

With the Stockholm Environment
Institute and in collaboration with PwC



Taking Stock of Business Efforts to Adapt to Climate Change

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Foreword



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The first Global Stocktake (GST) to monitor and evaluate the collective progress being made to achieve the goals of the Paris Agreement takes place at COP28. The GST represents an opportunity for countries and stakeholders to see where and how they are collectively making progress towards meeting their goals – in areas such as climate change mitigation, adaptation and finance – and where they are not. As such it is an opportunity to course-correct and identify gaps in delivery, as well as find ways to work together to agree on solutions and chart a better course for the future.

Businesses are – and need to be – integral to society's efforts to respond and adapt to climate change. So it is critically important that their contributions to the climate change adaptation agenda are fully captured. To support and complement the GST process, the World Economic Forum and Stockholm Environment Institute (SEI), with the support of PwC, have collaborated to take stock of business action on adaptation. This paper describes the actions that large global businesses are taking on adaptation, what is driving these

actions and the barriers they face to doing more. It was developed via a survey of 30 Forbes 2000 businesses, complemented by in-depth follow-up interviews and discussions with the wider World Economic Forum climate adaptation community.

Our research finds that businesses are doing more for adaptation than is acknowledged, but also less than they could. The barriers companies face to doing more are addressable, but this requires working in concert with the public sector and civil society to ensure that efforts can be scaled up and sustained.

Based on these insights, this white paper provides specific recommendations for action. As the report was developed to support the COP28 process, these recommendations seek to engage governments and the international community as well as businesses. The World Economic Forum will work together with all stakeholders on these recommendations to foster more public-private dialogue and build action-orientated partnerships that can strengthen community resilience in the face of new climate realities.

Executive summary

Collaboration between businesses and governments can align climate change adaptation more effectively with society's expectations and global needs.

In the international dialogue on adaptation there are two narratives about the role of business. One is that businesses are doing very little on climate change adaptation. A related and less well-established narrative is that businesses should be playing a major role in adaptation.

Most governments still do not publicly articulate a role for business in adaptation. However those that do suggest that the role should be large. These governments are growing in number. The role they envision for the private sector focuses overwhelmingly on finance, but also other areas such as product and service innovation and on managing transboundary climate risks via supply chains.

Each of these two narratives is problematic in its own way. The first narrative may not give the full picture, given that businesses may be taking action to advance adaptation in ways that do not involve providing tracked finance, for example. The second narrative is underdeveloped. It is not clear that the roles being envisaged for business align with what businesses are either willing or potentially able to do. Both need a reality check. Which actions are businesses currently taking on adaptation – whether or not they are referred to as adaptation or reported as such? What is driving these actions? What barriers do businesses face to doing more?

This white paper aims to answer these questions. It also offers suggestions for how governments and the international community can work to facilitate greater business action on adaptation, in ways that align with public-sector expectations and global needs.

This report draws on a survey of 30 large global businesses which shows that most are exploring adaptation by focusing on climate risk assessments, opportunity scanning, or community projects. About half of respondents are taking more substantial action, but not necessarily in the way the international community would expect or need. Mostly they are developing opportunities – either to improve efficiencies, create value via products and services, or maximize other sustainability outcomes. Only a minority are investing significantly in adaptation projects that build their own resilience or that of the communities in which they operate.

Many businesses still do not see physical climate impacts as a significant risk. This is mostly because near-term extreme weather events are hard to predict and can be insured against, while longer-term permanent changes to climate conditions may be seen as falling outside current planning timeframes. Additionally, businesses generally do not fully assess the risk to their value chains of changing climate conditions, focusing instead mainly on the risks to their own operations.

Consequently, many businesses find it difficult to make a strong business case for large adaptation investments. Other challenges include the availability of accurate data and climate models, as well as difficulty in accessing the broader mix of skills and collaborations needed to develop and execute successful adaptation projects. As a result, most businesses are not prioritizing adaptation.

Governments and international actors that want to catalyse business action on adaptation can pursue several approaches, as follows:

1. Enhance knowledge of climate risks and opportunities

International organizations, think tanks and governments can help businesses enhance their knowledge of climate risks and adaptation options through the exchange of data, tools and skills. The public sector and civil society could facilitate collaborative research, development and innovation by identifying growing adaptation challenges that could be of interest to businesses.

2. Make climate risk assessment and disclosures the norm

International climate and sustainability reporting initiatives have played a central role in getting the business community to focus on adaptation. One approach is to develop common, standardized approaches to risk assessment and disclosure, which provide guidance to businesses, enable comparisons among peers and allow for businesses to receive recognition. Another approach is to continue the trend towards mandatory disclosures, although this is best done in alignment with existing disclosure frameworks and in consultation with business.

3. Foster collaborations

Collaborations proliferate in the mitigation domain, while in adaptation they remain nascent. Collaborations – among businesses operating in the same geography or sector that face common risks, between businesses and their suppliers, or between peers, policy-makers and civil society – can help broker initiatives such as cost-sharing or de-risking agreements that help accelerate the flow of finance to adaptation and reduce the risk of maladaptation. Think tanks, international organizations, trade groups and governments can help shape these collaborations and send the signal that adaptation is as important as mitigation.

4. Engage in stronger public-private dialogue

Beyond these actions, this report calls for public-private dialogue on how to create a conducive enabling environment for private-sector action on adaptation. The goal of such dialogue is to create a set of agreements on the roles of business and government. This can make collaboration easier overall. Since adaptation is both a global and a local challenge, this dialogue should happen at international, national and local levels.

1

Businesses and climate change adaptation

Many governments see a major role for businesses in adaptation, primarily as providers of finance. However, most businesses take a different view and do not yet treat adaptation as a high priority.

1.1 The impact of extreme weather and climate variability on economic losses

🗣️ **Global economic losses from extreme weather events leading to food and water shocks could total \$5 trillion over a five year period.**

In the first eight months of 2023, there were 24 weather-related disasters in the United States that caused over a billion dollars in damage – on average more than one every two weeks. In the 1980s there averaged just one such event every four months.¹ Globally, economic damage from extreme weather events has increased seven-fold since the 1970s.² A recent study by Lloyd's suggests that global economic losses from extreme weather events leading to food and water shocks could total \$5 trillion over a five year period.³

Extreme weather events can damage companies' assets, affect their employees and disrupt operations. According to estimates from the International Labour Organization, under a 1.5°C warming scenario, heat stress could lead to the loss of working hours equivalent to 80 million full-time jobs globally by 2030. Southern Asia and Western Africa are expected to be the worst affected, contributing to around 43 million and 9 million full-time jobs respectively.⁴ In India, the potential income loss to the services, manufacturing, agriculture and construction sectors in 2021 from reductions in labour productivity due to extreme heat was estimated at 5.4% of GDP.⁵ In the US,

flood-related structural damage to retail, office and multi-unit residential properties is estimated to cost over \$13.5 billion annually.⁶

