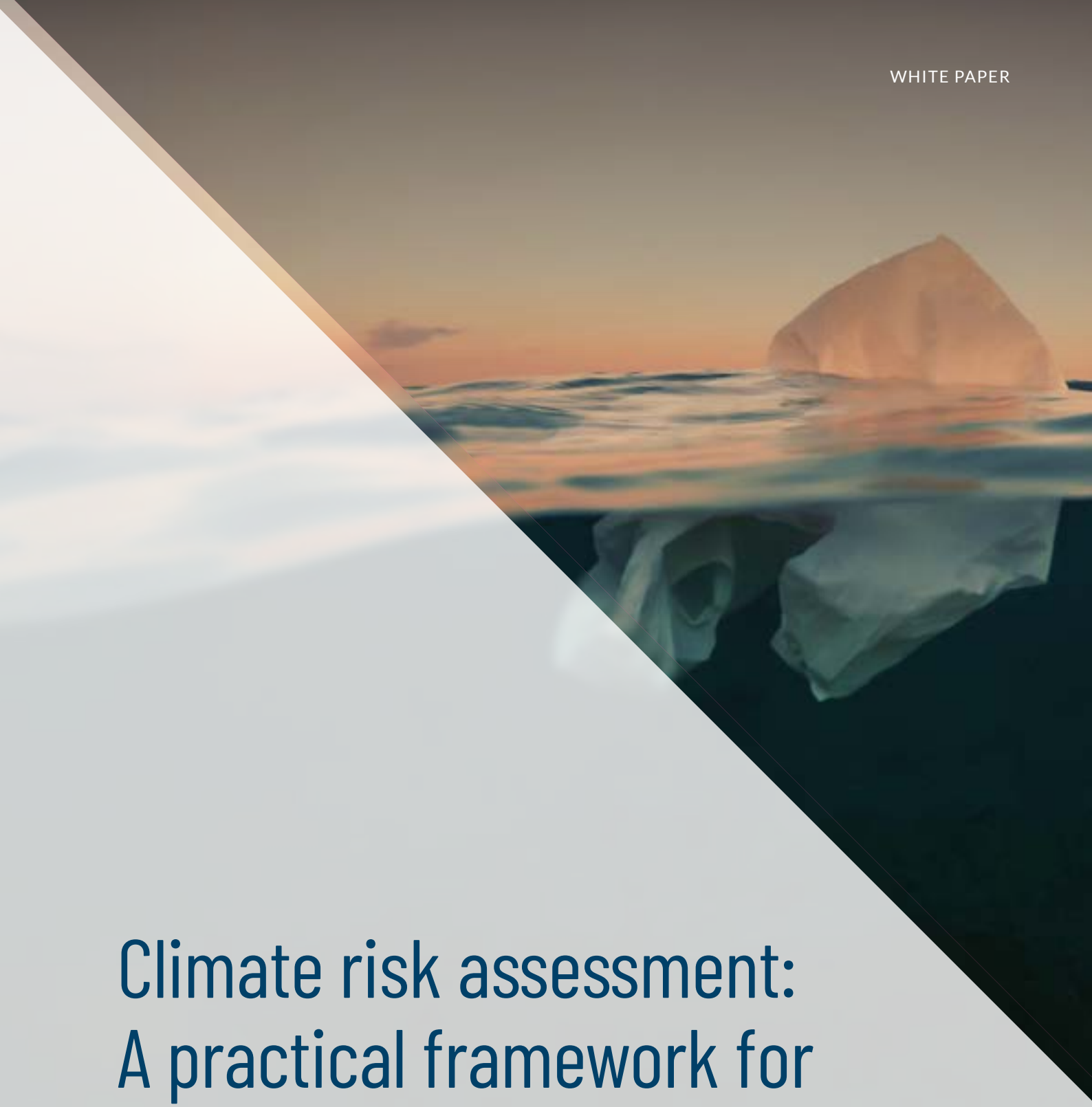
WHITE PAPER



Climate risk assessment: A practical framework for non-financial enterprises

protiviti®
Global Business Consulting

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Abbreviations

COSO — Committee of Sponsoring Organizations of the Treadway Commission

CSDDD — Corporate Sustainability Due Diligence Directive

CSRD — Corporate Sustainability Reporting Directive

DMA — Double Materiality Assessment

EBA — European Banking Authority

ECB — European Central Bank

EIOPA — European Insurance and Occupational Pensions Authority

ESG — Environmental, Social and Governance

FSI — Financial Services Industry

ICOSR — Internal Controls Over Sustainability Reporting

IPCC — Intergovernmental Panel on Climate Change

NFRD — Non-Financial Reporting Directive

NFRM — Non-Financial Risk Management

NGFS — Network for Greening the Financial System

OECD — Organisation for Economic Co-operation and Development

TCFD — Task Force on Climate-Related Financial Disclosures

Executive summary

The regulatory landscape for climate risk management is rapidly evolving, driven by international agreements like the Paris Climate Agreement and initiatives such as the European Green Deal. Key regulations, including the EU Taxonomy and the Corporate Sustainability Reporting Directive (CSRD), mandate comprehensive sustainability reporting and emphasise the importance of integrating climate risks into corporate governance. At the same time, financial institutions, under pressure from their own regulators to demonstrate operational resilience and robust risk management strategies, are increasingly taking climate risks into account when assessing the creditworthiness of applicants.

