Agrifood Exports and Climate Change

A GUIDE FOR BUSINESS SUPPORT ORGANIZATIONS

International Trade Centre

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About the paper

Climate change creates risks for agrifood exporters as extreme weather events and rising temperatures disrupt supply chains and reduce productivity. Micro, small and medium-sized enterprises also face risks from new policies, regulations and technologies designed to address climate change. Some climate change-related opportunities are emerging in response to these trends.

This guide, intended as a resource for business support organizations, maps out the climate change-related physical and transition risks facing companies. It identifies emerging climate-related market opportunities and service sectors for building resilience in the agrifood sector and offers recommendations to shape the strategies and service offerings of these organizations.

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Foreword

Nearly a decade ago, the adoption of the Paris Agreement heralded the start of a new chapter in the fight to avert a full-scale catastrophe from a rapidly warming planet. The years since have reaffirmed, however, that the battle is far from won – a message that rang out loud and clear at the conclusion of first Global Stocktake under the Paris Agreement at COP28 in Dubai.

That same United Nations climate conference also witnessed the endorsement by some 160 heads of state and government of the COP28 UAE Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action. The statement made by signatories reflects a reality that farmers around the world are already living, and which they understand intimately: 'We stress that any path to fully achieving the long-term goals of the Paris Agreement must include agriculture and food systems.'

Far from the international stage, agricultural producers know from firsthand experience why investing in adaptation to climate change and transitioning to low-carbon modes of production is an imperative. Otherwise, not only will they struggle to adapt to the impacts of climate change and fulfil local food security needs, but the very survival of their businesses would be at stake, especially those seeking to trade. However, achieving this transition also comes at a cost, especially as farmers work to access climate smart technologies and practices and furthermore to comply with multiple environmental regulations, standards and other measures both at home and in international markets.

Business support organizations (BSOs) play a pivotal role in helping these producers make the transition. They can help farmers identify their policy and legal risks, including from new environmental measures and regulations. They can help farmers determine the role that new technologies could, and should, play in helping them decarbonize and adapt to the impacts of climate change. And they can help small businesses adapt to the ever-evolving demands of consumers in international markets, especially in an age of voluntary sustainability standards, so these farmers know how to stay in the game.

This guidebook is intended to help BSOs in developing countries as they work with small companies in their decarbonization and climate change adaptation efforts. From identifying climate risks to developing new climate-related goods and services in the agrifood sector, this guide provides a comprehensive overview of how BSOs can help in making the green transition as seamless, effective and equitable as possible.

The timing of this guidebook coincides with the opening of a new chapter in climate change governance and practice. Not only is the international community looking ahead to new and updated nationally determined contributions after the first Global Stocktake, but it is also taking a deep look at the way forward for countries that are on the frontlines of climate change, including at the Fourth International Conference on Small Island Developing States and the Third UN Conference on Landlocked Developing Countries.

This publication is meant to be a practical, actionable contribution to these efforts, linking international momentum to concrete actions on the ground. It was also a team effort, one that reflects a comprehensive range of experiences and expertise. I would like to thank the many experts and stakeholders who contributed to the preparation of this guide, including the International Trade Centre's Institutions and Ecosystems Advisory Board.

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Acronyms

Unless otherwise specified, all references to dollars ($) are to United States dollars, and all references to tons are to metric tons.

BSO	Business support organization
CBAM	Carbon border adjustment mechanism
CO_2	Carbon dioxide
ETS	Emissions trading system
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse gas
IFRS	International Financial Reporting Standards
IISD	International Institute for Sustainable Development
IMO	International Maritime Organization
ITC	International Trade Centre
MSMEs	Micro, small and medium-sized enterprises
NDC	Nationally determined contribution
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
TCFD	Task Force on Climate-Related Financial Disclosures
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Economic Programme
UNFCCC	United Nations Framework Convention on Climate Change

Glossary

Adaptive capacity

The ability of actors to design and implement effective strategies to reach a better fit with changing environmental conditions.

Anthropogenic

Environmental change caused or influenced directly or indirectly by human activities.

Climate hazard

Physical process or event linked to hydro-meteorologic or oceanographic phenomena and which can cause harm to socioecological systems.

Climate vulnerability

The proneness or predisposition of a system, receptor or unit to be adversely affected by climate change and which varies according to the level of sensitivity and the level of adaptive capacity of the receptor.

Environmental goods and services

Also commonly referred to as eco-industries, environmental goods and services refers to a heterogeneous set of goods and services deployed to protect, conserve and rehabilitate the environment and the management of natural resources.

Nationally determined contribution

A climate action plan developed by government describing the country's plan to cut greenhouse gas emissions and adapt to climate change.

Net zero

Net zero refers to a state in which the greenhouse gases entering the atmosphere are balanced by removal from the atmosphere. To 'go net zero' is to reduce greenhouse gas emissions and/or to ensure that any ongoing emissions are balanced by removals.

Paris Agreement

This international treaty on climate change, adopted in 2015, covers climate change mitigation, adaptation and finance.

Physical risk

Physical climate risks are climate risks associated with the physical impacts of climate change and are classified as either chronic or acute.

Scope 1 greenhouse gas emissions

Direct emissions from a company's owned or controlled sources.

Scope 2 greenhouse gas emissions

Indirect emissions from the generation of purchased energy.

Scope 3 greenhouse gas emissions

All indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.

Stranded assets

Assets that have suffered from unanticipated or premature write-downs, devaluation or conversion to liabilities. In recent years, the issue of stranded assets caused by environmental factors, such as climate change and society's attitudes towards it, has become increasingly high profile.

Task Force on Climate-Related Financial Disclosures

Working group established by the Financial Sustainability Board of the G20 that has set a series of recommendations for companies to disclose information on how to account for physical and transitional climate risks in organizational governance, strategy, risk management and metrics.

Transition risk

Risks stemming from the transition to a low- or net zero carbon economy. These can be related to policy, legal, technology and market changes that can generate different levels of financial and reputational risks.

Executive summary

Agricultural development is crucial to raise incomes in the poorest sections of the population, contributing to economic growth and ensuring food security. Agriculture is both a major emitter of greenhouses gases and a driver for land-use change while also sensitive to the impacts of climate change.

Trade in agricultural goods contributes substantially to the export performance of developing countries and generates significant employment opportunities. As climate change impacts grow, exporters of agricultural products are increasingly exposed to the physical risks of climate change. The green transition also poses risks in terms of new regulations governing market access.

This guidebook is designed for business support organizations (BSOs), including trade promotion organizations, sector associations and chambers of commerce. The information it contains will enable frontline staff at BSOs to engage meaningfully and credibly with firms on climate change issues and provide services that are better targeted, better designed and more effective. It will improve the way BSO leaders and executives review their climate-related strategies, risk management, operations, service offering, client management tools and key performance indicators.

Chapter 1 discusses risks stemming from the transition to a low- or net zero carbon economy, dependent on factors such as policy, legal, technology and market changes that can generate different levels of financial and reputational risks for companies. BSOs can use their knowledge of transition risks to develop customized advisory services for different types of businesses and support a just transition.

Chapter 2 informs BSOs about the physical risks from climate change to stakeholders across the value chain, including exporting farmers, agricultural cooperatives and exporters, and road and port operators. While climate change is expected to have adverse effects across a wide range of sectors, agriculture is the most affected, given the high sensitivity of agricultural inputs (such as water) and agricultural products (such as crops and livestock) to climate impacts.

Chapter 3 outlines the type of market opportunities associated with climate change mitigation as well as the new goods and services sector emerging in building climate resilience in agricultural value chains.

Chapter 4 outlines how BSOs can respond to transition and physical risks by mainstreaming climate risk issues into their business plans and advisory services, helping businesses navigate climate-related uncertainties and tapping into emerging market opportunities. BSOs will need to offer new services to address both the transition and the physical risks facing their members or clients, and thus their own organizations.


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Chapter 1

Transition risks

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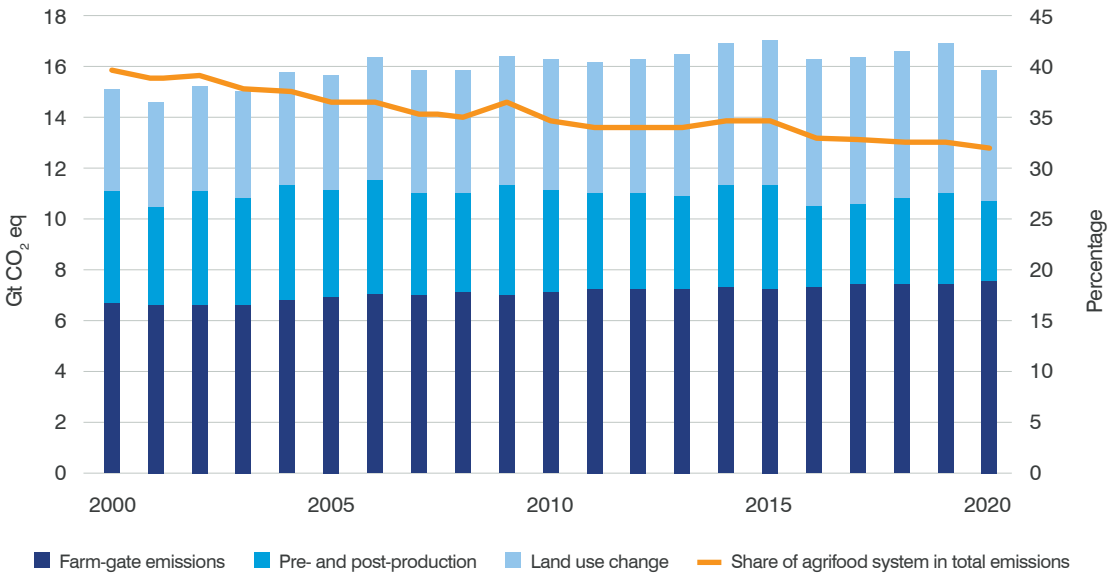
Chapter 1
Transition risks

What role does the sector play in greenhouse gas emissions?

The agrifood sector is a key contributor to anthropogenic causes of climate change, both as a significant emitter of greenhouse gases (GHGs) and as a major driver for land-use change. Agri-food sector emissions contributed 31% of emissions across all sectors in 2020, according to the Food and Agriculture Organization of the United Nations (2022), with farm-gate emissions being the largest contributor, followed by pre- and post-production processes and land-use changes.

Figure 1: Emissions from agrifood systems have been declining



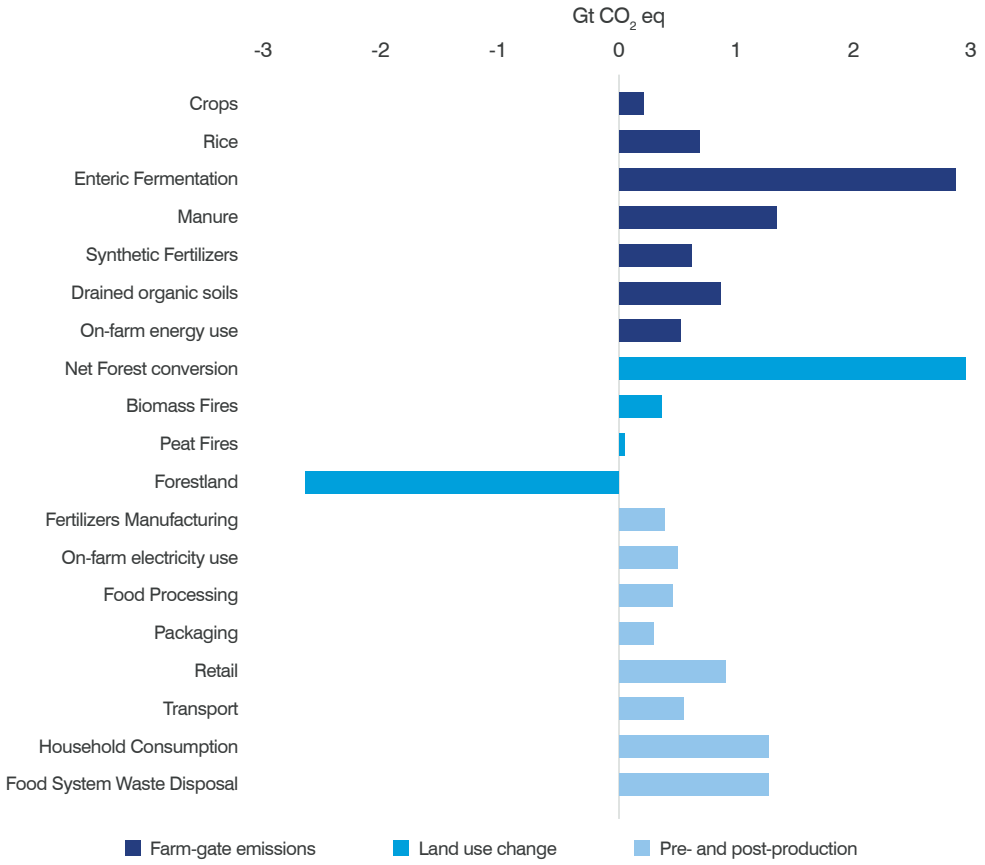
Source: FAO, 2022.

Agricultural activities emit several GHGs, in particular carbon dioxide (CO2), nitrogen dioxide and methane. According to FAO (2022), the most important contributors to global agrifood systems emissions were CO2 from deforestation and methane from livestock, which together represented nearly 40% of total emissions from the agrifood sector (see Figure 3).