Business losses from climate change are not limited to the impacts of extreme events. Climate variability also plays an important role. In agriculture, variability in temperature and rainfall accounts for 30%–50% of the variability in cereal yields, meaning that as weather gets less predictable so do yields. This creates costs that range from crop losses to changes in agricultural trade flows.⁷ Outside of agriculture, examples of this trend can be seen in the changing demand for climate-related goods and services – for example, cooling appliance makers are finding it difficult to plan their inventory due to unpredictable weather trends.⁸

Businesses can also be affected by climate change impacts along their value chains. These may be transboundary, meaning that climate events in one part of the world affect businesses in other regions. For example, in 2022, floods in central China that submerged large parts of a major economic and transport hub threatened global supply chains for goods ranging from cars and electronics to pigs, peanuts and coal.⁹

1.2 How governments perceive the role of businesses in adaptation

In addition to facing direct threats from climate change, businesses now must respond to emerging government expectations for them to act. While most governments do not yet articulate

the role of the private sector in addressing adaptation, many do. Of those that do, most see a major role for businesses, primarily as a provider of financial resources.

To give one example, the US's National Climate Resilience Framework envisages federal agencies working with the private sector to expand financing for climate resilience. Mobilizing private capital is one of the three pillars of the President's Emergency Plan for Adaptation and Resilience (PREPARE), which commits to mobilizing \$1 billion in public and private finance for climate-resilient water, sanitation and health (WASH) services. It also aims to facilitate increased private sector investment to advance adaptation and resilience in climate-vulnerable partner countries.¹⁰

A review of National Adaptation Plans (NAPs) submitted to the UN's Framework Convention on Climate Change (UNFCCC) by developing and Least Developed Countries (LDCs) shows that many LDCs also consider the private sector as a source of financing for implementing their adaptation plans. Some of these NAPs explicitly mention provision of capital by the private sector, while others discuss leveraging corporate social responsibility commitments.¹¹

Beyond finance, a few governments see a role for business in innovation, particularly as providers of adaptation goods and services.¹² Bhutan's NAP talks about how businesses can supply adaptation

services and products on a commercial basis.¹³ Bangladesh discusses working with companies to develop business models in the water sector.¹⁴

Some governments articulate a role for business in building the resilience of their operations and supply chains to climate risks. This is because international trade along global value chains is a principal vector for transboundary climate risks. For example, the United Kingdom's recently launched Third National Adaptation Programme (NAP3) assigns to private businesses the responsibility of investing in the resilience of supply chains, including the overseas component.¹⁵

Finally, it is important to note that very few governments outline how they plan to support businesses in fulfilling the roles expected of them. The United Kingdom again is an exception here, with its NAP3 describing the role of government in ensuring that businesses have the information they need and a constructive regulatory environment to support them in this process. NAP3 also commits the government to helping address climate risks to business and industry through a combination of macro-economic policy, investment in resilience, evidence gathering and business engagement.¹⁶

1.3 A business framework for climate adaptation

“ Most businesses are only just starting on their adaptation journey and do not yet treat adaptation as a high priority.

Businesses themselves tend to see their role differently from how governments see it. Firstly, most businesses are only just starting on their adaptation journey and do not yet treat adaptation as a high priority. Research from S&P Global shows that just one in five companies has a plan to adapt to the physical impacts of climate change, and of those only 35% have either begun implementing this plan or expect to do so within the next ten years.¹⁷

Those businesses that are looking closely at adaptation tend to focus primarily on reducing or managing their own direct exposure to climate risk, so as to ensure business continuity. Consequently, they frame their efforts using terms such as “business resilience”, “climate risk management” or “business continuity planning”.¹⁸

Given uncertainty around the role of business in adaptation, in January 2023 the World Economic Forum in collaboration with PwC published its white paper Accelerating Business Action on Climate Change Adaptation. The report presented a climate adaptation framework which illustrates the role businesses can play (see Figure 1):¹⁹

- Businesses should focus on building their own resilience to climate impacts, while their efforts should also reach beyond immediate operations to their value chains and the communities connected to them.

- Businesses can capture gains by providing the goods and services needed for adaptation, finding opportunities for cost savings and developing mitigation co-benefits.
- Businesses can strategically collaborate with other stakeholders towards reshaping systems on which they depend and which will need to change in the face of climate impacts.

This framework – discussed at greater length in the next chapter – represents a broader perspective on adaptation than the one currently driving most corporate action, and it provides an approach for businesses to avoid losses, capture gains and shape important systemic outcomes collaboratively with partners.

A broader perspective is necessary to avoid the maladaptation that could result from focusing exclusively on ensuring business continuity.²⁰ Focusing solely on building operational resilience could, for example, lead to investments that redirect risks towards vulnerable communities, such as flood protection schemes that uniquely protect a particular business asset. Similarly, it may seem to a business that the best climate risk management strategy is exiting operations or discontinuing suppliers from a particular market or geography. This can have a huge adverse knock-on effect on the economy of that region in terms

“ A broader perspective is necessary to avoid the maladaptation that could result from focusing exclusively on ensuring business continuity.

of jobs and livelihoods and add to the vulnerability of local communities to climate impacts. This can exacerbate the sorts of transboundary risks mentioned earlier and rebound back on global businesses in myriad ways.

Recent research shows evidence of firms beginning to take such actions. Some are starting to terminate existing supplier relationships to favour replacement suppliers with lower expected climate-risk exposure.²¹ This means that the time to engage businesses more deeply in adaptation is now, before such maladaptive practices become widespread.



1.4 Why a business stocktake on adaptation is important

“ The Sharm El-Sheikh Adaptation Agenda includes a goal for 2,000 of the world’s largest companies to develop actionable adaptation plans by 2030.

Engaging business in adaptation is a clear priority for the international community. This was reflected in the launch at COP27 of the Sharm El-Sheikh Adaptation Agenda, which includes a goal for 2,000 of the world’s largest companies to develop actionable adaptation plans by 2030.²² Achieving this goal and scaling up business efforts require a clear understanding of current business action on adaptation and the challenges businesses face in playing a larger role.

This paper aims to contribute towards that clearer understanding. Based on a survey of 30 companies and in-depth interviews, Chapter 2 presents a summary of current business actions on adaptation. Chapter 3 focuses on barriers companies face to doing more. Chapter 4 then develops recommendations for governments and the international community to engage businesses in light of these findings.

2

Current efforts by businesses on adaptation

A survey conducted for this report reveals that while less than a third of companies are addressing physical climate risks to their business, two-thirds have identified opportunities in climate adaptation.




This chapter captures the efforts that businesses are making under the three pillars of the climate adaptation framework presented in our January 2023 white paper [Accelerating Business Action on Climate Change Adaptation](#) (see Figure 1):

- **Pillar 1: Enhance resilience** – so that operations and value chains that can not only adapt to but thrive in the face of current and future climate change impacts.
- **Pillar 2: Capitalize on opportunities** related to new markets for adaptation-related goods and services, as well as opportunities to achieve greater efficiency and sustainability.

