will likely have profound negative but also possible positive implications for the firm's existing business and operating models.

The following sets out some high-level principles that firms should consider when developing their climate change risk management strategy.

I. Identify RISKS and OPPORTUNITIES to develop climate-friendly products and services

II. Establish a BASELINE for the level of change and impact you expect

III. Adapt existing BUSINESS MODELS and develop new operating models

IV. Revisit your COMPANY PURPOSE and assess your current Business Strategy

V. Develop a CLIMATE CHANGE STRATEGY that aligns to external commitments

VI. Develop or adopt a FRAMEWORK to implement the climate change strategy

I. Identify risks and opportunities to develop climate-friendly products and services

Best practice questions

Has the firm assessed the climate-related financial risks associated with their clients and counterparties?[30]

Risk and opportunities identification options

- **Examine the entity's risk inventory to determine which climate-related risks have or have not been identified**
- **Identify the climate-related risks and opportunities that may affect the organisation's strategic and operational plans, and its products and services**
- **TCFD, suggests that companies should "describe their risk management processes for identifying and assessing climate-related risks," including "whether they consider existing and emerging regulatory requirements related to climate change**
- **Risk management can map the outputs of these activities or processes on the business strategy and objectives to identify climate-related risks or opportunities**

[30] Woods, S. Managing climate-related financial risk – thematic feedback from the PRA's review of firm's Supervisory Statement 3/19 (SS3/19) plans and clarification of expectations. Prudential Regulation Authority. p.5. 2020

- **Low Carbon Proposition; Product Approval Committee (new products introduced, existing products changed, future product changes or new products)**

II. Establish a baseline for the level of change and impact you expect

Best practice questions

Firms should ask themselves, "Is the approach to climate risks and opportunities management responsible, responsive or strategic?"

- **Responsible - is the chosen approach driven primarily by corporate social responsibility (that focuses on reputational risks)?**
- **Responsive - is an approach that views climate change as a financial risk (albeit from a relatively narrow, short-term perspective)?**
- **Strategic - a more comprehensive approach is adopted that takes a long-term view of the financial risks with Board engagement**

It is important for risk leaders to consider the uncertainties associated with each strategic option. As the awareness of the climate change risk increases, business strategy cannot be fully developed without factoring in climate change risks and opportunities. Climate-related opportunities are expected to have more significant impact on business strategy than climate-related risks.

When establishing a baseline, firms need to think about Scope 1 emissions (direct emissions from owned or controlled sources), Scope 2 emissions (indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the firm) and Scope 3 emissions (all other indirect emissions that occur in a company's value chain).

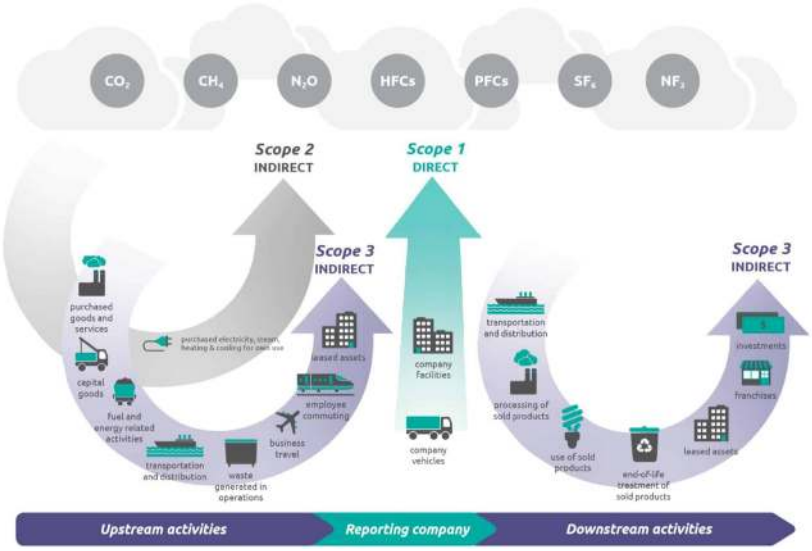

Figure 23: Scope 3 emissions - Source: GHG Protocol

Implementation options

Typically a structured implementation plan would follow a number of steps. These would include:

- **Idea generation during a Board strategy away day**
- **Review or create a set of hypotheses / strategic narratives**
- **Strategy Mapping & Risk Assessment that identifies uncertainties associated with each strategic option**
- **Horizon Scanning, Bow-Tie analysis or SWOT analysis**
- **Deep dive review of material risks / themes identified in the risk register / emerging risks profile**

III. Adapt existing and develop new models (both business and operating)

Best practice questions

Has the Board identified climate change as an opportunity to create competitive advantage, differentiate themselves from competitors and disrupt existing markets?