Figure 2: Different agricultural activities contribute to emissions

Source: Adapted from UNEP-FI (2023)

Figure 3: Emissions in agrifood sector by subcomponent



Note: Emissions/removals on forestland (which are not part of agrifood systems emissions) are also shown as included in the FAOSTAT Emissions database.

Source: FAO, 2022.

Transport is also a major contributor to GHG emissions in agrifood systems, contributing 12%–20% of emissions from the agrifood sector, according to different sources. Box 1 provides information on the contribution to GHG emissions of transport and logistics, a subsector that depends greatly on fossil fuels but has few immediate solutions to decarbonize at scale. Box 2 in Section 2.2.3 further reflects on the concept of 'food miles' and the implications for developing countries exporting agricultural products to distant markets.

Box 1: Greenhouse gas emissions from the transport and logistics sector

Logistics

Logistics is responsible for 10%–11% of total energy-related CO2 emissions. Most logistics emissions (around 85%) come from freight transport operations, the remainder from warehouses, terminals and related office activities. Although three-quarters of tonne-kilometres are moved by sea, the average carbon intensity of shipping is 10% of that of trucking (McKinnon, 2021).

Pressure is mounting, however, to decarbonize logistics operations. This is difficult due to rising demand and because they are almost entirely powered by fossil fuels. Longer-distance freight, in particular, faces great obstacles to reduce emissions.

Road transport

Emissions from the burning of gasoline and diesel from all forms of road transport contribute 11.9% of global GHG emissions. Road freight (trucks) account for 40% of these emissions (Emissions by sector – Our World in Data). The movement of freight by road is by far the biggest emitter, representing two-thirds of all freight transport CO2 emissions (McKinnon, 2021).

Shipping

Shipping accounts for 1.7% of global GHG emissions (Emissions by sector – Our World in Data). Mitigation measures may affect sea transport costs. These include the United Nations International Maritime Organization's (IMO) own initiatives and the European Union's (EU) proposal to include shipping in its emissions trading system (ETS) if talks with IMO to reduce emissions fail (World Bank, 2021).

The IMO adopted its first GHG Abatement Strategy in 2018, aiming to lower 'CO2 emissions per transport-work, as an average across international shipping, by at least 40% by 2030, pursuing efforts toward 70% by 2050 compared to 2008', while aiming eventually to phase out emissions entirely.

Aviation

Aviation accounts for 1.9% of global GHG emissions. Passenger travel is responsible for 81% of these emissions and freight for 19% (Emissions by sector – Our World in Data). The aviation sector is also under pressure to reduce emissions from no fly, 'flight shame' consumer campaigns.

The International Civil Aviation Organization has adopted a mitigation policy based on technological improvements, supporting operational improvements and capping CO2 emissions at their 2019 level and offsetting aviation emissions above this level through the Carbon Offsetting and Reduction Scheme for International Aviation.

The aviation industry has been included in the EU ETS since January 2012. Flights out of Europe are exempt until 2024, after which the EU may decide to include all flights if it is dissatisfied with the level of ambition and operation of the Carbon Offsetting and Reduction Scheme for International Aviation.

Both shipping and aviation offer few opportunities to shift demand from these modes of transport to more sustainable alternatives, and low-carbon alternative fuels are still not available at scale. The relatively lower energy density of batteries compared to fossil fuels limits electrification of aviation and maritime shipping. Other alternative fuels such as hydrogen, ammonia and synthetic fuels are still at early levels of technological maturity.

Therefore, improving energy efficiency is essential to reduce emissions from freight and longer-distance passenger travel (McKinnon, 2021).

Source: Malina et al., 2022; McKinnon, 2021; Sweeney and Watzer, 2021; Organisation for Economic Co-operation and Development (OECD), 2021.

Types of transition risks

There are four main types of transition risks: those associated with (a) policy and legal changes, (b) changes in technology, (c) market changes and (d) reputational risks.

Policy and legal

Concerns about climate change are driving the development and enforcement of regulations on the domestic and trade policy levels to curb GHG emissions. Some of these changes will affect agricultural production and trade. Countries are deploying domestic policies (e.g. carbon pricing instruments and forestry regulation) that can increase production costs and alter growth trajectories for the sector.

A growing number of climate-related policy measures are likely to affect trade flows. These measures are commonly referred to as trade-related climate measures. The two main types of policy and legal risks are:

- Price and market mechanisms, such as environmental taxes, emission trading schemes, carbon border adjustments.
- Climate requirements governing access to the market, such as product/production specifications, voluntary/mandatory standards, performance, labelling, quotas and bans.

Price and market mechanisms

Carbon tax

A carbon tax is a pricing instrument established by governments setting a price that emitters must pay each year for every ton of GHG emissions they discharge into the atmosphere. As noted in Section 2.1, the agrifood sector contributes GHGs and is thus potentially subject in the future to pricing mechanisms to reduce its emissions. Applied to agricultural activities, a carbon tax would increase the cost of fertilizer, making more marginal land cultivation unprofitable.

Furthermore, such a tax could lead to more intensive cultivation in carbon-rich land and lead to leakage in terms of land-use change. The United Nations Environment Programme (UNEP) Finance Initiative cites research showing that a carbon tax of $144 per ton of CO2 equivalent emissions could increase production costs for energy intensive crops such as corn and soya bean by 27.5% on average and, in certain scenarios, have a negative impact on farmer incomes.

Using the case of British Colombia, Olale et al. 2019, cited in UNEP Finance Initiative, found that farmers experienced a decrease in net farm income-to-receipt ratios of between 8 cents and 12 cents per dollar of farm receipts.

Carbon pricing instruments are being integrated into GHG abatement strategies for sectors that affect food trade, such as transport and energy. In developing countries, integration has been established through fuel taxes, although there are country differences as to how such taxes are applied.[1]

Countries may also develop carbon border tax adjustments to compensate for differences in national laws that may lead to carbon leakage or influence the competitive advantage of companies in countries with no carbon pricing instruments,[2] which could affect exports from developing countries in the sectors where tax adjustments are applied. Ultimately, agribusinesses that are more carbon-efficient and operate within value chains with lower emissions costs will become more competitive over time.

[1] For example, India and the Philippines only tax coal, while Mexico taxes coal and petroleum products, Zimbabwe only taxes gasoline and diesel, and both natural gas for fuel and coal are tax exempt in Colombia.

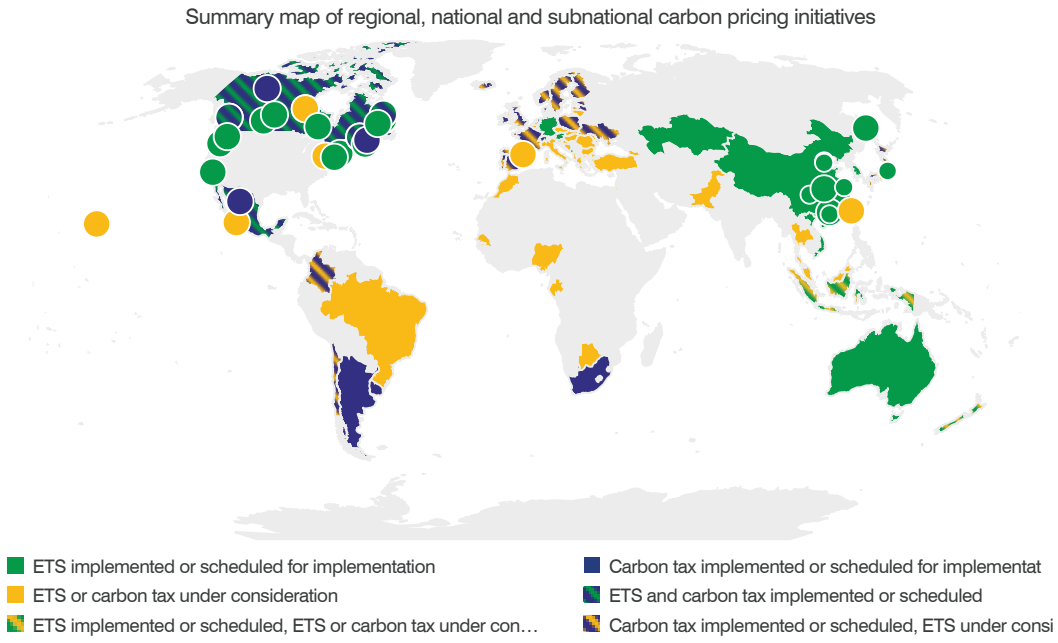
[2] Carbon leakage describes the situation that may occur if, due to costs related to climate policies imposed domestically, businesses transfer production to countries with laxer emission constraints. These concerns around carbon leakage are one of the main reasons given for proposals to tax products for their carbon content when they originate from countries with weaker climate policies.

Emissions trading systems

An ETS is a system where emitters can trade emissions to meet their emissions targets. These include cap-and-trade systems, which set an absolute limit on emissions that can be distributed, and baseline-and-credit systems, where the emission levels are defined by regulated entities and credits issued to those entities that reduce emissions below the baseline.

The EU introduced an ETS in 2005. Agriculture is not included. There are plans to include the sector in the New Zealand ETS in 2025. The World Bank Carbon Pricing Dashboard, presented in Figure 4, is a useful resource to find information on countries implementing ETS and carbon taxes.[3]

Figure 4: World Bank carbon pricing dashboard



Source: World Bank, 2023.

Border carbon adjustments

A carbon border adjustment is a duty on imports based on the amount of carbon emissions resulting from the production of the item in question. Border carbon adjustments have several objectives:

- Reduce the risk of carbon leakage – when tough domestic standards and regulations (such as a carbon tax) are undermined by lower standards abroad, pushing companies to move abroad
- Maintain competitiveness of domestic industries
- Support domestic climate ambition by levelling the playing field between imported and domestic goods
- Drive international climate action by pressing other countries to implement stronger climate policies

A border carbon adjustment mechanism can have negative economic impacts on exporters of carbon-intensive products. Its design also raises practical challenges such as measuring the carbon footprint of trade, the country and sector coverage and the complications in supply chains.

[3] Another valuable resource on countries' carbon pricing profile is the International Carbon Action Partnership Status report 2022, available at https://icapcarbonaction.com/system/files/document/220408_icap_report_rz_web.pdf

The most salient example of a border carbon adjustment is the EU's carbon border adjustment mechanism (CBAM). Countries including Canada, Japan and the United Kingdom are considering similar measures. Starting in January 2026, high carbon-generating companies importing goods to the EU will have to pay a carbon border tax, estimated at €75 per ton of CO2 emissions. In its first phase, the CBAM will only affect carbon-intensive sectors. Cement, iron and steel, aluminium, fertilizers and electricity are among the most exposed from a developing country standpoint.

In developing countries, energy-intensive industries such as aluminium rather than agriculture are more likely to be affected. A report by the London School of Economics and the Africa Climate Foundation notes that the impact could be more substantial if the scope of CBAM is expanded.

As carbon is priced into trade, new services will emerge to help businesses address policy requirements, negotiations and transition challenges as part of trade discussions, ensuring that they remain competitive under new climate-related trade measures (such as border carbon adjustments) and able to comply with climate standards.

Carbon clubs

The emergence of carbon clubs, first proposed by Nobel laureate William Norhaus, is tied to the development of border carbon tax adjustments. Countries that belong to a carbon club would agree on an international target for a carbon price and would impose a uniform tariff on the exports into the club from countries that are not members.

The carbon price would rise over time acting as an incentive for countries to put a price on carbon. The efficacy of carbon clubs is debated and there is the probability of pushback by developing countries given its potential conflict with the principle of common but differentiated responsibilities.

Fossil fuel subsidies

There is broad consensus (see International Energy Agency, 2023;[4] OECD, 2023;[5] Asian Development Bank, 2016;[6] and Damania et al., 2023[7]) on the need to remove or at least reduce fossil fuel subsidies as they distort markets, send the wrong price signals to users, widen fiscal deficits in developing economies and discourage the adoption of renewable energies.

Subsidies intended to aid low-income households often favour wealthier households that use more fuel and energy and should therefore be replaced with more targeted forms of support. Public funding should be redirected towards the development of low-carbon alternatives alongside improvements in energy security and energy efficiency, while extending social safety nets to mitigate impacts of energy subsidy reforms.

Removing agricultural subsidies

The introduction of policies to decarbonize supply chains will eventually pressure governments to reduce financial support for intensive farming systems. The loss of agricultural subsidies would have a negative impact on producers. Total annual support towards the agricultural sector reached $817 billion over 2019–21 for the world's leading 54 economies. Support policies can contribute to increasing agricultural emissions.

Significant levels of support are still provided to high-emission commodities – such as beef and veal, sheep meat and rice – and represent 8% to 15% of those commodities' gross receipts. Eliminating agriculture-related subsidies would reduce 11.3 million tons of CO2 equivalent globally by 2030.

However, removing all government support would have socioeconomic impacts. It would decrease crop production, livestock farming production and farm employment by an estimated 1.3%, 0.2% and 1.27%, respectively. It would also affect consumers due to lower output and higher prices.

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[4] https://www.iea.org/topics/energy-subsidies
[5] https://www.oecd.org/fossil-fuels/
[6] Asian Development Bank (2016). *Fossil fuel subsidies in Asia: trends, impacts, and reforms—Integrative report*. Mandaluyong City, Philippines: Asian Development Bank. https://www.adb.org/sites/default/files/publication/182255/fossil-fuel-subsidies-asia.pdf
[7] Damania, R., Balseca, E., de Fontaubert, C., Gill, J., Kim, K., Rentschler, J., Russ, J., and Zaveri, E. (2023). *Detox Development: Repurposing Environmentally Harmful Subsidies.* © Washington, DC : World Bank. http://hdl.handle.net/10986/39423.