While not everyone has committed to the goals of the Paris agreement, the effects of rising temperatures affect everyone, endangering not only the environment but global economic stability. Companies need to actively track, identify and assess the risks resulting from this climate change because they can lead to market distortions, asset losses and systemic financial risks, especially if climate risks materialise abruptly. Such developments could result in high price volatility and economic losses and endanger long-term economic stability.

Integrating climate risk assessment into existing risk management frameworks is therefore crucial for companies as they navigate both climate realities and regulatory demands. By embedding climate risk considerations into their current strategies, organisation can systematically identify, analyse and evaluate potential threats, understand how these risks intersect with other non-financial factors and develop holistic risk mitigation strategies. This alignment of climate risk with strategy and other risks fosters cross-departmental collaboration and enhances transparency for stakeholders, ultimately positioning organisations to attract green financing and meet regulatory and investor expectations.

This white paper proposes a detailed methodology for conducting climate risk assessments by companies in the non-financial sector, emphasising the importance of scenario analyses to identify vulnerabilities and opportunities. By leveraging both qualitative and quantitative approaches, organisations can gain a holistic understanding of climate risks and develop informed, data-driven strategies to manage these risks sustainably and position themselves strategically for a dynamic and unpredictable future.

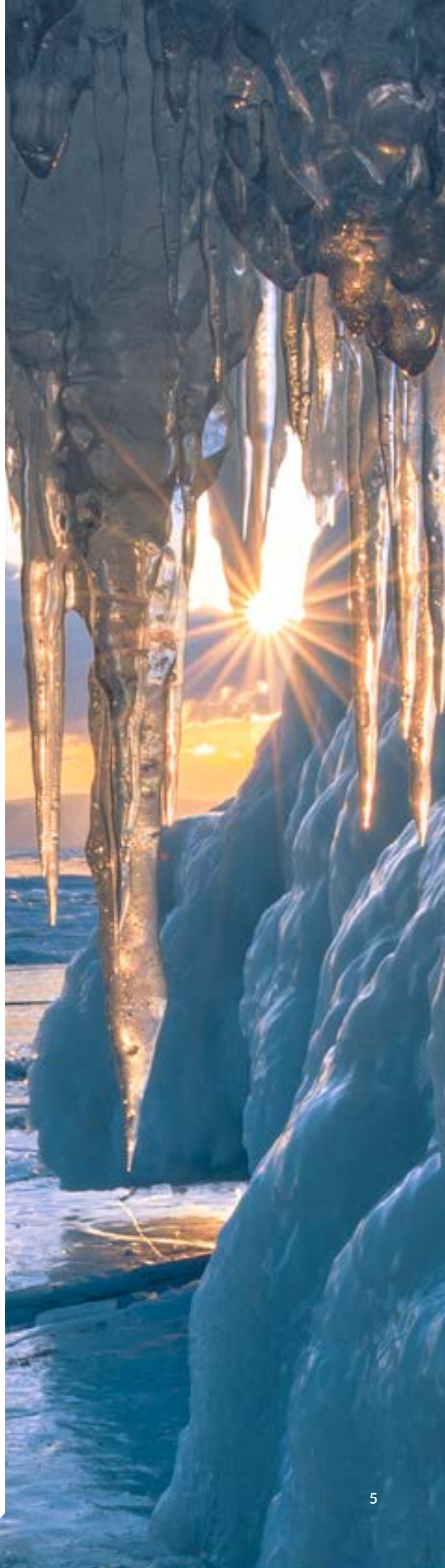
Factors driving the need for climate risk assessments

Regulatory drivers

The regulatory landscape for climate risk management has undergone significant transformation in recent years, driven by a global consensus on the urgent need to address environmental challenges and their impact on economic stability. The Paris Climate Agreement of 2015 was a pivotal moment, setting ambitious targets to limit global warming to well below 2°C, preferably to 1.5°C, compared to pre-industrial levels. This international treaty has catalysed a slew of regulatory initiatives designed to enhance transparency, accountability, and proactive management of climate-related risks.

The EU Omnibus bill does not do away with the regulations; the EU regulatory landscape for sustainability remains active and largely unchanged.

In 2019, the European Green Deal affirmed the goals of the Paris Agreement and created a strategic policy framework for achieving climate neutrality in the region by 2050. This strategy underpins various regulatory measures today, such as the EU Taxonomy, which standardises the classification of sustainable activities performed



and the Corporate Sustainability Reporting Directive (CSRD). The CSRD mandates comprehensive sustainability reporting based on the principle of double materiality (i.e., how a company impacts the environment, and how environmental changes impact the company). This includes the disclosure of climate-related risks and opportunities as part of corporate governance and strategy.