Industry leaders have recognised that the climate crisis has changed the competitive landscape and that existing business models will need to adapt if the firm is to survive.

One of the key attributes of a risk leader is to become a relentless change leader - an individual who promotes enterprise-wide innovation and ongoing adaption to the portfolio of business models, so that large scale strategic initiatives become less necessary.

Consequently, firms will benefit if they are able to correctly identify and define their portfolio of business models and the firms strategic positioning with regards to the climate crisis relative to their competitors.

Business models can be viewed as a special example of a configuration that connects traditional value chain descriptors with how customers are identified and satisfied and secondly, how the firm captures (monetises) value.

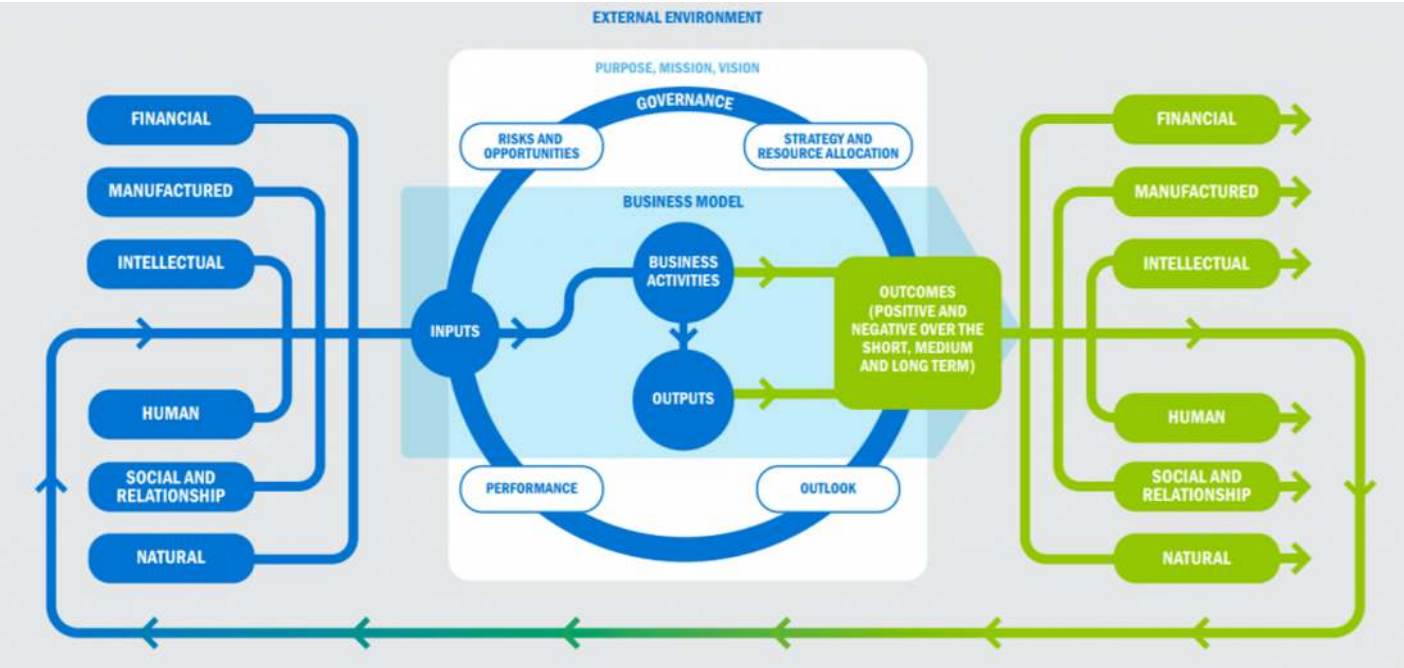

Figure 24: Analysing a business model - Develop or adopt a framework to implement climate risk management[31]

Figure 24 provides a visualisation of how a business model can be analysed. To complete your review, follow these steps:

- **List your business models**
- **For each business model, identify the key resources it uses (e.g. financial resources, user data, highly skilled human resources, or new technologies)**
- **For each business model, identify the key capabilities that stem from it (for example, technological or communication capabilities) and place them in a "Capabilities" column to the right of the "Resources" column**