Climate requirements governing access to the market

Scope 3 Reporting requirements

Investors and regulators are looking for ways to reduce supply-chain GHG emissions as part of climate risk management and low-carbon transition strategies. Emissions are categorized into organizational boundaries and corresponding scopes. Scope 1 and 2 emissions are those are owned or controlled by a company. Scope 3 emissions are a consequence of the activities of the company, but occur from sources it does not own or control. See Table 1 below and the Greenhouse Gas Protocol.

Scope 3 emissions typically account for more than 70% of a business's carbon footprint. Companies are therefore under pressure to reduce their Scope 3 emissions. However, calculating these emissions is difficult due to the high number of players in the value chain. Measurement methodologies are also complex, so compliance is challenging and costly for exporters.

Reporting on Scope 3 emissions in agriculture value chains has been limited. Nevertheless, as regulations change and environmental, social and governance commitments strengthen, suppliers in developing countries are likely to face more requests from their upstream buyers for information on GHG emissions in production, processing and logistics operations.

In March 2022, the United States Securities and Exchange Commission proposed climate-related disclosure including Scope 3 reporting requirements for large U.S. publicly owned companies. Following the consultation period, large organizations will have to make disclosures on Scope 3 emissions and their intensity by February 2025.

The International Financial Reporting Standards (IFRS) Foundation created the International Sustainability Standards Board in November 2021 to help companies report on environmental, social and governance matters. To consolidate many standards (such as Climate Disclosure Standards Boards, Climate Disclosure Project and Sustainability Accounting Standards Board), the board launched its inaugural standards IFRS S1 and IFRS S2 in June 2023.

IFRS S1 is a consolidated standard on disclosure requirements on sustainability-related risks and opportunities, while IFRS S2 pertains to climate-related disclosures. Meant to be used together, the standards incorporate the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) and were designed to allow firms and investors to standardize on a single global baseline sustainability and climate disclosures for capital markets, with any additional requirement being built on top of this global baseline.

The information required by the IFRS standards works with any accounting requirement and is intended to accompany financial statements.

IFRS S2 requires companies to disclose Scope 1, 2 and 3 GHG emissions (See Table 1). To report Scope 3 emissions correctly, businesses can assess where emissions lie in their value chain and identify laggards and leaders in terms of environmental performance. Moreover, they can better engage suppliers in sustainable practices, boost the credibility of their brand and inform decisions pertaining to procurement, logistics and product design.

Table 1: Scopes 1, 2 and 3 – emissions

	Scope 1	Scope 2	Scope 3
Definition	Direct emissions from owned or controlled sources	Indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company.	All other indirect emissions that occur in a company's value chain
Examples	■ Fuel combustion ■ Company vehicles ■ Fugitive emissions	Purchased electricity, heat and steam	■ Purchased goods and services ■ Business travel ■ Employee commuting ■ Waste disposal ■ Use of sold products ■ Transportation and distribution ■ (upstream and downstream) ■ Investments ■ Leased assets and franchises

Source: Adapted from Carbon Trust.

EU's Corporate Sustainability Due Diligence Directive

The European Union aims to foster sustainable and ethical corporate behaviour and to anchor human rights and environmental consideration through, among other instruments, its Corporate Sustainability Due Diligence Directive, adopted by the European Parliament in June 2023 as a negotiating text. This directive would set corporate due diligence requirements on large EU companies as well as smaller companies in 'high-risk' sectors to prevent/mitigate adverse impacts. Directors are incentivized to contribute to sustainability and climate change mitigation goals.

Micro, small and medium-sized enterprises (MSMEs) are not directly in the scope of the proposed directive, but will be affected if they are linked to the value chains of in-scope companies. The core elements of the established due diligence duty are identifying, ending, preventing, mitigating and accounting for negative human rights and environmental impacts in the company's own operations, its subsidiaries and its value chains.

The agreed draft law requires formal approval by the Legal Affairs Committee and the European Parliament as a whole, as well as by the Council (EU governments), before it can enter into force. The final compromise text on the directive was put forward for endorsement of the Council on 28 February 2024, but the necessary support (a qualified majority) was not found.

This implies that as of 1 March 2024, the Belgian presidency of the Council of the European Union has been tasked with seeing if it is still possible to address the concerns voiced by some member states, in consultation with the European Parliament, and amid great uncertainty about the future of mandatory human rights and environmental due diligence.

Compliance with sustainability standards

Rates of deforestation for agricultural production are especially high when tropical commodities are involved. In response, countries have started to develop regulations to reduce the net purchase of commodities driving deforestation. Norway, for example, has committed to not using any product linked to deforestation. The European Union has proposed a new regulation to minimize EU-driven deforestation and forest degradation by promoting 'deforestation-free' products.

To comply with the new regulation, firms will need to set and implement due diligence systems and will be held accountable by enforcing authorities to ensure goods have not been produced on land degraded or deforested after 31 December 2020. Six commodities are covered – beef, coffee, cocoa, palm oil, soya and wood – along with some of their derivatives, such as leather, chocolate and furniture. The regulation applies to both domestic and imported commodities, both of which will be measured by the same standards.

Similarly, the United States is discussing a new Forest Act[8] to end illegal deforestation, forbidding products linked to illegal deforestation from entering the country.

What actions can BSOs take for transition risks related to policy and legal?

This information is especially important for export-oriented businesses, agribusinesses and firms involved in international trade. Three questions BSOs could ask firms to assess their exposure to the policy and legal risks are:

- How does your company monitor and adapt to changes in environmental regulations, particularly those related to GHG emissions and climate-related trade measures?
- Are you aware of the potential impact of emerging policies, such as carbon pricing instruments, border carbon adjustments and Scope 3 reporting, on your supply chain and market access?
- Have you evaluated the sustainability practices of your suppliers and the potential implications of upcoming regulations, such as those aimed at promoting 'deforestation-free' products, on your sourcing strategy?

BSOs should consider building their internal knowledge base as well as partners and referrals to include experts in:

- Environmental policy and compliance – Experts who help businesses understand and adhere to evolving environmental regulations, carbon pricing mechanisms and emission trading schemes.
- Sustainable supply-chain management – Specialists who can help companies assess and enhance the sustainability of their supply chains, addressing issues related to Scope 3 emissions and deforestation-free product regulations.

Additionally, BSOs can:

- Publish policy and legal briefs to summarize requirements and implications for MSMEs.
- Organize expert talks and question-and-answer sessions by market/region or specific topic.
- Partner with legal firms or build a directory of legal experts to work on individual cases.

[8] The Fostering Overseas Rule of Law and Environmentally Sound Trade (FOREST) Act seeks to outlaw commercial products linked to deforestation such as meat, soy, palm oil, cocoa, rubber and wood pulp. Source: McCarthy, J. (2022). Global Citizen, at https://www.globalcitizen.org/en/content/what-is-the-forest-act/#:~:text=The%20FOREST%20Act%20would%20prohibit,and%20organizations%20driving%20illegal%20deforestation

Technology risks

Technology risks emerge as new technologies displace obsolete systems, disrupting the economic systems and generating winners and losers as part of the shift towards greener and low carbon technologies. An early move into a market can offer opportunities for agribusinesses, whereas late adoption can make companies uncompetitive in shifting market conditions and cause reputational risks, especially to companies that are carbon intensive.

Technological innovations in the agriculture sector include the adoption of less carbon-intensive technologies, such as anaerobic digester technologies to reduce methane emissions and use of new dietary additives, as well as better agronomic practices (to lower emissions) and drainage management practices. Carbon-intensive agriculture practices are also at threat of becoming uncompetitive against innovative technologies that reduce agriculture's carbon footprint, such as 3D-printed protein meat and lab-grown meat.

The use of plant-based alternatives to meat could rise by 30% in the coming years, according to the Heinrich Böll Foundation (2020), which puts meat producers with unsustainable farming practices at risk.

What actions can BSOs take for transition risks related to technology?

This information is especially important for agribusinesses, food producers and companies involved in agriculture-related technologies. Three questions BSOs could ask firms to assess their exposure to the technology risk are:

- How is your company embracing or adapting to new and emerging technologies in the agriculture sector, especially those aimed at reducing carbon intensity and improving sustainability?
- Have you assessed the potential impact of evolving technologies, such as 3D-printed protein meat and plant-based alternatives, on the competitiveness of your products in the market?
- Does your company have strategies in place to stay ahead of technological shifts in agriculture, considering the potential reputational risks associated with outdated or carbon-intensive practices?

BSOs should consider building their internal knowledge base as well as partners and referrals to include experts in:

- Agricultural technology integration – Experts who can help businesses adopt and integrate less carbon-intensive technologies, such as anaerobic digester technologies, new dietary additives and innovative agronomic practices.
- Food technology – Specialists who can help companies navigate the landscape of emerging technologies such as 3D-printed protein meat, lab-grown meat and plant-based alternatives, ensuring they stay competitive and aligned with evolving consumer preferences and sustainability trends.

Additionally, BSOs can:

- Partner with universities, research centres and innovation labs to access expertise and technology to test innovative concepts.
- Showcase the success of MSMEs adopting new technology to encourage others in the sector.

Market risks

Market risks emerge through shifts in the supply and demand of goods and commodities. This largely results from changing consumer preferences and new emerging technologies that lower the relative costs of new services (e.g. renewable energy). Export competitiveness in developing countries is affected in several ways as consumer demand shifts in response to concerns about the environmental impact of food products.

Compliance with sustainability standards

Sustainability standards have become a de facto market entry requirement for many product lines. Compliance with these standards involves changing production and processing methods in line with the principles and criteria of the standard. For example, organic production methods ban weedkillers and artificial fertilizers and allow the use of only a very limited number of naturally derived pesticides. Organic is the top standard in terms of area certified, although other standards are gaining ground.

Trends towards localization of demand

Food miles is a concept that describes the distance that a product has travelled from producer to market. It implies that the greater the distance, the greater the environmental impact of the product. While the data show that most emissions from production derive from production and the consumer (food preparation and travelling to the supermarket), the concept has traction with consumers. Box 2 explores this trend and the implications for food producers in developing countries.

Box 2: Food miles as a measure of sustainability

The 'food miles' concept is the idea that the distance a product travels from farm to consumer greatly influences its carbon footprint. Retailers in the United States and the EU have promoted the idea to support the marketing of local and nationally produced food. The concept has alarmed exporters in developing countries who are located very far from their export markets.

Maintaining market access

Campaigners have advocated for describing trade as 'fair miles' as an alternative to ``food miles'. Given that the carbon footprint of farmers in sub-Saharan Africa is 30 times smaller than that of the consumers purchasing their products, it would only seem 'fair' that they should have been able to transport their produce to market, whatever the distance involved. Furthermore, despite contributing less than 4% of global GHG emissions (CDP 2020), sub-Saharan Africa is highly vulnerable to the negative impacts of climate change. Placing barriers to market in the name of climate change is unpalatable to African farmers in that respect.

Debunking food miles

At the time, experts agreed that food miles was a misleading proxy for sustainability of food products. The concept is still subject to scrutiny today. As shown by Xu et al. in 2021, only 12% of food's GHG emissions are associated with its transport to market. Dietary choices are also important in determining the carbon footprint of a household's food shop. In 2008, Weber and Matthews showed that a shift away from red meat could be more effective to lower an average household's food-related climate footprint than buying local.

Sources: CDP, 2020; Chi, MacGregor and King, n.d.; Kasterine, 2021; Xu et al., 2021; Weber and Matthews, 2008.

Sustainability applications

Many apps offer consumers information about the sustainability of products and cover a wide range of issues, such as carbon emissions, biodiversity, deforestation, pollution, food waste and water use, and stimulating shifting consumer behaviours. Exporters should be aware of these apps to understand further changing demand around sustainability.

Some selected food- and climate-related apps are:

- Track and reduce personal carbon emissions MyEarth
- Help reduce food waste
- Analyse health impact of food products and cosmetic
- Find restaurants selling vegan food

What actions can BSOs take for transition risks related to markets?

This information is especially important for businesses engaged in international trade, particularly those in the food and agriculture sectors. Three questions BSOs could ask firms to assess their exposure to this risk are:

- How is your company adapting to the growing importance of sustainability standards as a market entry requirement, and have you considered the implications of changing production methods to comply with these standards?
- Are you monitoring and responding to the trend towards localization of demand, considering factors such as food miles and the environmental impact of your products in response to changing consumer preferences?
- Is your company leveraging or preparing for the influence of sustainability apps that give consumers information on product sustainability, and are you aware of the potential impact on shifting consumer behaviours?

BSOs should consider building their internal knowledge base, as well as partners and referrals, to include experts in:

- Sustainability standards and certification – Experts who can help businesses understand and comply with sustainability standards and assist them in navigating the changes required in production and processing methods.
- Environmental impact assessment – Specialists who can help companies assess and respond to trends related to the environmental impact of products, localization of demand and strategies to enhance market competitiveness.
- Consumer behaviour analysis and marketing – Professionals who can help businesses understand and adapt to changing consumer behaviours, especially influenced by trends such as increasing rates of vegetarianism and the use of sustainability apps.

Additionally, BSOs can:

- Promote and use the free International Trade Centre (ITC) Standards Map to advise MSMEs to adopt sustainability standards: https://www.standardsmap.org.
- Publish analyses of international markets by country or region including consumer trends, standards and market entry requirements.
- Use the Global Trade Helpdesk platform to provide detailed information about imports, market dynamics, tariffs, regulatory requirements and potential buyers in international markets: https://globaltradehelpdesk.org.