Complementing these two key European regulations is the Corporate Sustainability Due Diligence Directive (CSDDD), which obliges large companies to identify, prevent and mitigate adverse impacts on human rights and the environment throughout their value chains, with civil liability and enforcement mechanisms for non-compliance.

Most recently in early 2025, the EU Omnibus bill was introduced, aimed at making targeted adjustments to these regulations to reduce some of the compliance burden for companies by giving them more time to prepare. It does not do away with the regulations; the EU regulatory landscape for sustainability remains active and largely unchanged.

Banks and insurers as indirect drivers

Banking regulations related to climate risk matter to non-financial companies because they can affect their ability to obtain financing. The two main guidelines for financial institutions are the European Banking Authority's (EBA) guidance on management of environmental, social and governance (ESG) risks and the European Central Bank's (ECB) guidance on climate-related and environmental risks. Both emphasise the importance of integrating climate and sustainability risks into financial institutions' business strategies, governance structures and risk management processes. To protect their portfolios from defaults, banks are taking a more scrutinising look at climate risk factors when making investment decisions. More than reporting, banks are prioritising operational resilience for their credit takers, recognising that reporting alone is insufficient to safeguard financial stability. They seek evidence that borrowers are actively implementing robust risk management systems, contingency planning and adaptive business practises that can withstand and respond to environmental disruptions.

According to the European Insurance and Occupational Pensions Authority (EIOPA, 2021), insurers consider similar ESG and climate-related risks as banks, incorporating them into key areas such as pricing, underwriting and reserve modelling. EIOPA highlights that this integration can result in stricter underwriting standards, increased premiums or reduced insurance coverage, particularly affecting sectors with high exposure to climate risks, such as energy, infrastructure and heavy-emitting industries.

Another reason companies should be aware of climate regulations in the financial sector and of underwriting trends in the insurance sector is the broad applicability of risks being considered, which can inform non-financial companies' approach to managing risks. The ECB stresses that businesses in *all* industries may find themselves exposed to market, sector or geographical vulnerabilities due to climate change. Its recommendations on integrating climate risks into corporate strategy, governance, risk culture, capital planning, and disclosure offer valuable insights that can benefit both financial and non-financial companies.

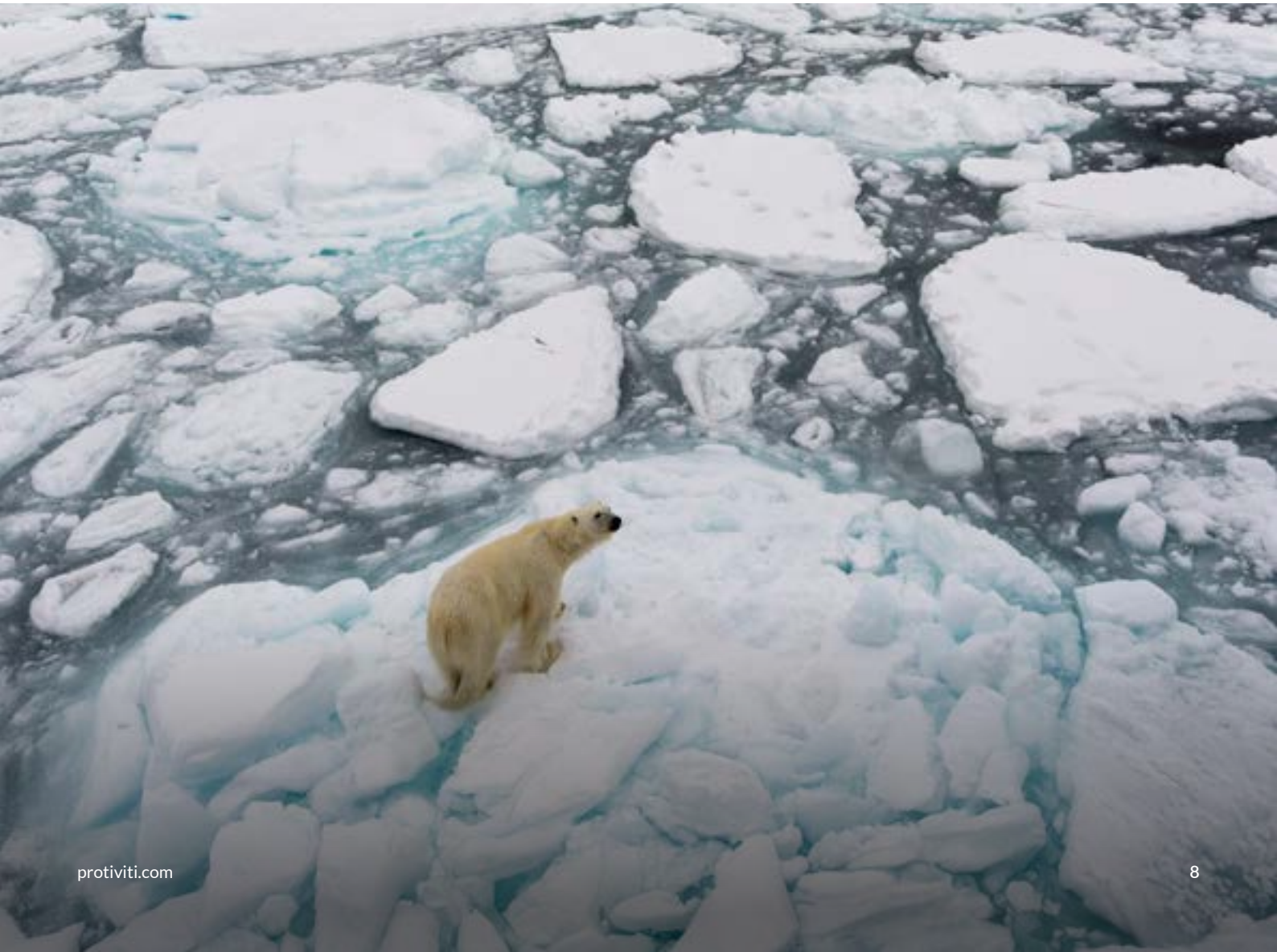
It is advisable for companies to establish regular communication with financial experts who specialise in sustainability and climate risk, as they can provide insights into evolving financial sector regulations and help businesses strategically position themselves in response. By engaging in advocacy, participating in industry forums and joining working groups, companies can contribute to the regulatory dialogue on how climate risks are integrated into banking supervision. Although non-financial corporations are not the primary addressees of financial regulation, supervisory authorities such as the ECB and the EBA invite input from them and other stakeholders in public consultations, providing companies with a channel to ensure their perspectives are considered in the development of regulatory approaches.