- **Pillar 3: Shape collaborative outcomes**, by engaging with governments, communities and other stakeholders in actions to boost adaptation to the cascading effects of climate change.

The framework also states that businesses should take **enabling measures** (e.g. establishing a climate strategy, mainstreaming climate risk in decision-making, submitting comprehensive climate disclosures) to build an organizational environment that enables more effective progress on the core actions under each pillar above.

FIGURE 1 Climate adaptation framework for businesses

Business case	Avoid economic loss	Increase revenue, cost savings and sustainability	Protect communities and ecosystems
	↓	↓	↓
Pillars	 Enhance resilience	 Capitalize on opportunities	 Shape collaborative outcomes
	↓	↓	↓
Core actions	<ul style="list-style-type: none"> - Assess the impacts of climate risks on businesses and act to adapt and build resilience - Work with suppliers and communities connected to the value chain to enhance business resilience 	<ul style="list-style-type: none"> - Leverage products, services and business models that help businesses, communities and ecosystems adapt and build resilience - Pursue adaptation opportunities that contribute to efficiency, sustainability and climate change mitigation 	<ul style="list-style-type: none"> - Participate in multistakeholder efforts that promote action on climate change adaptation - Deliver transformative projects to build community and ecosystem resilience
Enabling measures by business – to support core actions above	<ul style="list-style-type: none"> - Establish a climate strategy that integrates climate change adaptation and net-zero transformation - Mainstream climate risk considerations into business decision-making - Make comprehensive and transparent climate disclosures 		

2.1 Pillar 1: Enhance resilience

“ Only 33% of respondents said they are currently working on addressing physical climate risks.

Key finding 1: Global businesses are assessing the physical climate risk exposure in their operations.

Among the 30 respondents, 80% said they have conducted risk assessments to identify physical climate risks to their business. Of these, all reported that their risk assessments cover existing operations while around half said they cover new operations.

Key finding 2: Only about half of businesses identify any physical risks that they deem “material.”

Materiality refers to having significant financial or strategic impact; 43% of businesses surveyed found physical climate risks that they deem material.

Key finding 3: Some businesses report current efforts to build resilience to physical climate risks.

Only 33% of respondents said they are currently working on addressing physical climate risks. Half of these have developed or are in the process of developing a specific company-wide adaptation plan, while the remaining half have plans developed or being developed by different business functions.

Key finding 4: Businesses are yet to focus on adaptation in their value chains.

Of the 80% of respondents who conducted climate risk assessments of their existing operations, half said they have also conducted risk assessments of upstream value chain activities. However, fewer than one in ten businesses are moving beyond assessments to work with value chain partners or the communities connected to them.

Key finding 5: Business strategies for responding to climate risks are diverse.

Of the 33% of respondents who said they are currently working on addressing physical climate risks, all said they adopt risk transfer measures (e.g. insurance, derivatives). Similarly, all of them are implementing one or more risk reduction measures (e.g. new technology adoption, resilient inputs, process changes). Some of these businesses are diversifying their product portfolios (60%) or pursuing market diversification strategies (60%).

Key finding 6: Businesses may be pursuing maladaptive measures to mitigate climate risks.

Thirteen percent of survey respondents said they are relocating either their operations or their supply chains away from certain geographies due to physical climate risks.

2.2 Pillar 2: Capitalize on opportunities

“ 67% of respondents said they had identified opportunities arising from physical climate risks and measures to address them.

Key finding 1: Many businesses have identified market opportunities arising from adaptation.

Two-thirds of respondents (67%) said they had identified opportunities arising from physical climate risks and measures to address them. These opportunities could entail sales of products and services, cost savings and efficiencies, or improvements on other sustainability outcomes.

Key finding 2: Visionary businesses have started working towards capitalizing on adaptation-related market opportunities.

More than half of respondents are working to develop opportunities arising from physical climate risks and measures to address them. This means that a very large share of businesses that find opportunities are acting on them (over 80%).

Key finding 3: The most frequently explored opportunity is revenue generation from adaptation-related products and services.

Nearly half (43%) of respondents said they are working on actions to explore opportunities in products and services. These actions include developing new use cases for existing products/services, investing in research, development and innovation, and collaborating with other businesses and stakeholders for new product development and solution deployment. Meanwhile, 23% said they are working on adaptation interventions that can help them achieve cost savings, sustainability and climate change mitigation goals.

2.3 Pillar 3: Shape collaborative outcomes

“ 87% respondents recognize that they have a role to play in protecting communities and ecosystems from physical climate risks, but only 13% said they have committed financial resources for such initiatives in the next five years.

Key finding 1: Businesses believe they have a role to play in building the resilience of communities and ecosystems.

Nearly nine out of 10 (87%) respondents recognize they have a role to play in protecting communities and ecosystems from physical climate risks, while the great majority (83%) said they are part of multistakeholder efforts on adaptation.

Key finding 2: Most businesses are engaged in adaptation activities at community level.

More than half (57%) of respondents are designing, investing in and implementing community adaptation and resilience projects. Two-thirds (67%)

of companies surveyed are working with other businesses and industry associations, while 60% are engaging with non-governmental stakeholders, such as community and Indigenous leaders, academia and development agencies.

Key finding 3: Only a few businesses are ambitious in their efforts to support community and ecosystem resilience.

However, just 33% of respondents have made commitments or set goals and targets related to protecting communities and ecosystems from the impacts of climate change, while only 13% said they have committed financial resources for such initiatives in the next five years.

2.4 Enabling measures to support core actions

“ Very few respondents said their businesses have developed a climate policy that integrates mitigation and adaptation.

Key finding 1: The adaptation agenda mostly sits with sustainability teams.

Although adaptation touches strategy, risk, finance and other domains, most respondents said that their sustainability team or environmental, social and governance (ESG) function is responsible for adaptation-related activities. There is also a trend towards establishing a board-level climate governance mechanism. However, roles and responsibilities related to adaptation have not been

assigned at all management levels, and very few respondents have provided management incentives.

Key finding 2: Adaptation is not well integrated into businesses climate strategies.

While most respondents said they have integrated climate risk considerations into their business decision-making systems and processes, very few of them said their businesses have developed a climate policy that integrates mitigation and adaptation.

2.5 Summary of business progress on adaptation

“ A sizeable group of companies is developing adaptation-related business opportunities. This is a poorly understood phenomenon that deserves more attention and support.

Figure 2 presents a summary of progress made by the businesses surveyed for this report in relation to the three pillars of the Forum’s climate adaptation framework.