Reputational risks

Reputational risks emerge when a company no longer meets the expectations of its customers, stakeholders and/or the community. With respect to climate change, these risks can materialize as a result of supply-chain disruptions, consumers' perceptions about a company's commitments to decarbonize its operations, failure to abide by voluntary reporting frameworks and agricultural practices that can lead to deforestation.

As the expectations of consumers and investors change and governments strengthen regulations to ensure more sustainable agricultural practices, firms may be exposed to reputation risks that result in increased liability and litigation risks, as well as in changes in their risk rating.

One of the main reputational risks with respect to environment is deforestation. The financial implications of legal allegations to companies driving deforestation can be profound – for example, by suspending contracts with firms accused of undertaking illegal land clearing. This was the case in 2016, when Kellogg's and Mars suspended contracts with IOI Corporation for allegations of illegal land clearance in Indonesia.

Data-driven transparency initiatives such as Trase, which has mapped more than 60% of international trade in soy, palm oil and cocoa, help to identify hotspots, buyers and supply chains that are more closely linked to deforestation areas. In supporting the promotion of deforestation-free value chains, Trase helps evaluate the sustainability of export markets.[9]

As global trade in fresh fruits and vegetable grows, the industry's water footprint is under increasing scrutiny and puts its reputation at risk. Box 3 illustrates how, in horticultural value chains, reputational risk relates to concerns around overuse of water in producing countries due to conflicts over land rights and weakness in environmental regulation and enforcement.

Box 3: Horticulture industry's use of water under the spotlight

Green gold avocado

Avocado production is associated with water conflicts and stresses as well as broader negative socioeconomic impacts on local communities. It is also a very valuable crop to farmers. Production of avocado typically occurs in subtropical, tropical and Mediterranean climates where water consumption is generally high and where trees of this species cannot usually be grown at commercial scale without supplementary irrigation.

Freshwater resources are increasingly overexploited in many parts of the world. In Mexico, the world's largest producer, a substantial area of native forest has been converted into avocado fields. The increase in avocado farming is associated with high rates of tree cover loss in Mexico. Subsistence crops have been pushed on to more marginal land (some of which was previously forested) to expand avocado plantations.

The role of trade to improve sustainable production includes calls for a roadmap that brings together authorities, producers and communities to develop a strategic action plan, for buyers to implement sustainable certifications and for governments to make provisions on trade agreements.

'Drought strawberries'?

In 2023, a consumer campaign in Germany pressured German supermarkets to discontinue buying what it dubbed 'drought strawberries' grown near the Doñana wetland of Spain. The province of Huelva produces almost all Spain's red fruits and is the world's largest exporter of strawberries. Germany imported €196 million of strawberries from Spain in 2022.

The campaign highlighted proposed legalization of illegal wells near the ecologically sensitive reserve, while retailers argued that they required all their Andalusian fruit and vegetable suppliers in Andalusia to be certified in accordance with accepted standards for sustainable groundwater use and irrigation. Teresa Ribera, Spain's environment minister, told the Financial Times that some farmers were facing 'real reputational risk'.

Further aggravating this conflict is what the central government described as a 'prolonged drought' across 35% of Spain, including Huelva.

Sources: Sommaruga and Eldridge, 2022; World Resources Institute, 2020; Financial Times, 2023.

[9] Trase is available at https://www.trase.earth/

Reputational risk exists also at the local level, where communities pressure companies to comply with environmental norms and regulations and grant them the 'social licence' to operate. This notion is largely associated with natural resources and extractive industries, including forestry, mining, gas and minerals, hydropower and petroleum, and the chemical industry. Companies, industrial associations and international financial institutions have designed standards and norms to help managers in their decisions about relations with local communities and help them cope with reputational risks.

A social licence to operate ensures reputational harm can be reduced when firms demonstrate their ability to address the social and environmental impacts of their operations and are responsive to and trusted by customers, stakeholders and/or the community.

What actions can BSOs take for transition risks related to reputation?

This information is important for businesses across various industries, especially those involved in international trade, natural resources and agriculture. Three questions BSOs could ask firms to assess their exposure to this risk:

- How is your company actively managing and communicating its commitment to sustainability, especially in terms of climate change mitigation and adherence to voluntary reporting frameworks, to align with changing consumer and investor expectations?
- Have you evaluated the potential reputational risks associated with your supply chain, including risks related to deforestation and water usage, and do you have strategies in place to address and mitigate these risks?
- How is your firm engaging with local communities and ensuring compliance with environmental norms, recognizing the importance of the social licence to operate, and are you aware of the potential reputational impacts at both global and local levels?

BSOs should consider building their internal knowledge base as well as partners and referrals to include experts in:

- Sustainability communication and reporting – Experts who can help businesses effectively navigate the different reporting frameworks and communicate their sustainability commitments and practices to consumers, investors and stakeholders, minimizing the risk of reputational damage.
- Supply chain sustainability and risk management – Specialists who can assist companies in assessing and managing reputational risks associated with supply-chain practices, including deforestation and water usage, ensuring alignment with evolving environmental expectations.
- Community engagement and social licence to operate – Professionals who can guide businesses in engaging with local communities, understanding and complying with environmental norms, and building and maintaining a social licence to operate that reduces reputational risks at both global and local levels.

Additionally, BSOs can:

- Lead by example, sharing BSO sustainability reporting and communication initiatives.
- Expand the international networks to support community engagement in international markets (sector associations, non-governmental organizations [NGOs], community groups).
- Expand BSO service offering to provide training in communications, reporting and risk management to MSMEs.
- Use ITC's Green Performance Assessment to help MSMEs track their goals linked to energy, water, waste, wastewater, environmental management systems, GHG emissions and chemicals and soil. See https://greenperformance.intracen.org/home

Case studies

Appendix I contains three case studies that, through real examples and modelled scenarios, illustrate transition climate risks that affect the agriculture sector.

The first case study uses a future climate scenario to explore the potential effects of transition risks in the beef industry in Colombia, concluding that higher production costs and tighter land use restrictions and forest conservation efforts may incentivize actors in the sector to switch to other economic activities.

The second case study explores the implications of introducing a carbon tax in the U.S. market and its effects on agricultural production, commodity trade and GHG emissions associated with global land-use change. The third case study offers an example of a TCFD-aligned climate-related financial disclosure, for a company providing specialty products and methodologies in the precision agriculture, building and infrastructure as well as data communications sectors.

Finding data and information about transition climate risks

Numerous online platforms and guidelines offer free access to data and information that can allow users of this guidebook to investigate and compare climate policy trends. Table 2 summarizes key sources.

Table 2: Sources of data for transition climate risks

Policy and legal	Main data source
Climate-related laws, as well as laws and policies promoting a low-carbon transition for 30 countries	Climate Change Laws of the World database
Nationally determined contributions (NDCs) also offer critical information on climate action and commitments at the country and sectoral levels, helping to identify emerging trends in transition risks	NDC Registry database[10]
Existing and emerging carbon pricing initiatives around the world. Used to track which countries have carbon instruments.	Carbon Pricing Dashboard
National greenhouse gas emission inventories and implied national mitigation (NDC) targets	IMF Dataset
Other sources of information	**Main data source**
UN Handbook on carbon taxation for developing countries: A practical guide containing real-world examples and practical tools, including checklists to assist policymakers and government officials	Link to source
Science-based targets: Science-based targets offer companies a clearly defined path to reduce emissions in line with the Paris Agreement goals. Offering a range of target-setting resources and guidance, Science Based Targets independently assesses and approves companies' targets in line with its strict criteria.	Link to information
GHG Protocol: Scope 3 Calculation Guidance	Link to information
Carbon Trust, briefing: What are Scope 3 emissions?	Link to information
ITC Standards Map: Helps users find trusted and neutral information about sustainability standards, codes of conduct, audit protocols, reporting frameworks and company programmes on sustainability	Link to information
ITC, Research Institute of Organic Agriculture, International Institute for Sustainable Development: State of Sustainable Markets	Link to information
ITC (2014) Product carbon foot printing standards in the agri-food sector	Link to information

Source: Authors

[10] While tools such as the NDC Explorer and Climate Action Tracker continue to be refined and information from more countries is incorporated into these databases, the NDC Registry remains the more comprehensive source to access countries' NDCs. NDC Explorer can be acceded at https://klimalog.die-gdi.de/ndc/#NDCExplorer/worldMap?NewAndUpdatedNDC??income???catIncome and Climate Action Tracker can be accessed at https://climateactiontracker.org/.

Chapter 2

Physical climate risks

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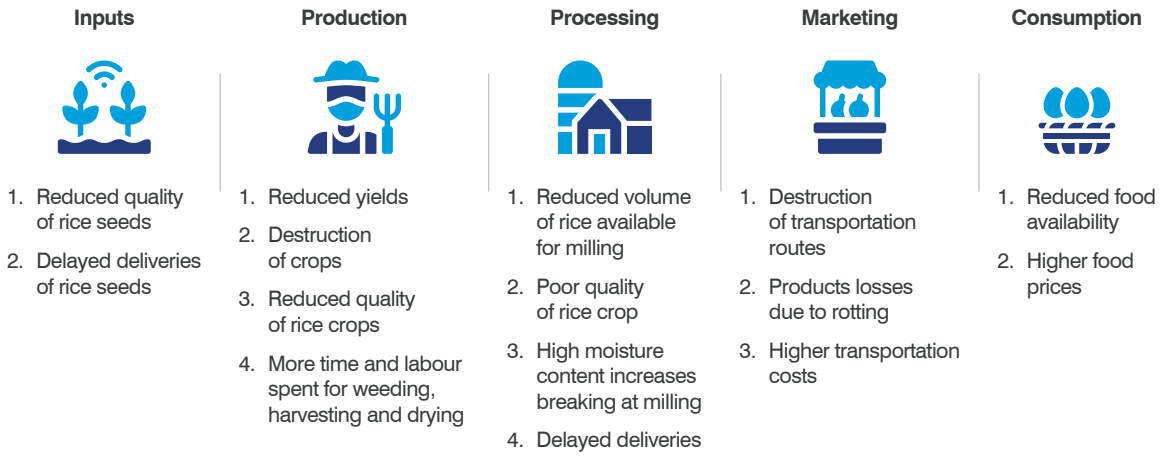
Chapter 2
Physical climate risks

Risks across the food value chain

Climate change hazards pose risks across the whole value chain, from production through processing to the transport and distribution of agricultural goods. Examples affecting the rice value chain in Uganda are listed below. For a full classification of climate-related hazards, see Appendix II.

Figure 5: Physical climate risks in the Ugandan rice value chain



Source: IISD (2016).

Risks to agriculture production

Two types of climate hazards, chronic and acute, pose physical risks to agricultural production.

Chronic physical climate hazards, such as changes in temperature and rainfall patterns, increase the incidence of pest, disease and invasive species. This threatens the quality and quantity of yields and forces farmers to spend more on pest control, raising their operational costs. Ocean acidification, on the other hand, threatens wild fisheries as well as mariculture operations.[11]

Acute hazards or extreme weather events, such as cyclones and flooding, damage physical assets and infrastructure, causing supply-chain disruptions. These cause losses in revenue and add maintenance costs for owners.

[11] Mariculture has been defined as the cultivation, management and harvesting of marine organisms in their natural environment (including estuarine, brackish, coastal and offshore waters) or in enclosures such as pens, tanks or channels.

Climate risks result from the interaction of a climate hazard at an exposed location with a specific operation. The greater the magnitude of the hazard and its probability to cause harm, the greater the risk to the operation. When risks materialize, they can trigger various consequences and result in material impacts to businesses (briefly summarized in Table 3).

Table 3: How do climate drivers affect agricultural productivity?

Climate hazards	Associated climate risk	Possible consequences	Material impact to businesses
Chronic (slow onset climate drivers)			
Increased temperature	■ Increased evapotranspiration ■ Reduced soil quality	■ Reduced quality and quantity of yields	■ Loss of income ■ Increased maintenance and operational costs ■ Loss of employment
	■ Increased incidence of pest and disease	■ Reduced quality and quantity of yields	■ Increased maintenance and operational costs
	■ Increased reach of tropical insects and mosquitoes ■ Changed pathogen distribution ■ Heat stress	■ Increase reach of vector-borne disease ■ Lower labour productivity ■ Threats to livestock	■ Impacts on employee safety ■ Reduced agricultural output
Changed cooling degree days	■ Plants cannot complete the phenological cycle before the first flowering	■ Life cycle of crop is undermined, affecting induction of new buds	■ Reduced revenue
Water scarcity	■ Reduced water availability for production ■ Reduced volume of water flows in rivers and dams ■ Increased risk of drought and wildfires	■ Reduced quality and quantity of yields ■ Decreased reliability and generation capacity of hydropower plants	■ Loss of income ■ Increased maintenance and operational costs ■ Loss of employment
Sea level rise	■ Coastal erosion ■ Increased risk of coastal flooding and storm surges	■ Damage to infrastructure	■ Increased maintenance and operational costs ■ New costs of coastal defence
Acute (extreme weather events)			
Hurricanes and cyclones	■ High winds ■ Storm surges ■ Extreme rainfall ■ Coastal and riverine flooding	■ Damage to assets and infrastructure ■ Disruption to business operations and supply chains ■ Risks to employee safety	■ Increased maintenance and operational costs ■ High recovery costs ■ Loss of life
More and more intense rainfall	■ Increased risk of flooding and landslide ■ The application of fertilizers is made ineffective by the anticipated onset of the rainy season, as rains cause fertilizer runoff	■ Damage to infrastructure and equipment ■ Reduction/loss of yields due to soil degradation and erosion	■ Increased maintenance and operational costs ■ Supply-chain disruptions
Drought	■ Effects on crop longevity ■ Increased risk of wildfires ■ Increased reliance in irrigation	■ Loss of yields	■ Loss of income ■ Increase capital investment costs ■ Loss of employment
Extreme temperature	■ Heatwaves	■ Reduced quality and quantity of yields ■ Threats to livestock: heat stress, mastitis on cows, reduced production ■ Adverse work conditions	■ Loss of income ■ Increased maintenance and operational costs ■ Loss of employment ■ Impacts on employee safety

Source: IPCC (2022), Chapter 5, Sixth Assessment Report.