> The tightening climate expectations placed on banks will inevitably cascade to the real economy. The winners will be those companies that don't wait to comply, but anticipate and turn the constraints into their own strategic advantage.
>
> Timo Rupprecht,
> Manager,
> Risk & Compliance

Climate risk assessment: A proposed approach

In this section, we discuss the foundational steps of climate risk assessment, which are critical prerequisites for effective risk management and the development of operational resilience.

In addition, we explore the value of scenario analyses as a powerful tool for identifying vulnerabilities and uncovering opportunities. These analyses not only help organisations anticipate the impact of climate-related events but also guide strategic decision-making to enhance resilience and sustainability in an increasingly volatile environment.



Types of climate-related risks

Climate-related risks are generally divided into two primary categories: Physical risks and transition risks. Below are examples of each type and related drivers.

Physical risks arise from direct effects of climate change on people, infrastructure and buildings.

Examples of physical risk drivers

Acute	Chronic
• Storms • Floods • Heavy rain • Forest fires • Droughts • Landslides	• Rising sea levels • Rising temperatures • Increasing heat and drought periods • Water scarcity

Transition risks arise from the transition to a more climate-friendly economy and from political, regulatory, technological or market changes.

Examples of transition risk drivers

- **Regulatory:** new emission regulations, stricter environmental laws, disclosure obligations
- **Technological:** investments in low-carbon/climate-friendly technologies
- **Market:** changes in demand behaviour
- **Reputation:** greenwashing

It is important to distinguish between the climate risk itself and the climate risk drivers. Climate risks are typically classified into physical risks and transition risks, providing the overarching categorization of potential impacts. Climate risk drivers, by contrast, are the underlying factors that cause these risks to materialise, such as storms, floods, regulatory or market dynamics. While the category of risks define the broad typology, drivers represent the concrete triggers that make these risks operationally and financially relevant for companies.

The breadth and substantial potential impact of these risks underscore the importance of integrating them systematically, along with other ESG factors, into companies' risk management frameworks and strategic decision-making.

Step-by-step climate risk assessment

Next, we explore the critical components of and practical steps for identifying and assessing these risks, from understanding the business context of the company and relevant climate risk drivers to determining which risks are material.

Step 1: Leverage a comprehensive list of climate risk drivers

This initial step entails compiling a comprehensive and detailed inventory of both transitional and physical climate risk drivers, drawing from established reporting standards such as EU Taxonomy, scientific publications, and industry best practices. Reporting standards contain relevant regulatory and policy-related drivers, mostly transition risks such as stricter disclosure requirements. Scientific publications highlight physical drivers, focusing on weather extremes and long-term climate shifts. Industry best practises, such as those developed by the Network for Greening the Financial System (NGFS) or the Task Force on Climate-Related Financial Disclosures (TCFD), provide structured lists of commonly recognised drivers across sectors. By referencing these sources, organisations ensure that a wide range of climate risk drivers are considered, preventing any critical factors from being overlooked.

Examples of physical climate risk drivers:

- Extreme weather events: Increased frequency and intensity of hurricanes, floods, droughts and wildfires can disrupt operations, damage infrastructure and lead to supply chain interruptions.
- Temperature changes: Shifts in average temperatures can affect energy consumption patterns, agricultural yields, and worker productivity, impacting overall business performance.