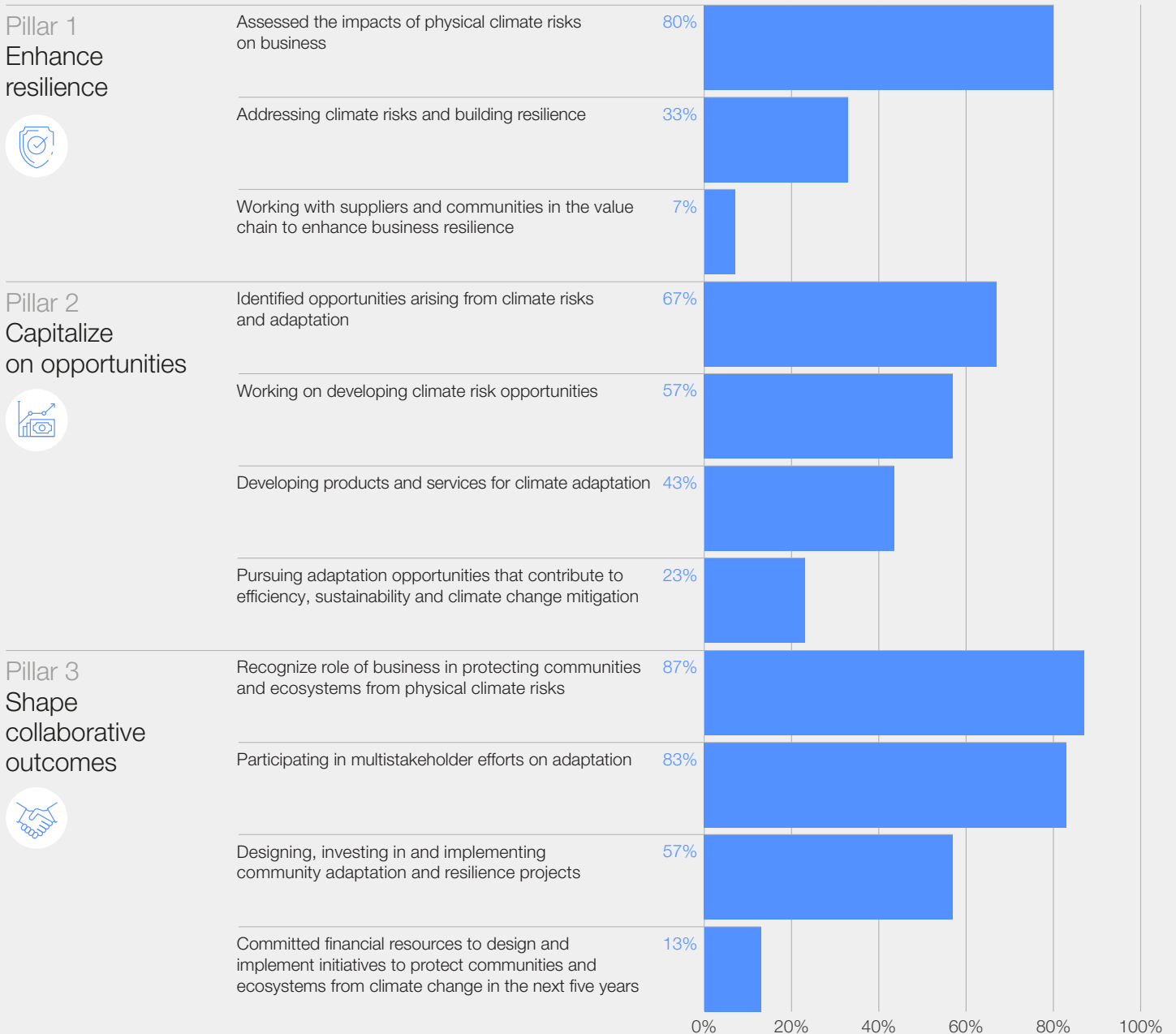
The overall picture to emerge from the survey is one of interested exploration.

Corporate interest in adaptation is clear. Only 20% of respondents said their leadership lacked interest in adaptation. Most companies surveyed are assessing physical climate risks to their operations. Almost all feel a responsibility towards protecting communities and ecosystems from climate impacts.

However, adaptation is also not generally a priority, at least not on a par with mitigation. While 60% of respondents rated climate mitigation as a “very high” priority for their businesses, just 27% rated adaptation as a “very high” priority. This 27% is significant. On the whole, roughly one quarter to one third of surveyed companies are taking significant adaptation action.

Among respondents, there is a sizeable group of companies developing adaptation-related business opportunities. This is a poorly understood phenomenon, to the extent that there are no good global estimates of the size of markets for adaptation-related goods and services. It deserves more attention and support.

FIGURE 2 Business progress against the climate adaptation framework



3

Understanding the drivers and barriers to business action

While companies are working on adaptation to comply with climate risk disclosure commitments, many barriers to business action on adaptation remain.

The findings in Chapter 2 pose several questions. Why do so many businesses that assess climate risks fail to act on mitigating them? What is driving their interest in the first place? This chapter will

explore the drivers and barriers to action that are influencing business behaviour on adaptation, aiming to answer these questions and others.

3.1 Drivers for business action on resilience

While multiple factors contribute to companies' interest in adaptation, a few stand out. Among survey respondents, 33% reported being motivated by the desire to enhance the resilience of the business to physical climate risks. Meanwhile 23% said they wanted to establish themselves as leaders in taking climate action. When asked about their motivations directly, more than one third of respondents reported working on adaptation so as to ensure their commitment to or compliance with existing and emerging climate risk disclosures.

risk that it had not asked before, which made it curious to learn more.

The importance of disclosures in driving action aligns with their popularity. About 4,500 companies from all around the world, including more than 1,800 financial institutions, support the TCFD's recommendations.²⁴ According to the 2023 TCFD Status Report, 62% of companies participating in TCFD report on climate-related risks or opportunities, and the number of companies doing so has increased dramatically since 2020.²⁵

The climate risk disclosure mandates emerging in several jurisdictions across the globe in the past two years have also led to more businesses taking up adaptation as a priority. With the launch by the International Sustainability Standards Board (ISSB) of the International Financial Reporting Standard (IFRS) S2 Climate-related Disclosures, the momentum has increased further and increasing numbers of businesses are now focusing on climate risk and adaptation.

The most commonly conducted adaptation action among survey participants is to perform a climate risk assessment. This is followed closely by "publishing risk disclosures", with 70% publishing reports aligned to the Task Force on Climate-Related Financial Disclosures (TCFD).²³ Furthermore, disclosure requirements and the desire to build resilience to physical climate risk may be linked. In an interview, one respondent said that by developing TCFD-aligned risk disclosures the company asked questions about physical climate

“ One respondent said that by developing TCFD-aligned risk disclosures the company asked questions about physical climate risk that it had not asked before.

3.2 Barriers to business action on resilience

Surveyed businesses identified a number of barriers that inhibit corporate action on adaptation, including the following: physical climate risk is not deemed to be a risk – or it can be managed; human resources

and expertise are lacking; adaptation is costly and the investment case is difficult to make; and the policy landscape offers no incentives for action.