Not all climate change impacts are expected to be adverse, at least in the short term. With adequate adaptation measures in place, enhanced CO2 concentrations may have an initial positive impact in photosynthetic rates and accelerate crop development for certain types of crops. In particular, C3 type photosynthesis plants (e.g. wheat, rice, oats, barley, soybeans and cotton) that are more adapted to higher temperatures and drier climates than C4 type plans (e.g. sorghum, cotton and sugarcane) may be affected positively by higher CO2 concentrations, despite certain limiting factors.

Moreover, higher temperatures may improve conditions for crops in certain geographies by extending the length of the potential growing season, reducing periods required for crop maturation, expanding crop-producing areas and increasing the possibility of completing two or more cropping cycles during the same season. Case study one shows how in some northerly latitude regions, increasing temperatures and CO2 concentrations may have net positive impacts when adequate adaptation measures are also undertaken.

Risks to processing and post-harvest operations

Climate hazards also pose a series of risks to processing activities, in particular to the availability of input resources (such as water and raw produce). Lack of adequate and reliable access to these resources may increase production costs or even make it impossible for processors to operate.

Additionally, extreme events can affect processing facilities and operations and may also damage the product whilst it is being stored. These factors can occur simultaneously. For example, a climate hazard such as heavy rainfall can destroy crops but can also flood processing facilities. Similarly, increased temperatures and humidity can affect crop quality at harvest but may also augment the spread of fungi in storage areas. Table 4 below offers a summary with illustrative examples on the consequences of climate hazards to processing activities and their impact to businesses.

Table 4: Impacts of climate drivers on agricultural productivity

Climate hazard	Associated climate hazard	Examples of consequence	Material impact to businesses
Heavy rainfall	■ Increased risk of fluvial and pluvial flooding and landslide	■ Damage to product in storage or post-processing facilities located in low-lying areas	■ Loss of revenue
High temperature and humidity	■ Proliferation of fungi and disease	■ Damage to product in storage areas	■ Loss of revenue ■ Increased costs
Hurricanes and cyclones	■ Strong winds ■ Flooding ■ Storm surges	■ Damage to processing equipment	■ Increased costs

Source: IPCC, 2022.

Risks to trade transport networks

Climate change hazards (in particular extreme weather events) affect terrestrial inland transport routes as well as maritime infrastructure, causing disruptions to agricultural value chains and food trade. Impactful consequences range from damage to infrastructure and equipment to negative effects on operations. Up to $27 trillion a year could be lost due to damage caused by coastal flooding and sea level rise.

The resulting supply-chain disruptions can lead to greater uncertainty and higher costs for exporters. Table 5 offers a summary with illustrative examples on the consequences of climate hazards to transport routes (both terrestrial and maritime).

Table 5: Climate change impacts on transport infrastructure

Climate hazard	Associated climate hazard	Examples of consequence	Material impact to businesses
Heavy rainfall	■ Fluvial and pluvial flooding ■ Landslides	■ Damage to coastal infrastructure and inland transport connections ■ Reduced vessel manoeuvrability ■ Increased sedimentation in navigation channels ■ Reduced visibility and time delays	■ Loss of revenue ■ Increased costs of maintenance (such as dredging, road works) ■ Supply-chain disruptions ■ Reputational loss
Sea level rise	■ Coastal flooding	■ Damage to transportation system infrastructure: impact on storage areas, terminals and cargo ■ Coastal erosion	■ Supply-chain disruptions ■ Increased costs of maintenance (such as road maintenance) ■ Loss of revenue ■ Reputational loss
Hurricanes and cyclones	■ Strong winds ■ Coastal flooding ■ Storm surges	■ Damage to equipment and containers ■ Reduced operability of cranes at port terminals ■ Disruption to transport infrastructure (airports, ports, railways, highways) ■ Increased coastal erosion	■ Supply-chain disruptions ■ Food insecurity ■ Loss of revenue ■ Reputational loss
Increase in mean temperatures and frequency/ duration of heat waves	■ Drought and associated reductions in water flows	■ Reduced navigability of inland waterways due to droughts ■ Increased risk to personnel and passengers ■ Damage to paved roads and equipment ■ Higher energy consumption for cooling	■ Supply-chain disruptions ■ Loss of revenue ■ Reputational loss

Sources: United Nations Conference on Trade and Development (UNCTAD), 2020; Inter-American Development Bank, 2015.

Climate change impacts on inland transport infrastructure can be severe. A recent global multi-hazard risk assessment study suggests, for example, that more surface and river flooding could become the main hazard for road and railway infrastructure, increasingly disrupting international and domestic transportation of agricultural commodities. Similarly, high temperatures in the summer can cause rail buckling and decrease thermal comfort for passengers, increasing demand for air conditioning.

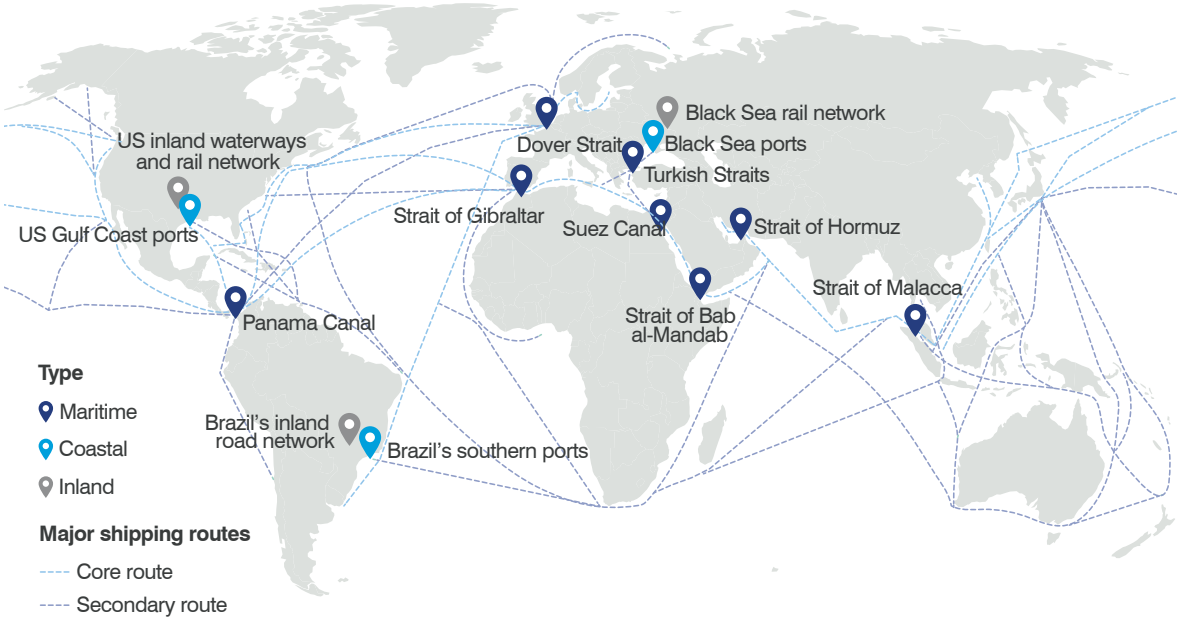
Severe drought in Europe in 2022 caused major reductions in the flows of its major rivers, negatively affecting river transport (on the Rhine river) and the generation of nuclear power (on the Rhône river). In 2023, the capacity of the Panama canal was reduced by 20% due to drought.

Ports and other maritime transport infrastructure are at even higher risk. Due to their location, coastal assets and maritime infrastructure are extremely exposed to climate hazards – especially coastal flooding, storm surges and strong winds – but also to increased temperatures and heatwaves, which can disrupt operations.

The impacts on trade stemming from the effects of climate change on transport systems are, however, not evenly distributed. Less developed countries tend to have fewer ports of entry and alternative transport routes, so extreme weather events can affect them disproportionately. Small island developing States are disadvantaged as most of their critical transport infrastructure (ports, airports, railways, highways) is located in low-lying areas. A single event, such as a hurricane, can disrupt an island's entire transport network, halting its ability to import necessary goods (e.g. food, tools, medicines) in the aftermath of the disaster.

In addition, food trade flows are strongly concentrated at critical junctures of specific transport routes, through which exceptional volumes of trade are passed (the so-called chokepoints – see Figure 6). An interruption at one or more of these checkpoints could lead to major shortages in food supply, commodity price spikes and systemic consequences.

Figure 6: Maritime, coastal and inland chokepoints and major shipping routes



Source: Bailey and Wellesley, 2017.

Transboundary climate risks

Agribusinesses and consumers are not only exposed to climate risks occurring where they operate, but also to transboundary climate risks, understood as risks that 'reach across borders, affecting one country – and requiring adaptation there – as a result of climate change or climate-induced extreme events in another country' (Hedlund et al., 2018).

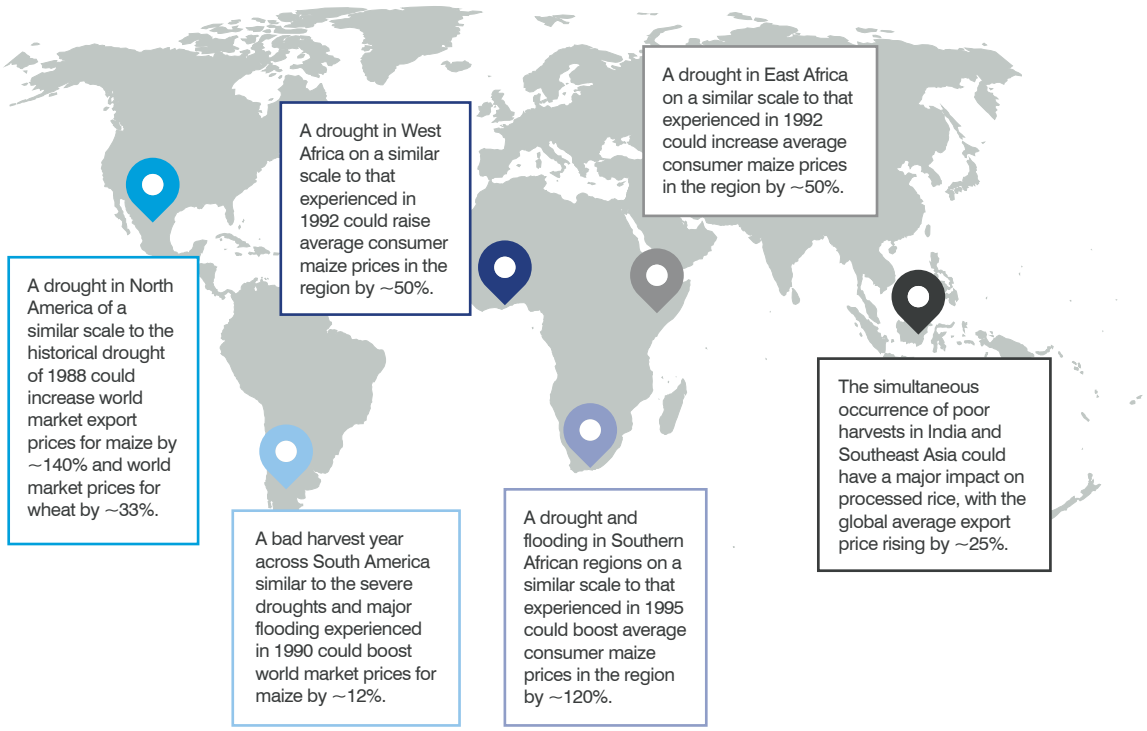
Climate change impacts result in greater price volatility and disruptions to supply chains. As noted by the European Environment Agency in 2021, this volatility and disruption will result in transboundary impacts on the reliability of supply and distribution of agricultural commodities. The scale of transboundary climate risks may depend on factors including the level of sensitivity of the crop, where producers are located and the structure of the commodity market itself, which can influence how risk propagates in the value chain.

> *'Transboundary climate risks in agricultural commodity flows are a serious global challenge that are in need of further study and exploration and deserve the urgent attention of policymakers.'*
>
> Adams et al., 2021

Figure 7 shows that agricultural price shocks due to the impacts of extreme weather events may take many forms and have different magnitudes and can lead to significant economic impacts, both on the domestic and international levels. A recent study found that changes in global food commodity prices caused by harvest disruptions and weather shocks in other regions of the world could become more frequent.[12] In fact, 'an event that we would have called a 1-in-100 years extreme adverse food production shock over the period 1951-2010 may become as frequent as 1-in-30 years before the middle of the century".

[12] The study, published in *Nature Climate Change* in 2021, looked at the impacts in 75 countries for 4 key agricultural commodities: corn, wheat, rice and soybeans.

Figure 7: How might extreme weather scenarios affect world prices in 2030?



Source: Willenbockel, 2012.

It is worth highlighting that the policy responses to climate risks can compound impacts on markets. This was the case in 2010, for example, when an extreme heatwave in the Russian Federation and Ukraine affected world grain production. The shortfall in grain harvest was followed by a series of responses (including international financial speculation, export bans and panic buying), which further affected market price volatility.

Case studies

Three case studies are introduced in Appendix III to illustrate, through real examples and modelled scenarios, physical climate risks that affect the agriculture sector.