Examples of transitional climate risk drivers:

- Technological advancements: The rapid development of clean technologies may render existing products or services obsolete, requiring companies to adapt their business models.
- Market shifts: Changing consumer preferences toward sustainable products can create both opportunities and challenges for businesses that need to pivot their offerings accordingly.

Step 2: Analyse the value chain

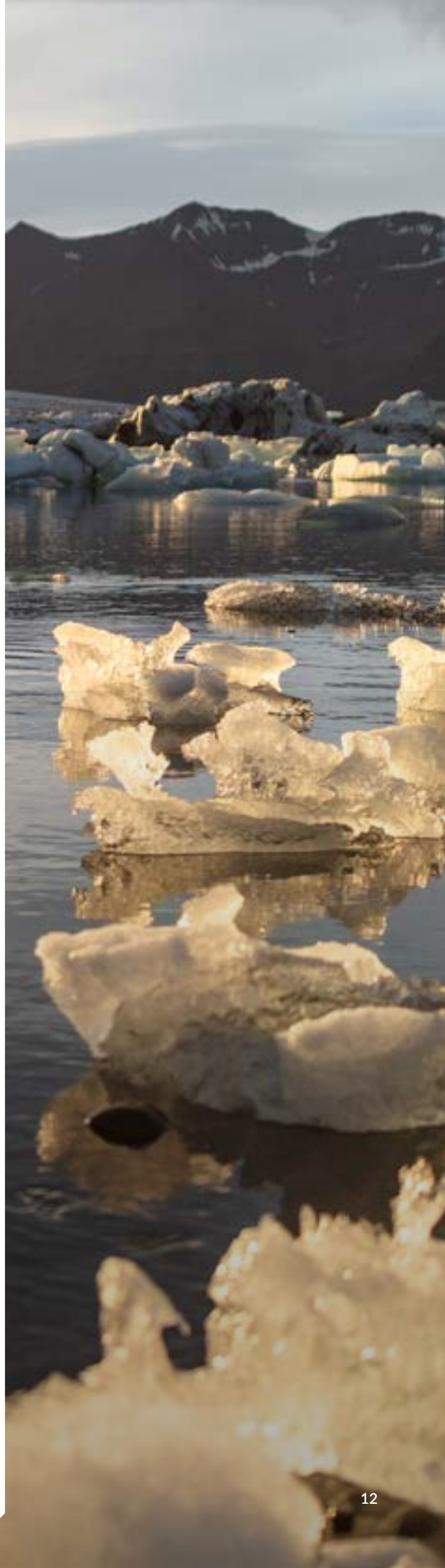
Next, organisations should conduct a thorough analysis of their value chain and core business activities in the context of climate risks to understand which parts of their value chain could be impacted by the identified climate risk drivers. This analysis should encompass all stages of production, from raw material sourcing to delivery of the final product. For example:

- **Supplier relationships:** Evaluate whether any suppliers are subject to climate risks due to their geographical location and potential exposure to extreme weather events and if any climate regulations apply to them specifically.
- **Production processes:** Determine if climate change could affect manufacturing processes, for example energy consumption and resource availability.
- **Distribution channels:** Analyse the logistics involved in transporting goods and whether disruptions from climate events could impact delivery timelines and costs.
- **Customer interactions:** Understand how climate risks could influence consumer behaviour and demand for products or services.

Step 3: Understand the business environment

Organizations should also conduct an assessment of the broader business environment, focusing on various external factors that can influence their response to climate risks. This includes:

- **Policy environment:** Examine existing and emerging regulations related to climate change, such as carbon pricing, emissions trading schemes, and sustainability reporting requirements. Understanding these policies helps anticipate compliance costs and adjust strategies accordingly.
- **Technological landscape:** Stay informed about advancements in clean technologies, renewable energy sources, and innovations that can mitigate climate risks. For instance, the adoption of energy-efficient technologies can reduce vulnerability to energy supply disruptions.
- **Market dynamics:** Be aware of shifts in market conditions that may arise from climate change, including changes in supply and demand, competitive pressures, and the emergence of new business models focused on sustainability. Organizations should consider how these dynamics might influence their market position and profitability.
- **Consumer trends:** Monitor evolving consumer preferences toward sustainable products and services. Understanding these trends can help organisations align their offerings with market demands, enhancing resilience and competitiveness.



Step 4: Identify relevant risks

The next step is to map the climate risk drivers identified in Step 1 to the supply chain and business environment identified in Steps 2 and 3, to ensure that only those risks with meaningful potential impacts are prioritised for deeper analysis and management. This exercise contextualises each identified climate risk driver within the organization's specific operations, supply chains, and geographic locations and ensures that the assessment that follows is tailored to the organization's unique context, filtering out less relevant risks. For instance, oceanic risks may be deprioritised for a manufacturing business operating inland (unless they affect portions of the supply chain). A retailer targeting eco-conscious consumers may focus on transition risks, such as market shifts and reputational challenges, more than on raw material sourcing risks.