[31] Source: www.integratedreporting.org

- **Identify performance measures important to your firm. These can be financial measures (such as return on equity, or return on investment), market-driven measures (such as market share, or number of users) or other types of measures (such as product quality)**
- **Consider the relationships between the models, the resources, the capabilities and the associated performance which connect each business model to its associated resources and capabilities and, ultimately to performance. The strength of the lines can depict the strategic importance**
- **Analyse which business models produce fewer (or less valuable) resources and capabilities. Key questions to consider are which business models display fewer synergies with the others? How strong is their relationship to performance measures?**
- **Business model portfolios are as dynamic as the activities they underpin and require regular review and challenge (and the dynamic has materially changed when ESG and/or Climate Change considerations are included within the process)**
- **Evaluate your current business model**
  - **Identify customers: The firm's targeted user and customer groups, including the situation where it creates new customers**
  - **Customer engagement: The value proposition (value creation) from each customer's perspective**
  - **Monetisation: A key part of value capture, including the provision of complementary assets (associated products or services)**
  - **Value chain and linkages: The mechanisms used to deliver the product or service to the customer**
- **Business model innovation and selection**
  - **Experimental-learning that incorporates rapid-prototype development**
  - **Co-create lots of ideas from a diverse group of individuals**
  - **Select a limited number of 'high-value' options**
- **Business Model implementation**
  - **Develop a target operating model as a blueprint for the execution of strategy**
  - **Constantly scan the internal and external environment for changes**
  - **Adopt a 'small wins' approach**
  - **Monitor implementation of the plan**

IV. Revisit your company purpose and assess your current business strategy

Best practice questions

It is important at the outset that risk leaders discuss the genuine role and purpose[32] of the firm in society with their Boards and Board Risk Committees. Risk leaders must facilitate a dialogue that focuses on the WHY and not be tempted to immediately focus on the HOW.

[32] Anon. The Risk Coalition. Leading Risk Thinking. Raising the Bar. Principles-based guidance for Board Risk Committees ad risk functions in the UK Financial Services sector. The Risk Coalition Research Company. P. 10 2019

Some firms have approached the subject of purpose by describing the firm's main areas of activity. This may include investment, insurance, operations and influence for example.[33] Each strategic business unit within the group will have their own business strategy. See Figure 25, with different strategic objectives and timescales for execution. The most likely outcome of adopting this approach is an understanding of the firm's climate change exposure to sectors and subsectors.

Does the Board consider the actual and potential impacts of climate-related risks and opportunities on the firm's business, strategy, and financial planning?[34]

Has the Board positioned evaluating and addressing climate change implications as a priority?[35]

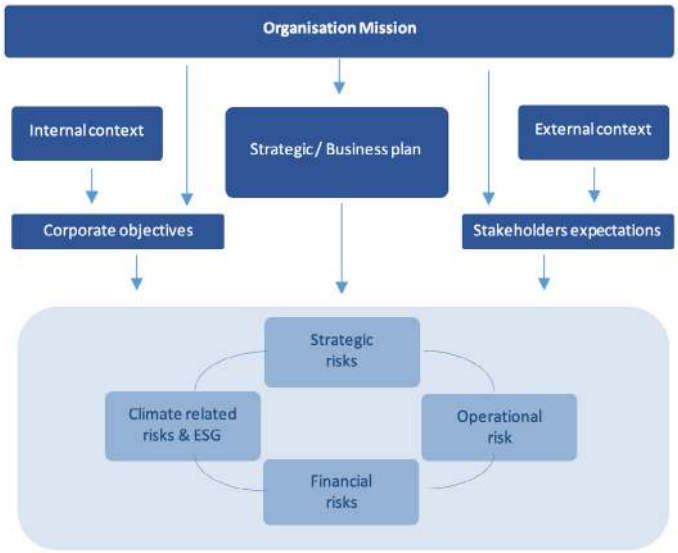

Figure 25: Organisation's strategy including key dependencies, core processes and objectives

Answering these questions will help identify the current state of play and to facilitate forming a basis for an climate action plan and prioritisation.

Implementation Options

- **Ask a series of 'what if' scenarios to identify and evaluate different strategic options**
- **Complete a qualitative impact assessment of the short, medium, and long-term risks and the effect they will have on the resilience of the business strategy under different scenarios**
- **Supplement qualitative scenario outcomes with quantitative analysis, including relative impacts if absolute numbers are not available**
- **Determine relative priorities and devise a plan than addresses specific concerns but which complement each other to maximise the benefits realised**

V. Develop a climate change strategy that aligns to external commitments

Best practice questions

How will the Board ensure that climate risks and opportunities are identified, mitigated, managed and monitored across the company?