The first case study illustrates how, in the case of high-latitude agricultural systems, such as the ones found in Canada, climate change may have both positive and negative effects on livestock and crop production, largely depending on the type of measures taken to counter potential negative impacts.

The second case study reflects on the current situation in East Africa, where the impacts of prolonged drought combined with the effects of the COVID-19 pandemic and the Russian invasion of Ukraine have pushed grain prices up, exposing millions to food insecurity.

Finally, the third case study illustrates the climate vulnerability of Europe's food processing industry. The EU sources many tropical commodities and animal feed for secondary processing from developing countries. Drought and other climate hazards have disrupted supply of those goods.

Finding data and information on physical climate risks

Several online platforms offer free access to data and information that can allow users of this guide to investigate and compare climate trends and future projections across different countries. Key sources are summarized in Table 6. See Appendix IV for a qualitative comparison on the uses of existing climate data portals.

Table 6: Sources of climate hazard data: Past and future

Historical climate	
Canopy cover and vegetation	
Land cover and land cover altering indicator	IMF Climate Dashboard
Satellite remote sensing for global climate change	Examples
Land cover and land use indicators	Review of available data, by Vasco Diogo and Eric Koomen | 22 September 2016
Land use change	
Chronic physical climate risks	
Precipitation, temperature, sea level rise	WBCCKP* - Current climate
Sea level rise	WBCCKP* - Impacts
Water scarcity and drought	WRI Aqueduct and WBCCKP*
Disaster risk	Global Assessment Report on Disaster Risk
Chronic physical climate risks	
Floods	WRI Aqueduct Floods
Wildfires	GFDRR ThinkHazard
Tropical cyclones and hurricanes	GFDRR ThinkHazard
Extreme heat	WBCCKP* - Current climate
Future climate outlook	
Chronic physical climate risks	
Precipitation, temperature, sea level rise	WBCCKP* - Climate projections
Sea level rise	GFDRR ThinkHazard
Future climate outlook	
Acute physical climate risks	
Precipitation extremes	WBCCKP* - Current climate
Transboundary climate risks	
Global data on transboundary climate risks in agricultural commodity flows	SEI – Transboundary water dependency + Trade openness + Cereal import dependency + Embedded water risk + KOF Globalisation Index

Sources: * WBCCKP: World Bank Climate Change Knowledge Portal.

Appendix I provides a comparison of different climate data platforms. However, when it comes to finding national- and subnational-level information on climate change trends and future projections, it is recommended to review information that may have been published by national governments, in particular in the national adaptation plans and climate resiliency strategies as well as countries' NDCs (see Table 7). These documents also contain a section on observed and projected impacts of climate change in agriculture.

Table 7: Global platforms for national-level climate change strategies

Global platforms for national-level climate strategies	
Nationally determined contributions	NDC registry
National adaptation plans	UNFCCC national adaptation plans list

What can BSOs do to find data and information on physical climate risks?

This information is particularly important for businesses operating in the agriculture and food processing sectors, as well as those involved in trade and transport networks. Three questions BSOs could ask firms to assess their exposure to this risk:

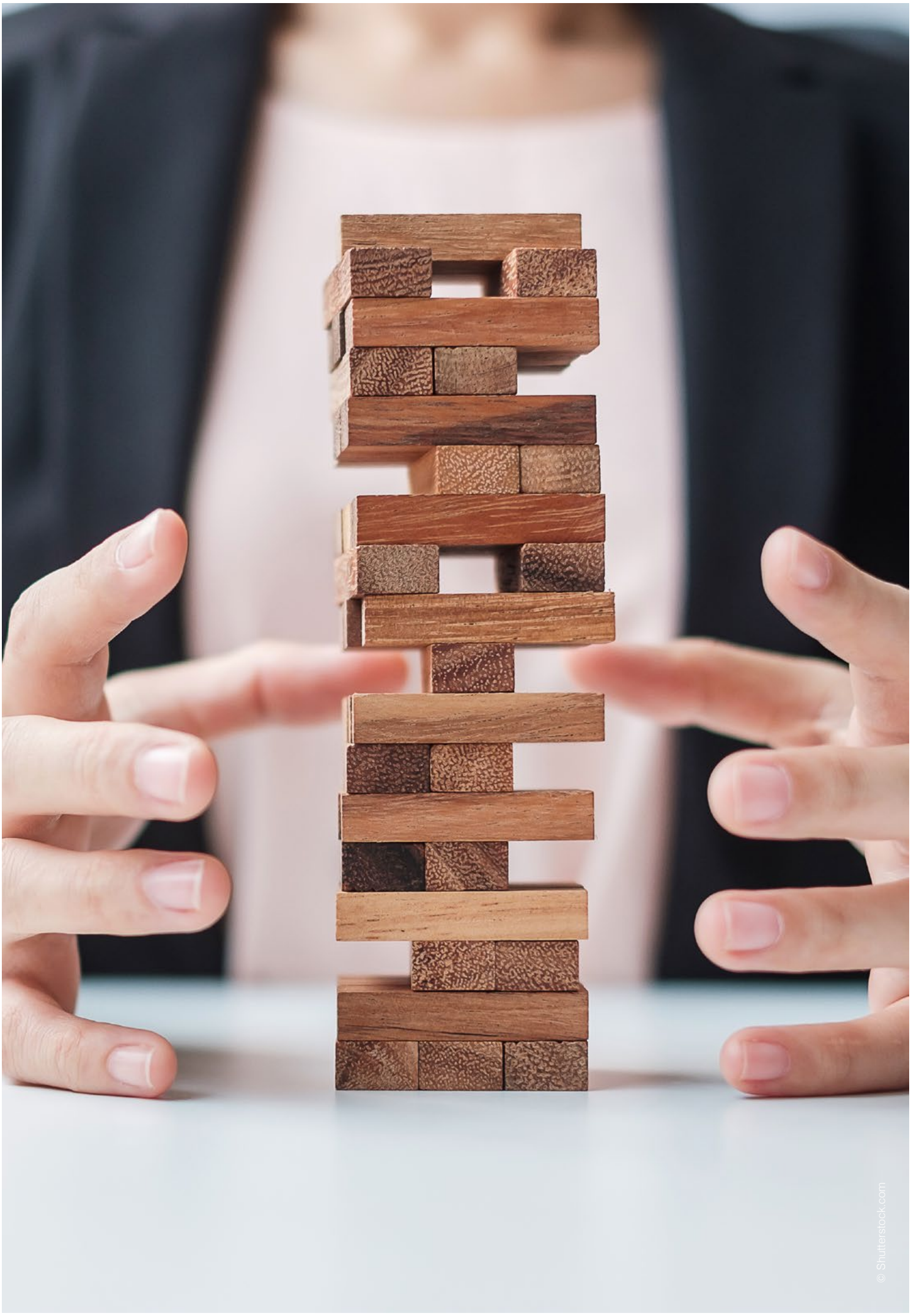
- How has your company assessed and prepared for the physical climate risks affecting agriculture production, including extreme weather events and changing climate patterns?
- What measures are in place to address physical climate risks in processing and post-harvest operations, considering potential disruptions to the supply chain due to climate-related challenges?
- How resilient is your company's trade and transport network to potential disruptions caused by transboundary climate risks, and what strategies are in place to adapt to changing climate conditions affecting international trade?

BSOs should consider building their internal knowledge base as well as partners and referrals to include experts in:

- Climate resilience in agriculture, trade and transport – Experts who can guide businesses in understanding and adapting to the specific risks climate change poses to agriculture production, trade and transport offering strategies to enhance resilience and sustainability.
- Climate data and information resources – Experts who can help companies find reliable and up-to-date data on physical climate risks so they can make informed decisions and implement effective adaptation measures.

Additionally, BSOs can:

- Partner with research centres and statistics organizations to access updated and reliable information.
- Set up specific channels to share information updates and inform about potential physical risks. Channels can include weekly/monthly updates, webinar series, SMS alerts, specific committees or working groups.



Chapter 3

Climate change-related opportunities in the agrifood sector

From risk to opportunity 30

Chapter 3
Climate change-related opportunities in the agrifood sector

From risk to opportunity

New climate policies, regulations, technologies and consumer trends present market opportunities for agrifood exporters. Furthermore, as agricultural producers and processors build resilience, they will demand new climate-related goods and services, creating new economic opportunities, particularly in rural areas.

As the transition incentivizes farmers to reduce emissions, there are a range of new opportunities around practices, technologies and markets to consider that have the potential to build resilience and generate new income revenues.

Climate-smart practices and technologies

Climate-smart agriculture is a farming approach that aims to achieve three outcomes: increased productivity, enhanced resilience and reduced emissions. BSOs can help farmers adopt practices and technology by improving providing demonstrations, extension services and information on climate change.

Alternative land uses

The potential to earn income from alternative land uses includes renewable energy integration, conservation schemes and sequestering carbon. Farmers can generate additional income by investing in renewable energy sources such as solar panels or wind turbines on their land. Conservation entrepreneurs are working with farmers to adopt environmentally friendly practices that are financially rewarded.

Projects that sequester carbon in soils and forests represent a large share of the carbon credits traded in international markets; yet, more innovative forms of carbon capture – such as blue carbon – are also starting to gain traction. Carbon sequestration present an interesting opportunity for farmers to develop a new service in their managed lands (see, for example, the first case study of Chapter 2).

Value-added products

Premium prices are associated with value-added produce such as organic and speciality goods. Retailers use labelling and certification schemes to communicate on the environmental attributes of products, including absence of pesticide use and low carbon footprint.

Opportunities also exist for firms and organizations able to help MSMEs in the agriculture sector navigate sustainability and climate-related standards, and to access sustainable markets and costumers through sustainable certification.

Climate-related goods and services

New goods and services are needed to help reduce the exposure and sensitivity of the agriculture sector to climate change hazards and to increase the adaptive capacity of agribusinesses to cope with climate change.

Tables 8 and 9 provide illustrative examples of the types of goods and services available in the market and for which demand is likely to increase. Many of these products and services are win-win solutions in that they enable economic gains and boost efficiency while contributing to climate change adaptation or mitigation.

Table 8: What goods and services support resilience in agriculture?

Climate-related hazard	Goods	Services
High temperatures	■ On-site monitoring devices ■ Remote sensing data	■ Soil condition monitoring ■ Weather monitoring ■ Smart crop monitoring systems ■ Smart livestock monitoring systems
Pests and disease	■ Protective structures	■ Digital pest management systems ■ Integrated weed management
Water scarcity and drought	■ Drip irrigation systems ■ Water-efficiency devices ■ Water-harvesting devices	■ Monitoring and modelling water resources ■ Wastewater treatment and recycling ■ Desalinization ■ Deficit irrigation and irrigation suspension ■ Development and monitoring of nature-based solutions

Source: FAO and CCAFS, 2020

Table 9: What goods and services support resilience in ports?

Climate-related hazard	Goods	Services
Flooding	■ Pumps to drain surface flooding or ground waters ■ Demountable flood defences; sandbags; pallets, bricks or similar for temporary defences to raise water ■ Reinforcement structures such as revetements, wave dissipating block and parapets ■ Protection barriers, yard furniture, etc. ■ New mooring technology such as vacuum mooring systems ■ Water splash or scour protection ■ Floating infrastructure ■ Flood-proofing measures	■ Ensure effective maintenance of existing drainage system ■ Install and maintain sustainable drainage systems ■ Dredging ■ Deck design ■ Installation and maintenance of flood-proofing measures ■ Monitoring and recordkeeping on location-specific surface water-related metrics ■ Prepare, review and regularly update flood risk maps and flood response plan ■ Flood risk modelling ■ Provide training in use of demountable defences, placing sandbags, raising assets, etc. ■ Research
Apl Extreme heat	■ Heat-tolerant or resistant plants, equipment, infrastructure or materials ■ Improve thermal efficiency *design for (temperature regulation)	■ Vegetation management for shading ■ Monitoring and recordkeeping on location-specific heat-related metrics ■ Research
Reduced visibility (from high rainfall)	■ Warning equipment, fog horns, radar, high visibility lighting, etc. ■ Manoeuvring aids, navigation aids, (beacons, lights, buoys, etc.) ■ Instrument-only navigation equipment ■ Visibility measuring instrumentation ■ River information systems or vessel traffic services ■ Use airtight equipment to reduce condensation issues ■ Multi-modal cranes and other equipment for use when prolonged fog precludes river use	■ Monitoring and recordkeeping on location-specific fog-related metrics ■ Warning systems ■ Research ■ New protocols or codes of practice for operations in poor visibility (recreational use, pilotage, etc.). ■ Awareness raising or provision of training

Source: Based on portfolio adaptation measures developed by PIANC, n.d.

In addition, physical climate risk advisory and analytic services will become more important. Key services and products are summarized in Table 10.

Table 10: Classification of adaptation solutions

By adaptation solution type	
Climate adaptation intelligence	Advisory services for climate risk exposure and vulnerability identification and assessment, among others Data management and operations (such as provision of calibrated/validated data sets; collection and provision of raw data for global weather, and climate change applications) Decision-support tools (such as early warning systems, software performing cost/benefit analysis of adaptation solutions) Physical climate risk identification and impact assessment (such as spatial hazard and vulnerability mapping analysis, disaster risk assessment tools, systematic monitoring and remote sensing climate-impact analysis)
Climate adaptation products and services	Physical climate risk management (including water efficient irrigation technology, rainwater harvesting; crop storage and geosynthetics) Physical climate risk transfer (such as parametric insurance)

Source: Trabacchi et al., 2020.

What actions can BSOs take to explore these opportunities?