This refinement process considers:

- **Relevance to operations:** How directly the risk driver impacts specific activities within the value chain. For example, can droughts or floods affect availability of agricultural inputs to products?
- **Geographic specificity:** Whether the risk driver is relevant to the organization's operational or supply chain locations (e.g., coastal flooding for facilities near shorelines).
- **Magnitude of potential impact:** The severity of the risk's effect on business continuity, financial performance or strategic objectives. For example, can energy grid disruption cause manufacturing delays?
- **Interdependencies:** How the risk interacts with other non-financial risks, such as reputational or market risks. For example, can abrupt shifts in supply or quality of goods cause brand and reputational damage?

Oceanic risks may be deprioritised for a manufacturing business operating inland. A retailer targeting eco-conscious consumers may focus on transition risks, such as market shifts and reputational challenges.

Example structure for value chain mapping

Value chain stage	Description of activities	Identified climate risk driver	Vulnerability assessment	Potential impact on objectives
Raw material sourcing	Procurement of agricultural inputs	Droughts, floods, temperature rise	High (crop yield variability)	Supply shortages, cost increases
Manufacturing/ processing	Production and assembly	Energy supply disruption, heatwaves	Medium (energy dependency)	Production delays, higher costs
Logistics & distribution	Transportation of goods	Extreme weather, flooding	High (route exposure)	Delivery delays, increased costs
Sales & customer service	Product delivery and support	Market shifts, reputational risks	Medium (consumer trends)	Demand changes, brand impact

The output of this exercise is typically an exhaustive list of business-relevant climate risks tied to each stage of operations, serving as the foundation for a systematic assessment of their likelihood and impact, which is the next step.

Step 5: Execute a climate risk assessment

Organizations can employ both qualitative and quantitative approaches to conduct a comprehensive climate risk assessment, leveraging the strengths of each method to gain valuable insights.

A **qualitative approach** is particularly useful in situations where data is limited or when exploring complex and uncertain future scenarios. This method relies on expert judgement, experience, and contextual knowledge to evaluate risks, making it ideal for identifying and understanding risks that are difficult to quantify. For example, an organisation might use a qualitative approach to assess the potential reputational impacts of failing to meet stakeholder expectations for sustainability or to explore the cascading effects of interconnected risks within its value chain.

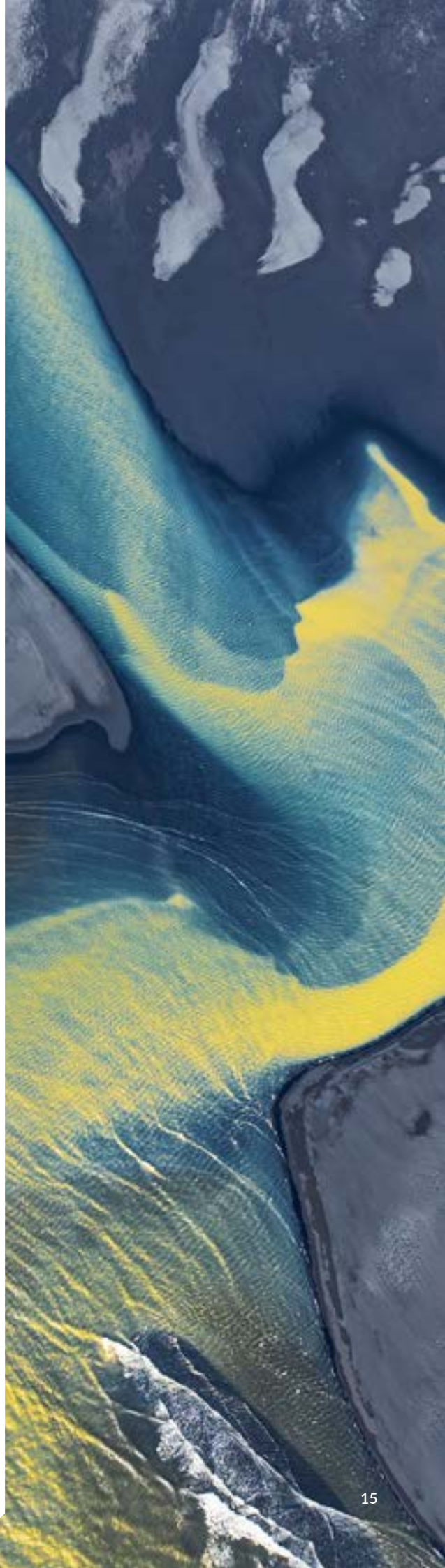
In contrast, a **quantitative approach** uses numerical data, models, and statistical techniques to measure the likelihood and magnitude of climate-related risks. This method enables more precise prioritisation and supports data-driven decision-making. Quantitative assessments are particularly valuable when detailed risk metrics are required for financial or operational planning. For instance, an organisation with access to robust climate data may use quantitative analysis to model the financial costs of extreme weather events, such as floods or hurricanes, on its infrastructure and supply chains.