Governments recognise the need to shift towards a low-carbon economy. In the 2015 Paris Agreement, national governments agreed to strengthen the global response, with each party committing to Nationally

[33] Aviva's Climate-Related Financial Disclosure 2019. Metrics and Targets summary (2019
[34] Anon. A climate change boardroom toolkit. Chapter Zero. p.35. 2019
[35] Anon. Principles and frameworks for climate change strategy and action. Chapter Zero. p.3. 2020

Determined Contributions.[36] Many firms have developed their own climate change strategy with the ambition of holding the increase in average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

Implementation Options

- **Define the level of ambition your firm wants to achieve**
- **Understand what 'Net Zero' means for your firm and set targets and metrics**
- **Develop a clear strategic response to the financial risks of climate change and tools that help to inform business decisions**
- **Less complex firms may adopt a qualitative 'walk-through' that considers a possible sequence of events (shocks and responses) as a basis for developing the climate change strategy**
- **More complex firms may need to adopt quantitative metrics to substantiate the risk appetite statement**

VI. Develop or adopt a framework to implement climate risk management

Best practice question

Will the Board sign-off the implementation plans for the climate change strategy?[37]

Once risks and opportunities have been identified, firms must set out a practical roadmap for implementation.

TCFD proposes a framework to integrate climate risk management which is consistent with the COSO ERM framework, shown in Figure 26, but other risk management frameworks could be considered as well, such as ISO 31000 or the company's own risk management system.

Figure 26: COSO ERM framework

Chapter Zero (a community for Non-Executive Directors to assist them in leading board room discusion on climate change) propose the following approach, in Figure 27, where the initiatives identified are sequenced and grouped into planning horizons on a roadmap.[38]

[36] Anon. Scenario Analysis Chapter. Climate Financial Risk Forum Guidance. p. 7. 2020
[37] Anon. Principles and frameworks for climate change strategy and action. Chapter Zero. p. 3. 2020
[38] Anon. Principles and frameworks for climate change strategy and action. p. 22. Chapter Zero

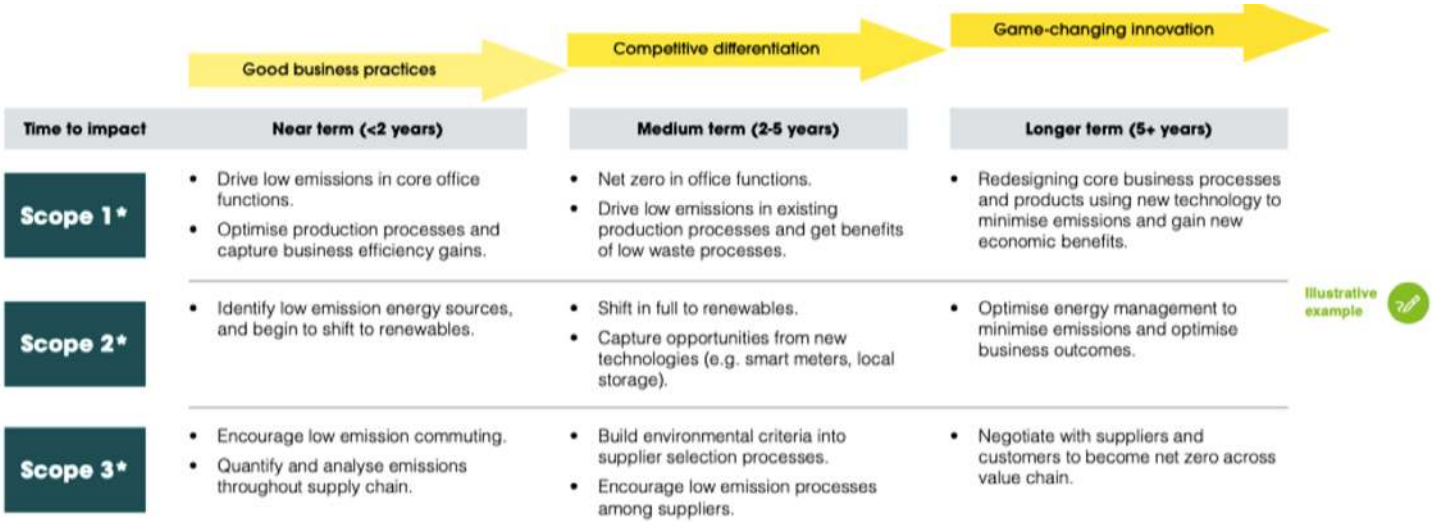

Figure 27: Chapter Zero's approach and initiatives

Implementation options

Establish a cross-functional approach to engagement across the firm, supported by intra-firm communication channels

Ensure responsibility is clearly allocated for implementing the climate change strategy. This needs to be clearly owned, joined-up and with a range of coherent measures → available frameworks (one relevant example e.g. TCFD; COSO ESG, etc.).