Three questions BSOs could ask MSMEs to assess their exposure to climate change related opportunities:

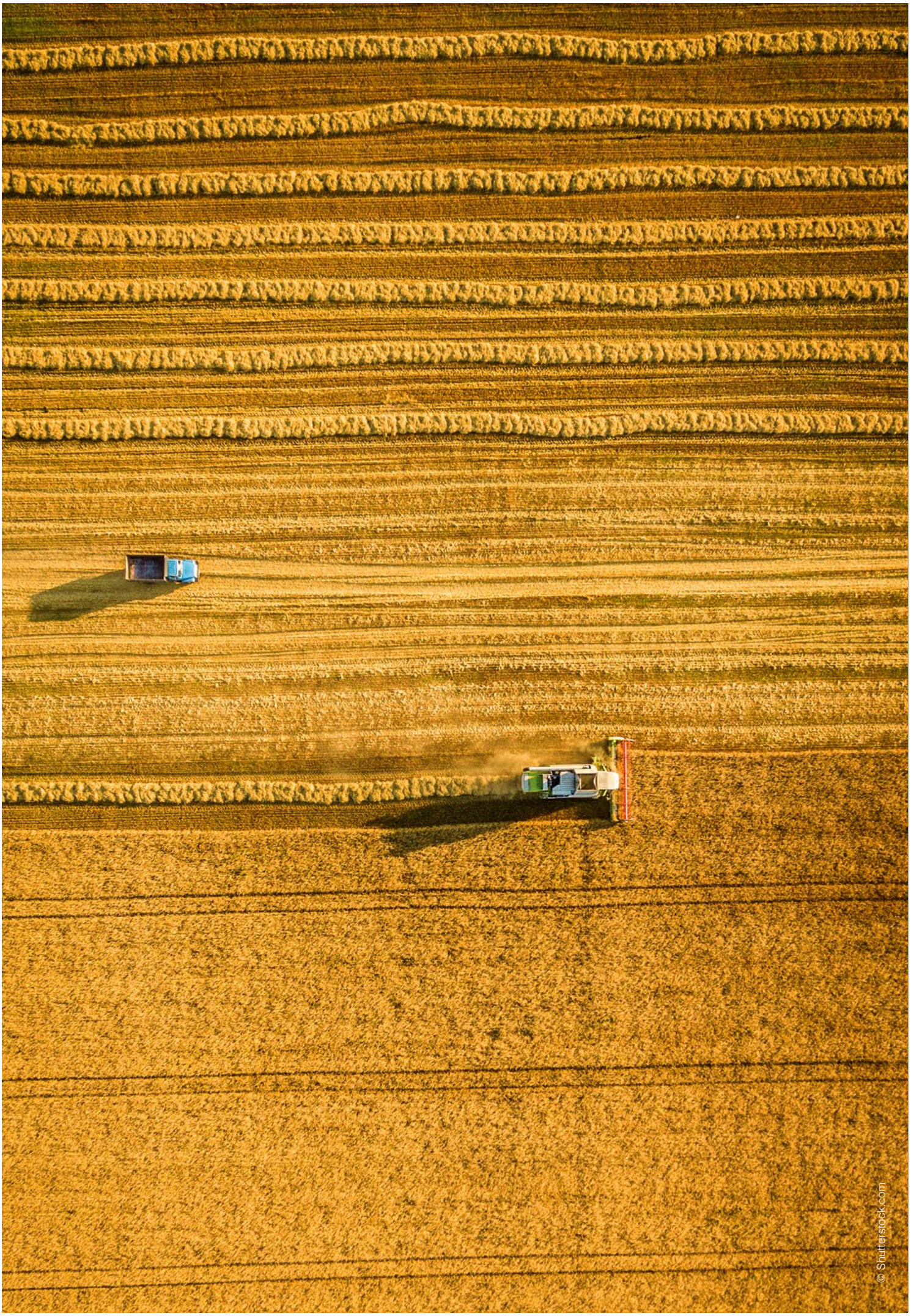
- How is your company leveraging new climate policies, regulations and technologies to identify and seize market opportunities in the agrifood sector, especially those related to climate-smart practices and technologies?
- Have you explored alternative land uses, such as renewable energy integration and carbon sequestration, to generate additional income and enhance resilience, considering the potential economic benefits in rural areas?
- Is your company aware of and capitalizing on the growing demand for climate-related goods and services in agriculture, including the adoption of technologies to monitor and manage climate-related hazards such as high temperatures, pests and water scarcity?

BSOs should consider building their internal knowledge base as well as partners and referrals to include experts in:

- Climate-smart agriculture implementation – Experts who can guide farmers and businesses in adopting climate-smart practices and technologies, offering demonstrations, extension services and information on climate change.
- Renewable energy and carbon sequestration – Specialists who can help farmers explore alternative land uses, including the integration of renewable energy sources and participation in carbon sequestration projects, providing new income streams.
- Climate adaptation goods and services – Professionals who can help businesses understand and access a wide range of climate-related goods and services available in the market, including tools for monitoring and managing climate-related hazards, as well as physical climate risk management solutions.

Additionally, BSOs can:

- Collaborate with local universities, research institutions, environmental NGOs, local technology hubs or innovation centres that specialize in climate-smart agriculture. Such partners can provide expertise, training materials and guest speakers for workshops, and offer technical insights into alternative land uses, carbon sequestration and sustainable practices.
- Partners with innovation hubs to connect MSMEs and start-ups, mentors and investors in the tech and agriculture sectors.



Chapter 4

Mainstreaming climate risks and opportunities into BSOs

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Chapter 4
Mainstreaming climate risks and opportunities into BSOs

Response to transition risks (mitigation)

BSOs can use their understanding of transition risks in different ways to increase the level of support for firms and policymakers. Here are some specific examples:

- **Develop climate strategies for a just transition:** BSOs can use their knowledge of transition risks to develop customized advisory services for different types of businesses. For example, they can help agribusinesses understand how transition risks may affect their supply chains or advise companies on how to manage policy risks associated with changes in government regulations.
- **Support the proliferation of goods and services that help agribusinesses reduce their GHGs and their contribution to climate change to boost reach and scale of climate markets.** BSOs can promote a vast range of mitigation related goods and services.
- **Provide technical assistance and capacity building:** BSOs can help firms develop the skills and knowledge they need to manage transition risks. This may involve offering guidance on how to use low-carbon technologies, supporting a just transition to a low-carbon economy, and how to navigate market shifts (driven by compliance, changing consumer preferences and localization of food demand).
- **Facilitate access to finance:** BSOs can work with financial institutions to develop new products that support sustainable investments. For example, they can design green bonds that allow investors to support companies that are transitioning to a low-carbon economy or help farmers tap into emerging opportunities in environmentally orientated markets such as carbon and for organic products. See Appendix V for examples of available sources of finance.
- **Engage in advocacy and policy dialogue:** BSOs can use their knowledge of transition risks to engage in policy dialogue with governments and other stakeholders. For instance, they can provide input on the design of carbon pricing mechanisms in the agrifood sector and advocate for policies that help lift barriers to trade of climate-friendly goods and services.
- **Facilitate collaboration and networking:** BSOs can use their networks to facilitate collaboration among firms that are working to address transition risks. For example, they can organize workshops or conferences on technological innovations and promote market fairs for low-carbon technologies.

By using their understanding of transition risks in these ways, BSOs can help businesses navigate the complex challenges associated with the transition to a low-carbon economy. This can help firms reduce their exposure to risks and also identify new opportunities and develop innovative solutions that can support their long-term success.

Response to physical risks (adaptation)

BSOs can use their understanding of physical climate risks to support businesses in various ways. Examples include:

- **Develop climate risk management and adaptation strategies:** BSOs can help businesses develop strategies to manage physical climate risks. This may involve conducting climate risk assessments to identify areas of exposure and then working with businesses to develop risk mitigation and adaptation plans. Understanding country-level differences can also help BSOs define tailored climate-support strategies in regions that are vulnerable to climate change or that have unique challenges and opportunities related to climate change.
- **Support the proliferation of goods and services that help agribusinesses adapt to climate change to expand reach and scale of climate markets.** BSOs can promote a vast range of adaptation-related goods and services.
- **Provide technical assistance and capacity building:** BSOs can provide technical assistance and capacity building to help firms improve their resilience to physical climate risks. This may involve offering training on best adaptation practices in the sector or providing resources to help businesses implement climate-smart technologies. For example, a BSO may offer workshops on climate-smart agriculture for small and medium-sized enterprises.
- **Facilitate access to finance:** BSOs can help businesses access finance for climate adaptation. This may involve connecting firms with sources of finance such as climate funds (see Annex V) or working with banks to develop climate-friendly lending products. For example, a BSO may help a farmer access finance to invest in climate-smart agriculture practices by helping him/her find a guarantor in the value chain or helping him/her demonstrate collateral through value-chain financing.
- **Engage in advocacy and policy dialogue:** BSOs can use their influence to advocate for policies that support climate adaptation. This may involve engaging with policymakers to promote the adoption of policies that incentivize climate-smart practices and that facilitate trade in carbon-related goods and services. For example, a BSO may lobby for the introduction of carbon pricing mechanisms or for regulations that encourage business practices that build climate resilience.
- **Facilitate collaboration and networking:** BSOs can use their networks to facilitate collaboration among businesses working to address physical climate risks, organize workshops, and encourage market fairs on climate-related goods and services to promote the adoption of adaptation technologies and climate-smart practices.
- **Be ready to leap to action:** With climate-related emergencies becoming more frequent and intense, BSOs should prepare their own business continuity plans so that when disasters hit, they can be quickly back in business, adapting their solutions, representing the voice of the private sector and offering support to firms when they need it most.

In summary, BSOs can use their understanding of physical climate risks to help businesses manage these risks, access finance for climate adaptation measures and improve their resilience to climate change, ensuring their future competitiveness. They can also engage in advocacy and policy dialogue to promote policies that support climate action.

A framework to mainstream climate change issues into BSOs

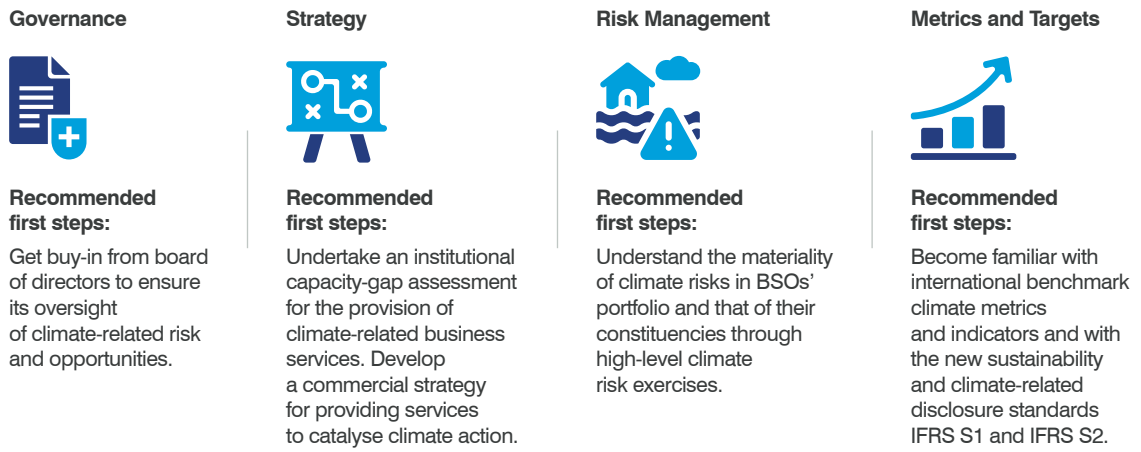
BSOs need to mainstream climate change issues into their own organizations. Based on the four pillars developed by the TCFD, the elements of mainstreaming are described in Figure 8 and elaborated in the paragraphs that follow. The four pillars are governance, strategy, risk management and metrics and targets.

As mentioned in Chapter 1, the IFRS Foundation now monitors the progress on companies' climate-related disclosures. IFRS S1 and IFRS S2 incorporate the recommendations of the TCFD.

ITC offers a range of tools and services related to both climate change and BSOs. The ITC assessment recognizes the interrelatedness of four areas of BSO performance excellence: leadership and direction, resources and processes, products and services, measurement and results. A climate-specific checklist is included as Appendix IV.

Furthermore, ITC offers a platform for BSO assessment that includes elements of environmental sustainability, https://www.itcbenchmarking.org/. As an example of climate-mainstreaming tools, BSOs can refer to ITC's internal mainstreaming guide at https://intracen.org/resources/publications/mainstreaming-sustainable-and-inclusive-trade-guidelines-for-international.

Figure 8: Aligning with TCFD recommendations: First steps for BSOs



Source: ITC, adapted from TCFD recommendations.

Governance: Climate awareness will set the tone

The TCFD recommends getting buy-in from the governance structure that provides BSO oversight and stewardship. This should include reviewing with the board (or similar governance structure) the elements of the mandate, mission and vision to assess to what extent they support or potentially conflict with considerations of climate opportunity and risk.

If climate-related constraints facing the members/clients of a BSO cannot be addressed within the current mandate, the BSO will need to review its mandate or find complementary actors in the business support ecosystem with which to connect. The review should also assess the representativeness and the awareness of the governance body to issues of climate risk and opportunity.

This assessment of diversity in climate thinking should also prompt the board to include youth in the evaluation of stakeholder needs and expectations. The board will have a role to establish trust and credibility on climate-related topics with stakeholders and facilitate new strategic partnerships and networks that will improve BSO effectiveness. In the short to medium term, it may be useful to establish a separate committee or a standing agenda item to help build board knowledge, establish patterns of thinking and define specific responsibilities.