Both approaches can be integrated into a hybrid assessment strategy, leveraging the strengths of each method to develop a comprehensive understanding of climate risks. Combining qualitative insights with quantitative data ensures that assessments are both grounded in expert knowledge and supported by measurable evidence, ultimately leading to more informed strategic decisions.

Assessing climate risks using the qualitative method

A fundamental first step in conducting a qualitative climate risk assessment is the selection of appropriate scenarios, which provide the foundation for Analysing the risks and their impacts. The chosen scenario should align with the list of risks derived in the previous step. For instance, a coastal tourism company should focus on scenarios related to rising sea levels and increased storm frequency, while an agricultural business should prioritise scenarios involving changing precipitation patterns and temperature fluctuations.

Defining an appropriate time horizon, whether short-term (1-3 years) or long-term (10-30 years), is essential for capturing both immediate risks and more profound future changes. For example, a short-term scenario might explore the immediate impacts of a severe drought on crop yields, whereas a long-term scenario could assess the gradual effects of climate change on soil health and agricultural productivity over decades.



Scenarios should be based on clear and understandable descriptions that highlight key climatic shifts without necessitating complex quantitative models. Considering different emission pathways, such as high-, medium- and low-emissions scenarios, helps encompass a range of possible futures, enhancing the robustness of the analysis.

For example, a high-emission scenario could project significant increases in global temperatures leading to more frequent heatwaves, while a low-emission scenario might envision a successful transition to renewable energy sources, resulting in stabilised climate conditions.

Incorporating input from stakeholders and experts further refines scenario selection by integrating regional specifics and local knowledge. For instance, engaging local farmers in discussions about climate impacts can provide insights into unique vulnerabilities and adaptation strategies relevant to their specific crops and practices. Given the inherent uncertainties in future climate trajectories, designing flexible and adaptable scenarios allows organisations to explore multiple potential outcomes, providing a comprehensive basis for risk evaluation. However, it is crucial that scenarios remain realistic and relevant, capable of supporting informed decision-making and effective risk management strategies.

Once scenarios are established, climate risks are evaluated in structured workshops facilitated by experts. These sessions leverage the specialised knowledge of subject-matter experts from various departments to ensure a comprehensive analysis. Facilitators guide discussions to frame each risk within the organization's operational landscape and strategic objectives, fostering active participation and critical thinking.

During these workshops, each previously identified climate risk is examined across the selected future scenarios and multiple time horizons to explore both immediate and future impacts. For example, the risk of supply chain disruptions due to extreme weather events may be assessed for its immediate effects on inventory levels (short-term), its impact on supplier relationships (medium-term), and the long-term implications for market competitiveness.

The results of this qualitative assessment can be documented and visualised using charts or matrices, to support strategic planning and resource allocation. By employing this structured approach, organisations can build a solid foundation for understanding and managing climate-related risks in a rapidly changing environment.

Quantitative assessment of climate risks

While qualitative assessments provide valuable insights into potential climate risks through expert judgement and scenario analysis, a quantitative approach offers a complementary perspective by measuring the likelihood and magnitude of these risks using numerical data and statistical models. This method enables organisations to develop more precise estimates of potential impacts, which can be used alone or combined with qualitative assessments.

A robust quantitative assessment begins with the gathering of relevant data, which can be external or internal. External data examples are historical climate records, insurance loss statistics and hazard maps, while examples of internal data are asset valuations, operational metrics and other existing datasets. The utilisation of artificial intelligence (AI) technologies, such as machine learning algorithms, enhances the data gathering process by automating the collection and integration of diverse data sources. These AI-driven insights serve as critical inputs for various modelling techniques, including probabilistic risk models and financial impact analyses. By applying these advanced tools, organisations can estimate the probability of specific climate-related events, such as flooding, heatwaves or supply chain disruptions, and quantify their potential consequences in terms of costs, downtime and other key performance indicators.

A core component of quantitative assessment is the development of risk metrics that combine both the likelihood and severity of each identified hazard. A risk score can then be calculated by multiplying the probability of an event by its estimated impact, resulting in a prioritised list of risks based on their estimated value. This structured approach allows organisations to compare different risks objectively and identify those requiring immediate attention. AI can play a pivotal role in this aspect as well, by analysing vast datasets to identify patterns and correlations that may not be immediately apparent. For example, machine learning models can refine risk scoring methods by continuously updating the probabilities of events based on new data, enhancing predictive accuracy.

Furthermore, sensitivity analyses can be conducted to understand how uncertainties in input data influence risk estimates. This helps in assessing the robustness of results and identifying areas where additional data collection or research may be necessary.

Following the completion of qualitative and quantitative analyses, which can be combined for more comprehensive results, risks can then be categorised based on their severity into two kinds:

- Not material: Risks with minimal potential impact that warrant monitoring over time.
- Material: Risks with substantial potential impacts requiring urgent mitigation strategies.