“ By failing to understand adaptation as a risk, not only do businesses limit investments into building their own resilience, they also miss opportunities to provide products and services to help others manage risks.

Physical climate risk is not deemed to be a risk

While 45% of survey respondents said they have identified physical climate risks through their climate risk assessments, they said the risks they identified do not have any significant financial or strategic impact on their business. Some said the likelihood of suffering climate impacts to their operations or value chain was low, while others said simply that the expected magnitude of climate impact did not meet their internal threshold for significance. Businesses gave several reasons for this lack of assessed significance:

- **Time horizons:** 21% of respondents said they think these risks only manifest in the long term, more than 10 years from now. Businesses generally use 3-10 year timeframes for risk management, 1-2 year timeframes for operational and financial planning, and 2-5 year timeframes for strategic and capital planning.²⁶
- **Limitations of climate data:** Available climate models do not provide accurate forecasts of climate events in the near future. Businesses are not able to estimate with certainty the frequency and severity of these events in the timeframes aligned with business processes. Furthermore, the spatial variability of these events is not captured in sufficient detail by existing datasets in many parts of the world.²⁷
- **Limitations of approaches, models and tools used for risk assessment:** Accurately estimating the financial implications of climate impacts is difficult, especially on longer

timescales. Often, the lack of a methodical approach results in an underestimation of financial impacts and the calculated value fails to reach the established materiality threshold.²⁸

- **Scope of climate risk assessments:** Only one respondent said their climate risk assessments cover their upstream and downstream value chain and communities connected to the value chain, in addition to their operations. The limited scope of most assessments could result in an underestimation of climate risk to businesses.

This barrier inhibits action on both Pillar 1 (Enhance resilience) and Pillar 2 (Capitalize on opportunities) of the framework for business action on adaptation. By failing to understand adaptation as a risk, not only do businesses limit investments into building their own resilience, they also miss opportunities to provide products and services to help others manage risks.

Physical climate risk can be managed

Many businesses think the physical impacts of climate change can be managed and therefore do not pose a significant risk. In fact, 87% of survey respondents rated their current level of preparedness related to adaptation as medium to very high. There is a common perception among many businesses that risk can be mitigated or managed by way of risk transfer instruments such as insurance.²⁹ As mentioned in Chapter 2, of the 33% of respondents who said they are currently

“ Half of respondents reported the absence of a conducive policy and regulatory landscape for adaptation investments as a major barrier to action.

working on addressing physical climate risks, all said they adopt risk transfer measures. The most likely near-term climate impacts are generally included in the standard insurance policies that businesses purchase to cover their operations. “Force majeure” clauses in supply chain contracts are considered sufficient tools for climate risk management.³⁰

Human resources and technical expertise are lacking

Insufficient human resources and lack of technical expertise were cited as a barrier by 34% and 31% of respondents respectively. It takes manpower to conduct climate risk assessments and scenario analyses, identify and prioritize appropriate adaptation measures, make a robust investment case, implement the measures, then track and report the progress and effectiveness of those measures.

Most of these tasks are technical in nature and span a diverse range of fields including climate science, risk management, civil engineering, financial analysis and project management. As a result, people who are skilled and experienced in these areas are needed to build a more holistic understanding of climate risks and adaptation. At present, adaptation is mostly managed by ESG or sustainability teams which generally lack the necessary human

resources, both in terms of numbers as well as specific technical skills and experience.

Adaptation is costly and financing is difficult

About 45% of respondents said that the huge investment needs associated with adaptation deter action. A similar number of respondents (41%) said financing adaptation interventions is challenging.

It is clear that some adaptation strategies can be capital intensive (e.g. retrofitting a facility to make it floodproof). It is also true that adaptation costs tend to fall under operational expenses (OpEx), such as the need to increase supplies of buffer stocks or invest in process changes. These factors may result in businesses perceiving adaptation costs to be huge, hard to finance and disproportionate to the risk. This may limit action, in turn limiting demand for adaptation finance, which then makes adaptation finance harder to access.

It is difficult to make the investment case for adaptation

About three-quarters of respondents said it is difficult to quantify the costs and benefits of adaptation



investments in order to make an investment case. Businesses need to persuade financial decision-makers of the need to invest in adaptation. This requires answering two sets of questions:

- First, how do climate impacts affect business today and in the future? What is the potential economic loss?
- Second, which adaptation strategies will help to avoid potential economic loss? What are the costs and benefits of each of those strategies?

As mentioned earlier in this paper, it is not easy to answer the first question due to limitations of climate data and the approaches, models and tools used for risk assessment. Answering the second question is also difficult, for a number of reasons:

- Because adaptation is so specific to the local geography, type of business and nature of risks, businesses struggle with identifying appropriate adaptation strategies and measures.
- There are benefits from adaptation that are not quantifiable in financial terms using traditional approaches.

Consequently, businesses fail to make a robust investment case or secure the buy-in and finance needed to implement adaptation measures.

There is no incentive to act – the policy and regulatory landscape is not conducive

Half of respondents reported the absence of a conducive policy and regulatory landscape for adaptation investments as a major barrier to action. As discussed in Chapter 1, most governments are yet to define their own role in facilitating business action on adaptation, meaning that policies and incentives have not been set up with adaptation in mind.

By contrast, a well-developed ecosystem of policies and incentives that goes beyond governments to include pressure from and recognition by third parties has been established for climate mitigation. Businesses are under significant pressure to act on carbon abatement and they receive accolades for setting emissions-reduction targets aligned with 1.5°C or well below 2°C pathways.

3.3 Analysis of drivers of and barriers to action

“ The adaptation agenda competes for already limited resources and attention with mitigation, which is frequently a CEO-level priority.

Though this chapter has listed and described a diverse set of drivers and barriers that businesses face, it is possible to look at them holistically and see a story beginning to emerge.

The survey has shown that in most companies there is a board-level governance function that looks at climate risk and that responsibility for the adaptation agenda generally lies with sustainability teams. Most boards have a hard time elevating physical climate risk as a top priority. In companies with obviously large and direct exposure to climate risk this can be different, but in general they struggle with the challenges described above around time horizons, data availability, methodological approaches and the availability of risk transfer mechanisms. There may also be an opportunity cost issue, as other risks are deemed clearer and more present – for example, in 2023 this could refer to generative artificial intelligence (AI) and geopolitical instability.

Within sustainability and ESG teams, the adaptation agenda competes for already limited resources and attention with mitigation, which is frequently a CEO-level priority. Adaptation also requires different and, in certain cases, more technical skill sets, which raises barriers related to human resources and expertise. There are sustainability teams that would like to elevate the adaptation issue internally but struggle to

make a solid business case, given the difficulty of articulating business impacts.