Conclusions for risk managers

Risk managers, through collaboration with a range of stakeholders and a broad understanding of the business, are well positioned to play an increasing role in supporting organisations as they identify, assess and manage climate-related risk and opportunities and integrate them into the existing ERM frameworks. This integration of emerging risk information and associated analysis (both quantitative and qualitative) will provide multiple benefits to organisations and will be enhanced if the approach is embedded within existing risk frameworks and risk profiles (taking into account a well-defined risk appetite and robust risk mitigation strategies across the organisation – which will be explored within the next sections of the guide).

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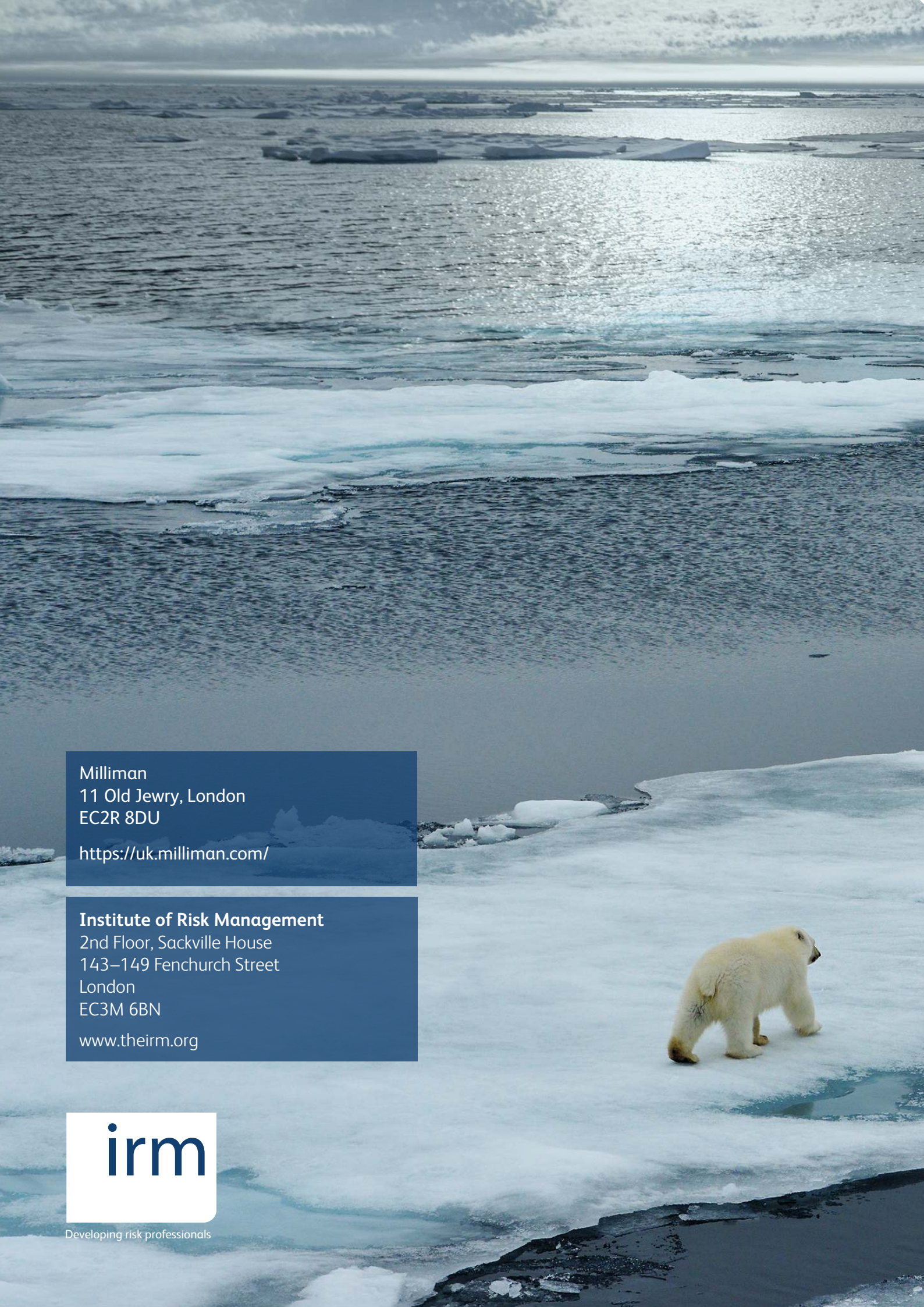

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