Example of climate risk scenario assessment results

Time horizons	Short term (1-3 year)		Medium term (5-10 years)		Long term (>10 years)	
Scenario	Hothouse world	Disorderly Scenario	Hothouse world	Disorderly Scenario	Hothouse world	Disorderly Scenario
Risk categories						
Supply chain disruption			Material		Material	
Physical asset damage					Material	
Energy price volatility	Material	Material	Material	Material		
Market demand shift			Material	Material	Material	Material
Regulatory & policy change			Material	Material	Material	Material

Not material Material

The results showcase that the assessed material risks have the potential for significant negative outcomes that could affect the organization's financial performance, operations, reputation or long-term strategy. These risks typically exhibit high probability or high impact (or both) across one or more scenarios and time horizons, and they warrant prioritised attention, robust controls and contingency planning.

The assessment approach is intentionally developed to be as simple as possible while maintaining effectiveness. This ensures ease of implementation and clarity in identifying material risks. The approach is inherently flexible and can be readily adapted to meet evolving regulatory requirements, such as alignment with the double materiality assessment (DMA) and full compliance with the CSRD.

Risk appetite and operational resilience

With the climate risk assessment completed and material risks identified, organisations must take deliberate and strategic actions to manage these risks effectively and embed resilience into their operations to safeguard long-term stability.

The first priority is to evaluate the identified risks against the organization's defined risk appetite, which outlines the types and levels of risks the company is willing to accept in pursuit of its objectives. By aligning the identified climate risks with this risk framework, organisations can see which risks exceed their tolerance thresholds or pose the greatest threat to operational continuity, financial performance and strategic goals.

With climate risks prioritised against the risk appetite framework, organisations should develop targeted mitigation strategies. These strategies may include strengthening infrastructure to withstand extreme weather events, diversifying supply chains to reduce dependency on vulnerable regions, or adopting more sustainable technologies and processes.

To ensure these risks are managed holistically, organisations need to integrate climate risk considerations into their broader business planning processes, the way they integrate other, non-climate-related risks. This integration should influence key decisions related to capital investments, product development, operational adjustments, and supply chain management. By embedding climate risk into every level of decision-making, organisations can ensure that climate resilience becomes a core component of operational resilience.

Moving forward: Integrating climate risk assessment into risk management frameworks

The most efficient and holistic way to manage climate risk on an ongoing basis is to integrate climate risk assessments into the overall risk management of the organization. This facilitates a comprehensive understanding of how climate impacts intersect with other risk types, enhances prioritisation and resource allocation across different areas, and ensures consistency in risk reporting.

Integrating climate risks into existing frameworks and governance structures can also streamline compliance efforts by aligning with existing reporting standards embedded in these structures while reinforcing the idea that climate risk is subject to proven governance, risk management, and internal control principles, such as COSO's internal controls over sustainability reporting (ICSR). This delivers a mature, familiar structure for governing climate risk and enables organisations to weave climate considerations into their risk universe and decision-making processes more effectively.

Moreover, incorporating climate risks into the non-financial risk management (NFRM) framework fosters cross-departmental collaboration, allowing teams from sustainability, operations, finance and compliance to work together more effectively. This collaborative approach encourages innovative solutions that address multiple risks simultaneously and promotes a culture of shared responsibility for risk mitigation.

Organizations that successfully embed climate considerations within their broader risk management strategies often gain a competitive edge, including access to green financing options and incentives tied to sustainable development goals.

> Ultimately, aligning climate risks with the company's risk universe enriches the overall risk management capabilities and strengthens resilience against future uncertainties.
>
> Ellen Holder,
> Managing Director,
> Sustainability

Conclusion

Integrating climate risk into the heart of business strategy means going beyond compliance and reporting. It requires the adoption of best practises from the financial sector, the alignment with evolving regulatory standards such as the EU Taxonomy and CSRD, and the development of resilient infrastructure and robust business continuity plans. These measures are increasingly becoming prerequisites for securing favourable financing terms, as banks and investors now prioritise companies that can demonstrate operational resilience and proactive risk management.

Building resilience across facilities and supply chains is essential to mitigate the risk of climate-related disruptions. Organizations that invest in adaptive infrastructure, contingency planning, and scenario-based risk assessments will be better positioned to withstand environmental shocks.

Equally important is fostering a culture of sustainability throughout the organization. By embedding sustainability and resilience values into corporate culture, companies encourage proactive risk management and innovation. This cultural transformation is vital for maintaining competitiveness and meeting the rising expectations of investors and stakeholders, who increasingly view sustainability and responsible governance as central to long-term value creation.

How Protiviti can help

Protiviti delivers end-to-end support that combines risk management expertise, robust methodologies, and practical implementation. We offer tailored risk scoping and scenario design aligned with the company's industry, operations, and strategic objectives, using both qualitative and quantitative analysis. Our professionals facilitate crossfunctional workshops, assess climate data, and help build or refine risk metrics, dashboards and governance frameworks. We can assist with data collection, model development, sensitivity analyses, and scenario testing across short- and long-term horizons, ensuring regulatory alignment and ESG reporting readiness. Additionally, Protiviti supports action planning by prioritising risks, designing targeted mitigation and resilience measures, and embedding ongoing monitoring, assurance and continuous improvement processes into the organization's risk management program.

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