The collective result of these issues is that while companies comply with disclosure requirements by assessing risk and establishing the necessary structures internally, adaptation rarely registers as a priority and businesses fail to substantively engage. This outcome in turn creates self-reinforcing consequences: because there is little private-sector appetite to undertake adaptation projects, adaptation finance remains under-developed and expensive; because adaptation is not a priority across the business, it is difficult to engage with value chain partners on the topic as higher priority agendas will drive such highly strategic relationships.

The situation is not helped by the enabling policy environment in most countries. As discussed in Chapter 1, only some governments have set out their expectations for the role of business in adaptation, and even fewer offer policies or incentives to encourage business action on adaptation.

What could governments and the international community do differently? How could they help businesses emerge from the current status quo and make much larger contributions to adaptation, in line with the expectations beginning to emerge in some National Adaptation Plans? This is the subject of Chapter 4.

Meeting the moment: how the public sector can catalyse business action on adaptation

Governments and international organizations can support businesses in adapting to climate change through support with data, reporting, collaborations and dialogue around shaping an enabling environment.

Chapter 1 of this paper detailed the severity and urgency of the climate crisis, while Chapter 2 made clear that, in general, business action on adaptation is limited. Relatively few companies have fully assessed the risks they face directly as well as through their supply chains, or made significant investments to address them. Businesses are also missing out on opportunities to create the products and services the world will need to adapt. And few are partnering with governments to drive the transformation of impacted systems.

It is clear that business action does not yet match the urgent need for adaptation. It is time to act. Governments, businesses, civil society and other organizations all share an interest in preparing for the impacts of climate change, and each can bring different strengths. By collaborating, they can make the most of their respective strengths and accelerate adaptation action.

This chapter identifies approaches for tackling the barriers and scaling-up business actions that governments and international organizations can lead or support.

4.1 Enhance knowledge of climate risks and opportunities

The first step is to actively engage with businesses to help them understand the climate risks and opportunities they face, in the near term and in the coming decades. This is crucial because, as discussed in Chapter 3, most business leaders have a relatively narrow view of climate risks, so they tend to underestimate them. This is not surprising. Given climate risk management is still a new topic for most businesses, they typically lack employees with the required expertise or detailed climate models and approaches to refer to.

However, international organizations, think tanks and, at times, governments often do have these resources. They can help businesses enhance their knowledge of climate science, analytical and planning tools and adaptation options. They can help business leaders understand how climate

science is evolving and highlight the risk of severe business disruption by sharing climate data and co-developing risk assessment approaches and tools.

The public sector and civil society could play particularly important roles in enhancing businesses' awareness of adaptation-related commercial opportunities. They may identify specific needs that a company is well-positioned to meet, such as off-grid solar power solutions in places at high risk of outages. Or they may simply share information about a growing adaptation challenge and invite businesses to come up with ideas for how to address it, perhaps through collaborative research, development and innovation.

Convening business leaders from all parts of the world to discuss climate risks and ways to address

them can help create a sense of urgency and mobilize “first movers” who then become models for their sectors. This has been a successful approach for many international corporate sustainability initiatives, including several that are now tackling adaptation challenges, such as the UN Global Compact Think Lab on Just Transition.³¹

Governments can do this as well, at the national and regional levels, in specific sectors with high exposure

to direct climate risks (e.g. agriculture, water-intensive industries), or in sectors with significant supply-chain risks (e.g. pharmaceuticals).³²

In addition to activating leaders, such efforts can provide valuable support for individuals within companies who already care about adaptation and are trying to make the business case for investing in it. Many such individuals have come forward during the survey and as part of this stocktaking work.

4.2 Make climate risk assessment and disclosures the norm

As discussed in Chapter 3, international climate and sustainability reporting frameworks, such as TCFD, have played a central role in getting businesses to disclose climate data and invest in climate action. By ensuring that climate risk assessment and disclosure becomes an accepted norm, the business community can be galvanized into focusing more on adaptation. One priority is to develop common approaches to risk assessment and disclosure. Standardized frameworks can prove valuable in three ways:

- **Providing guidance:** First, they provide guidance on best practice and which questions to ask to avoid missing important aspects of climate risk. For example, the TCFD recommendations call for businesses to consider risks not only in the short or medium term, but also in the longer term. They call for specific metrics and targets. They also ask how the board and management are engaged in assessing and managing climate risks, pointing to the need for senior leadership to be involved and not just designated sustainability officers.
- **Enabling comparisons:** Second, they enable companies to see how their risk assessments and adaptation strategies compare with those

of their peers. This can help them identify blind spots or missed opportunities. It also enables companies to present clearer information to investors and other stakeholders, who can push businesses towards a higher standard on climate risk management. Governments can work with these stakeholders, particularly investors, to design strategies for maximizing the effectiveness of such initiatives to catalyse further action.

- **Receiving recognition:** Third, they are one of the few ways available for businesses to receive recognition for taking positive measures on adaptation.

The recent trend of governments in mandating climate-related reporting, either directly through developing their own disclosure frameworks or through promoting frameworks such as TCFD, can prove beneficial in accelerating action on adaptation by businesses. However, mandating disclosure is best done in alignment with existing frameworks and in consultation with business. Another approach is to promote the use of climate risk and adaptation information by investors to assess and monitor the short-term performance as well as long-term sustainability of portfolio companies.

4.3 Foster collaborations

As the discussion above makes clear, adaptation is challenging for any business, but particularly difficult when acting alone. Collaborations can help ensure that companies have the knowledge, innovation, resources and financial room to manoeuvre that are required for effective adaptation.

In principle, collaborations can emerge organically, but in practice, they are typically initiated by think

tanks, international organizations, trade groups or sometimes governments. They can be quite narrow – for instance, a government agency might convene leaders within a sector or location to address a specific climate risk of concern, such as supply-chain risks in the pharmaceuticals sector or flood risks in a waterfront district. Or they can engage a broad range of stakeholders over an extended period (see Box 1).

Mitigation-driven coalitions such as LeadIT (the Leadership Group for Industry Transition) can offer useful examples of effective, focused collaborations.³³ Launched by the governments of Sweden and India in 2019, and supported by the World Economic Forum, LeadIT is a collaborative effort to decarbonize heavy industries such as steel and cement. For a successful transition, these sectors need not only new (and still-costly) technologies, but also infrastructure, finance and policies that create a level playing field. LeadIT, which has its secretariat at the Stockholm Environment Institute, fosters collaboration between the public and private sectors, convenes high-level dialogues, provides science-based

tools and expertise, and tracks plans and investments to achieve the partners' shared goal of decarbonization.

Another example is the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, a non-profit research and development centre focused on accelerating decarbonization in the maritime industry.³⁴ Founded in 2020, it now has 53 partners from 20 countries – traditional competitors coalescing around a shared need. Similar collaborations on knowledge-building and innovation could be very valuable in sectors and locations where climate risks are understood, but the solutions are still emerging.

Adaptation-focused collaborations could be key in addressing many of the barriers discussed in Chapter 3, for three reasons:

- **First, companies in a specific sector could work together, supported by think tanks, to delve deeper into risks they have identified and find viable adaptation strategies.** They might also launch joint ventures to develop solutions that would be too costly for any one company to invest in. Similarly, companies operating in the same industrial park, or in a region where they face similar risks (e.g. floods or droughts), might choose to invest together in adaptation measures they can all benefit from.
- **Second, collaborations are essential in managing climate risks across supply chains.** Businesses need to work with their suppliers to identify and address climate risks. Otherwise, not only could they miss important risks, especially in complex supply chains, but they may not know how best to adapt. Companies in the same sector that share supply chains

could collaborate around sharing risk data and joint adaptation support for the suppliers. Suppliers can provide insights on local practices, traditional adaptation strategies and challenges that might arise with proposed solutions. This can help reduce the risk of maladaptation.

- **Third, by collaborating with peers, policy-makers and civil society, businesses can gain a broader perspective on supply-chain risks to achieve more socially just and sustainable results.** As mentioned in Chapter 1, companies are beginning to stop buying from suppliers that are highly exposed to climate risks³⁵ or impose a risk premium if they continue the relationship. That might make sense for the buyer, but it could be devastating for suppliers and the people who depend on them, especially if multiple buyers make the same choice.

Collaborations can also be pivotal in sending the signal that adaptation is as important as mitigation, while creating a platform to recognize leadership action by businesses.

4.4 Engage in stronger public-private dialogue

“ The creation of an effective enabling environment will require not only country-level discussions, but more extensive public-private and private-private dialogues at the international level.

As Chapter 1 noted, few National Adaptation Plans submitted to the UNFCCC articulate a clear role for business. Fewer still provide examples of a public-private process for developing the appropriate enabling environment for adaptation action. Yet half the respondents to the survey conducted for this white paper reported the absence of a conducive policy and regulatory landscape for adaptation investments as a major barrier to action.

As climate risks are transboundary and adaptation is a global challenge, it is imperative for governments to develop a coherent framework for adaptation governance in the context of the Paris Agreement that takes private sector needs and opportunities into account. A key aspect here is to develop options for business efforts to contribute to the Global Goal on Adaptation.³⁶ For this, clear rules are necessary to ensure accountability and transparency.

Furthermore, beyond forging specific collaborations, governments need to work with the private sector to determine the enabling environment for adaptation. This entails working through topics around:

- Defining boundaries of responsibility between businesses and governments on adaptation
- Showcasing and piloting the most appropriate areas on which businesses can focus
- Devising policy options that enable the most effective business action and scaling-up across sectors and geographies

Given how adaptation is a challenge faced by all, with local, subnational, national, regional and international dimensions, the creation of an effective enabling environment will require not only country-level discussions, but more extensive public-private and private-private dialogues at the international level, both within the context of the Paris Agreement and outside.

A key consideration for governments in these dialogues is the need to balance incentivizing greater business action with the need to protect societies from maladaptation. Governments should steer businesses towards just solutions that benefit not only their financial bottom line, but also their workers, customers and communities.

This approach is incorporated in the idea of “just resilience”. It refers to, for example, policies and standards that may be needed to protect vulnerable people and ecosystems from harmful adaptation strategies such as water-hoarding. Some governments may also need to mandate adaptation measures, such as air-conditioning factories during extreme heat, or guaranteeing breaks for cooling and hydration for people working outdoors in the summer. International organizations can play a role by facilitating tripartite social dialogue, with government, labour and employer representatives as well as in public-private partnerships and international platforms, to help businesses recognize blind spots and potential unintended consequences of their actions.

Conclusion and next steps

As the negative impacts of climate change become more obvious, governments are focusing greater attention on the issue. Indeed, the UNFCCC's *Technical dialogue of the first global stocktake. Synthesis report by the co-facilitators on the technical dialogue* states that there is "increasing ambition in plans and commitments for adaptation action and support."³⁷

As governments focus more on adaptation, they are developing expectations that businesses should also do more. These expectations are starting to emerge in National Adaptation Plans or statements from the international community, as outlined in Chapter 1.

Businesses are not necessarily acting in ways that align with these expectations. This is most obvious in the area of climate risk, where governments speak of "shared responsibility" yet the Forum's survey for this report found that, of the 80% of businesses that assessed climate risks, more than half said they did not find any that are significant.

Businesses face a number of barriers to action on adaptation, including data and modelling availability, in-house expertise, and a belief that risk transfer mechanisms such as insurance will be able to help cope with any adverse impacts. These are not issues that businesses are necessarily able to overcome on their own. There is considerable

effort going into helping them do so, ranging from tech start-ups focused on climate risk analysis to international collaboration programmes. What is less frequently discussed is the role of governments and the international community in encouraging business action on adaptation.

The findings from the survey suggest that a good place to start would be by helping businesses to identify opportunities presented by climate risks. Among the businesses participating in the survey, significantly more are investing in developing opportunities related to adaptation than mitigating their own physical climate-related risks (over half compared to about one third).

Within the realms of both risk and opportunity, there is room for greater public-private collaboration. Areas where this is needed include climate information and modelling, managing shared risks along supply chains and developing shared solutions. Beyond these collaborations, greater public-private dialogue is needed to shape the enabling environment for business action on adaptation, at both country and international levels.

The World Economic Forum, working in collaboration with businesses, governments and international organizations, looks forward to convening such dialogues in 2024.

Appendix

The World Economic Forum's business adaptation stocktake survey covered 30 global businesses. Each one is listed on the Forbes Global 2000, and the totality represents a broad industry and geographic distribution. The market value of the selected companies adds up to approximately \$5.5 trillion in 2023, with revenues totalling about \$1.8 trillion. These companies have a footprint on six continents – Africa, Asia, North America, South America, Europe and Australia.

The sectors covered by companies responding to the survey include:

1. Advanced manufacturing
2. Agriculture, food and beverage
3. Automotive and new mobility
4. Aviation and aerospace
5. Banking and capital markets
6. Chemicals and advanced materials
7. Energy technologies
8. Engineering and construction
9. Information and communication technology
10. Institutional and private investors
11. Insurance and asset management
12. Logistics and transport
13. Mining and metals
14. Oil and gas
15. Retail, consumer goods and lifestyle

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Endnotes

1. By 11 September 2023, the United States alone had experienced 23 climate- and weather-related disasters with damages exceeding \$1 billion – up from 18 in all of 2022. Source: National Centers for Environmental Information, Billion-Dollar Weather and Climate Disasters, 2023, <https://www.ncei.noaa.gov/access/billions/>.
2. World Meteorological Organization (WMO), WMO Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019), 2021, https://library.wmo.int/doc_num.php?explnum_id=10989.
3. Lloyds, Lloyd's new data tool highlights vulnerability of the global economy to extreme weather, 11 October 2023, <https://www.lloyds.com/about-lloyds/media-centre/press-releases/lloyds-new-data-tool-highlights-vulnerability-of-the-global-economy-to-extreme-weather>.
4. International Labour Organization, Working on a warmer planet: The impact of heat stress on labour productivity and decent work, 2019, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_711919.pdf.
5. Climate Transparency, Climate Transparency Report: Comparing G20 Climate Action – India 2022, <https://www.climate-transparency.org/wp-content/uploads/2022/10/CT2022-India-Web.pdf>.
6. First Street Foundation, The 4th National Risk Assessment – Climbing Commercial Closures, 13 December 2021, <https://assets.firststreet.org/uploads/2021/11/The-4th-National-Risk-Assessment-Climbing-Commercial-Closures.pdf>.
7. Food and Agriculture Organization of the United Nations (FAO), The impact of climate variability and extremes on agriculture and food security: An analysis of the evidence and case studies, 2020, <https://www.fao.org/3/cb2415en/cb2415en.pdf>.
8. Suneera Tandon, Unstable weather patterns upend cos' best-laid plans, Mint Premium, 30 May 2023, <https://www.livemint.com/companies/news/unstable-weather-patterns-upend-cos-best-laid-plans-11685467961516.html>.
9. World Economic Forum, Droughts are creating new supply chain problems. This is what you need to know, 25 October 2023, <https://www.weforum.org/agenda/2022/11/drought-trade-rivers-supply-chain/>.
10. The White House, Washington, PREPARE Action Plan, September 2022, <https://www.whitehouse.gov/wp-content/uploads/2022/09/PREPARE-Action-Plan.pdf>.
11. Review of the National Adaptation Plans submitted to the UNFCCC conducted by the authors of this paper.
12. The World Bank Group and the Global Facility for Disaster Reduction and Recovery, Enabling Private Investment In Climate Adaptation & Resilience: Current Status, Barriers to Investment and Blueprint for Action, 2021, <https://openknowledge.worldbank.org/server/api/core/bitstreams/127de8c7-d367-59ac-9e54-27ee52c744aa/content>.
13. Royal Government of Bhutan, National Adaptation Plan (NAP) of the Kingdom of Bhutan, 2023, <https://unfccc.int/sites/default/files/resource/NAP-Bhutan-2023.pdf>.
14. Government of the People's Republic of Bangladesh, Ministry of Environment, Forest and Climate Change, National Adaptation Plan of Bangladesh (2023-2030), Government of Bangladesh, October 2022, [https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202211020942---National%20Adaptation%20Plan%20of%20Bangladesh%20\(2023-2050\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202211020942---National%20Adaptation%20Plan%20of%20Bangladesh%20(2023-2050).pdf).
15. World Adaptation Science Programme (WASP), Transboundary climate risk and adaptation, https://wasp-adaptation.org/images/Resources/WASP_Science_for_Adaptation_Policy_Brief_No._2.pdf.
16. Government of the United Kingdom, Third National Adaptation Programme (NAP3), 17 July 2023, <https://www.gov.uk/government/publications/third-national-adaptation-programme-nap3>.
17. S&P Global, Adaptation planning is the next step for companies to prepare for climate risk, 21 February 2023, <https://www.spglobal.com/esg/insights/adaptation-planning-is-the-next-step-for-companies-to-prepare-for-climate-risk>.
18. Based on interviews and consultations.
19. World Economic Forum, Accelerating Business Action on Climate Change Adaptation, January 2023, https://www3.weforum.org/docs/WEF_Climate_Change_Adaptation_2023.pdf.
20. An adaptation that increases rather than reduces vulnerability.
21. Pankratz, N. and Schiller, C., Climate Change and Adaptation in Global Supply-Chain Networks, Federal Reserve Board, Washington, D.C., 2022, <https://www.federalreserve.gov/econres/feds/files/2022056pap.pdf>.
22. United Nations Framework Convention on Climate Change, Climate Champions, COP27 Presidency launches Adaptation Agenda to build climate resilience for 4 billion by 2030, 8 November 2022, <https://climatechampions.unfccc.int/cop27-presidency-announces-ambitious-climate-resilience-agenda/>.
23. Based on the review of publicly available TCFD reports of the companies who participated in the survey.
24. Task Force on Climate-related Financial Disclosures: 2023 Status Report, October 2023, <https://assets.bbhub.io/company/sites/60/2023/09/2023-Status-Report.pdf>.
25. Task Force on Climate-related Financial Disclosures: 2023 Status Report, October 2023, <https://assets.bbhub.io/company/sites/60/2023/09/2023-Status-Report.pdf>.

26. CDP, CDP Climate Change 2023 Question-level Guidance, C2.1, 2023, <https://guidance.cdp.net/en/guidance?cid=C2.1&ctype=ExternalRef&idtype=RecordExternalRef&incchild=1µsite=1&otype=ORS&page=2&tags=>.
27. Network for Greening the Financial System, Technical Document, Guide to climate scenario analysis for central banks and supervisors, June 2020, https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_scenario_analysis_final.pdf.
28. Traditionally, a business evaluate risks using the concept of materiality which is often defined internally and informed by the business' risk appetite and tolerance. To check materiality, a threshold value (e.g. 0.5% of total assets, 1% of shareholders' equity, or 1% of total revenue) is established. If the estimated impacts of a risk go above this threshold, then it is identified as a material risk with potential to cause strategic and financial impact to the business and will therefore affect financial decision-making.
29. Based on interviews and consultations.
30. Task Force on Climate-related Financial Disclosures: 2023 Status Report, October 2023, <https://assets.bbhub.io/company/sites/60/2023/09/2023-Status-Report.pdf>.
31. United Nations Global Compact, Just Transition for Climate Adaptation: A Business Brief, 2022, <https://unglobalcompact.org/library/6099>.
32. European Parliament, Directorate-General for External Policies of the Union, Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy, March 2021, [https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU\(2021\)653626_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU(2021)653626_EN.pdf).
33. Leadership Group for Industry Transition (LeadIT), <https://www.industrytransition.org>.
34. Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, <https://www.zerocarbonshipping.com>.
35. Pankratz, N. and Schiller, C., Climate Change and Adaptation in Global Supply-Chain Networks, Federal Reserve Board, Washington, D.C., 2022, <https://www.federalreserve.gov/econres/feds/files/2022056pap.pdf>.
36. Stockholm Environment Institute (SEI), Five big ideas to make the Global Goal on Adaptation live up to its name, 10 December 2020, <https://www.sei.org/perspectives/five-big-ideas-global-goal-on-adaptation/>.
37. United Nations Framework Convention on Climate Change (UNFCCC), Technical dialogue of the first global stocktake. Synthesis report by the co-facilitators on the technical dialogue, 8 September 2023, <https://unfccc.int/documents/631600>.



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