Strategy: Ensuring a climate-relevant service offer

The TCFD recommends assessing institutional capacity gaps to improve climate-related business services and to follow up by developing a strategy to provide services to businesses to support their climate-related response.

The first step is to map the climate-related risks and opportunities for current clients/members and potential new ones. It is important to recognize, however, that depending on their location, sector, level of maturity and business model characteristics, each MSME will face different degrees of direct and indirect exposure to climate risk and different levels of vulnerability, including sensitivity and adaptive capacity.

Risk management: Assessments will inform strategy and advisory

The TCFD recommends running a climate risk assessment of key clients, sectors and projects to understand the materiality of climate and transition risks in the overall risk profile of the BSO. For many BSOs, climate-related delivery and financial risks have been poorly understood and greatly underestimated, leaving these organizations exposed to more risk than expected.

In parallel, risk will further increase if BSOs are committed to exploring and exploiting emerging climate-related opportunities. This is because of the degree of unfamiliarity associated with engaging with new subsectors, new client segments, new service lines and new markets.

Risk audits and risk-related reporting and accountability processes will need to be strengthened in the face of these newly recognized risks, with even more active management of risks in place to reduce both the likelihood and impact of these risks. To maintain a reasonable balance of overall risk, BSOs may find themselves having to reduce risk-taking in other domains, with a related trade-off in the potential for reward.

Metrics and targets: Measuring the effectiveness of climate-related actions

The TCFD recommends becoming familiar with the different frameworks for disclosure and internationally benchmarked climate indicators and metrics.

With this knowledge, BSOs should refresh their measurement system to ensure it is aligned with their own climate-related strategies and goals. The strategic decisions about prioritization of resources and possible new service offerings should prompt the establishment and review of climate-related baselines, targets and indicators to measure achievement of results, with this analysis then used to drive and further inform strategic decision-making.

Measurement collection and reporting should be robust, consistent and reliable, particularly given a potential increase in results scrutiny from stakeholders. When appropriate, this may include reviewing and adopting disclosure frameworks such as the TCFD or the Global Reporting Initiative.[13]

Client satisfaction should be used to improve product and service delivery. New climate-related services should be closely monitored to allow for adaptation and continuous improvement.

[13] For information and guidance on the Global Reporting Initiative, see www.globalreporting.org

BSOs' appraisal of climate-related opportunities

As agribusinesses enhance their ability to address climate-related risks and remain competitive in international markets, the rising demand for climate-related goods and services will generate new market opportunities for BSOs. To tap into emerging opportunities, BSOs will need to define the following:

- The characteristics of different business opportunities
- The market opportunity in accordance with different geographies and subsectors
- The adequacy of their institutional capacity to provide climate-related goods and services
- Avenues to strengthen their market position and institutional capacity to service members

Opportunities will depend on each BSO's capacity, strategy and business model as well as on the geographies it serves. There are five important climate-related opportunity areas, according to the TCFD, and BSOs can use this taxonomy to guide conversations on future climate-related investments and activities.

Figure 9: Five key areas of climate-related opportunities

Resource efficiency

Efficient heating solutions, LED lighting technologies; retrofitting buildings; circular economy business models; advances in industrial motor technology; electric vehicles

Energy sources

Solar; wind; hydro; nuclear; biofuels; geothermal; tidal; wave; carbon capture and storage

Products and services

Low-carbon consumer products; producer goods that reduce emissions; sustainable marketing and labelling; monitoring and advisory services

Markets

New emerging markets, stemming from collaboration among multiple stakeholders (e.g. banks, governments, SMEs, community groups); underwriting or financing green bonds and infrastructure

Resilience

Goods and services that reduce exposure and sensitivity to climate hazards and/or increase the adaptive capacity of asset, resources, operations and organizations

Source: TCFD, 2017.

In appraising these opportunities, BSOs should guide their strategies considering:

- What is the timescale of services and goods that need to be promoted?
- Do they respond to existing risks, emerging risks or market shifts?

When undertaking a market analysis, they should examine all information providing indicative trends on service demand, taking into account country or sector reports, legislative changes and corporate reports to estimate the future demand of the agriculture sector arising from physical and transition climate risks. Appendix V provides an overview of climate finance sources.

In doing so, BSOs can guide the analysis by considering:

- Will changes in policies and regulation have an impact on the sector's market?
- Will the sector's products and/or services provide competitive solutions to adaptation and resilience challenges?
- How will the sector's core financials be affected by adaptation and resilience responses in its value chain?

BSOs' appraisal of different climate scenarios

Each MSME will face different degrees of direct and indirect exposure to climate risk and a different level of vulnerability, including sensitivity and adaptive capacity. This means BSOs will have to develop tailored strategies to support their members in accordance with transition and physical risks they face.

Under a scenario where no climate action is taken (business as usual), lack of mitigation actions will mean high levels of physical climate risks for many firms, especially in the agribusiness sector. At the other extreme, under aggressive mitigation scenarios, in addition to physical risks, there will be high transition risk for firms including significant and rapid changes of regulations, taxes and market access.

BSOs must understand the nature of the risk at each point on this continuum and the effect on firm competitiveness with different subsectors, business models, geographic location and priority markets. BSOs should help firms group clients into climate-related segments and then adapt and promote their portfolio of specialist solutions as a result. They must also assess the capacity and positioning of the BSO to take advantage of opportunities in view of climate impacts over time, and the potential for market shifts as the agriculture sector responds to major changes in value chains and understand:

- How is the BSO positioned in the sector?
- Is it positioned to capture emerging climate-related opportunities?
- Does it require internal strengthening and further developments to tap into climate-related markets?

BSOs may find that they are forced to choose between upgrading their services to support traditional agricultural sectors (and existing members/clients) that might face substantial risk and few opportunities, and/or investing in emerging sectors where risk can be minimized or mitigated, and the future is more assured. This could imply a shift in the member/client base with political, resourcing and marketing implications.

Finally, BSOs should aim to identify the subsectors and geographies with the greatest potential opportunities to provide services in response to physical and transition risks, defining

- Is the market demand and the institutional capacity adequate for the BSO to pursue and invest in the development of its climate agenda?
- Are there specific opportunities in response to national-level physical and transition risks or in accordance with specific subsectors?

By doing so, BSOs can position themselves to capture emerging climate-related opportunities and strengthen their market position.

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Appendices

Appendix I: Case studies of transition risks

Case study one: Domestic transition risks in the Colombian beef industry[14]

The beef industry in Colombia not only contributes to its economy, but is an important part of its cultural heritage. Yet, the high emissions generated by cattle ranching, combined with the extensive use of land and associated deforestation, make the sector highly exposed to transition risks.

In trying to understand how climate transitions generate materiality issues in the beef industry through the use of scenario analysis, Orbitas Finance explored how the industry could be affected under different transition pathways. The results show that the industry's high emissions, suboptimal land use and association with deforestation expose it to numerous threats, including:

- Potential new emission costs stemming from production, transport and land clearing;
- Restrictions to land deforestation, impairing expansion of cattle ranching;
- Declining demand growth for beef products, with shifts in costumer preference and the rise of meat substitutes.

Table 11: Climate transition risks for the Colombian cattle industry

TCFD category risk	Risk event	Example of potential source
Policy and legal	Government restrictions on deforestation	The Supreme Court has passed laws to restrict deforestation in Amazonia.
	Introduction of greenhouse gas taxes or pricing systems that cover agricultural producers	Colombia has committed to reduce its greenhouse gas emissions by 20% below business as usual by 2030.
Technology	New planting technologies enable higher yields	Emerging agroforestry techniques such as intensive silvopastoral systems provide opportunities to boost yields, diversify income and reduce emissions.
Market	Declining demand for carbon-intensive protein sources such as beef	Both current trends and future transition scenarios project growing consumer substitution of ruminant meats in favour of lower-carbon protein sources.
	Retailers or wholesalers require new environmental standards from their suppliers	Colombian Tropical Forest Alliance partners Grupo Exito and Alqueria have committed to zero deforestation supply chains. Grupo Nutresa, Minerva, Burger King and other large beef actors have expressed interest in sustainable beef sourcing.
	Corporate and consumer demand for sustainable palm oil grows	Studies indicate that sustainable beef can command a price premium in Colombian markets.
	Land competition from lower-carbon crops	As security risks abate and land values rise, conversion cattle ranchers may convert or sell land to higher-margin, lower-carbon crops.
	Capital providers link financing to improvements in greenhouse gas emissions	El Fondo para el Financiamiento del Sector Agropecuario provides specialized financing.

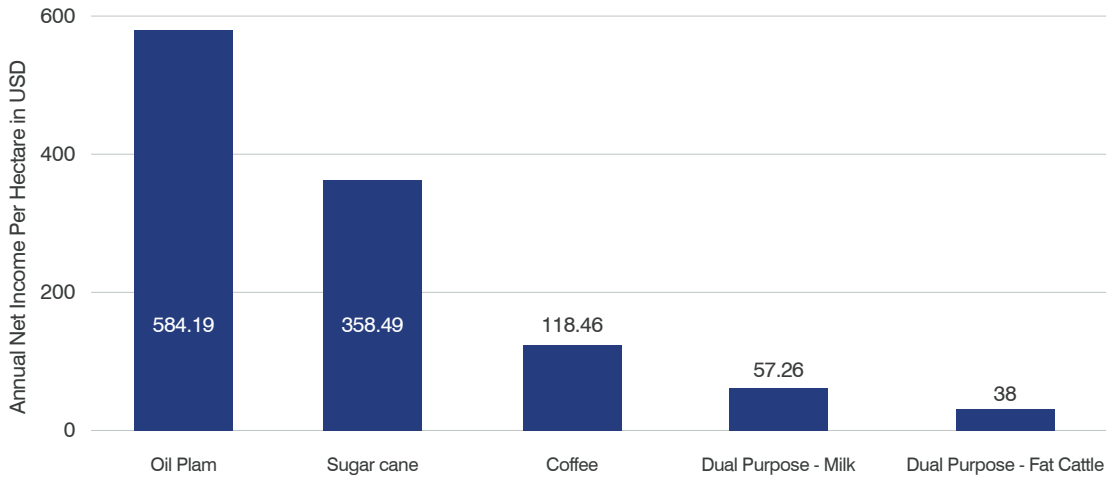
[14] Source of information for this case study: Orbitas (2020): Climate Transition Risk Analysis Brief: Colombian Cattle.

TCFD category risk	Risk event	Example of potential source
Reputation	Shareholders or capital providers divest or express concerns about environmental commitments	Seven major European investment firms have threatened to divest from nearby Brazilian beef producers and grains traders over deforestation concerns.
	Increased NGO and stakeholder concern about issues such as deforestation or climate change increase scrutiny of tropical commodity supply chains	NGOs play a highly active role in monitoring deforestation in Colombia, particularly around Amazonia.

Source: Orbitas, 2020.

Transition scenario models suggest that climate transitions will incentivize emission-intensive and inefficient producers to leave the market, as production costs rise while demand slows. The sector already has tight margins. With higher production and transportation costs, new costs, laws preventing expansion into new areas and land competition from higher-margin agricultural use, some producers will find it more effective to exit the industry and perhaps enter more profitable markets (such as palm oil, sugar cane or even reforestation).

Figure 10: Oil palm, sugar cane are highly profitable in Colombia



Source: FEDEGAN, 2015, in Orbitas, 2020.

Case study two: Effects of a carbon tax in U.S. agricultural markets[15]

What would happen if a carbon tax were established in the United States for agricultural activities?

This is the question that Jerome Dumortier of Indiana University–Purdue University Indianapolis and Amani Elobeid of the Department of Economics (Iowa State University) tried to answer.

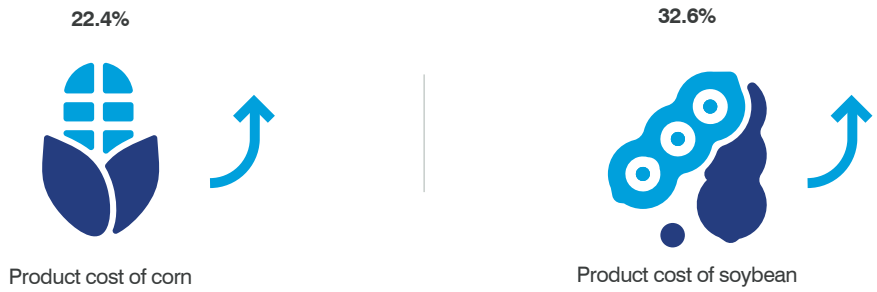
By applying a global agricultural simulation model to assess the effects of a carbon tax on agricultural production, commodity prices and global trade, the two academics undertook a range of investigations to model the potential effects of introducing a carbon tax over a 10-year period. Different carbon tax scenarios were explored, with prices ranging from $15 to $144 per metric ton of CO2-equivalent.

[15] Source of information for this case study: Dumortier, J., and Elobeid, A. (2021). *'Effects of a carbon tax in the United States on agricultural markets and carbon emissions from land-use change,'* Land Use Policy, 103, 105320. https://doi.org/10.1016/j.landusepol.2021.105320

In the absence of innovation and incorporation of technologies to reduce emissions from agricultural production, the results project that the higher the carbon tax, the greater the increase in the production costs of agricultural commodities and the lower the net rate of economic returns.

(1) Impact on U.S. agriculture

Under a carbon tax of $144 per metric ton of CO2-equivalent



Source: Dumortier and Elobeid, 2021.

An increase in production costs results in a decrease in net returns for both crops, yet the production cost increase is partly compensated by an increase in commodity prices.

(2) Impact on agricultural commodity trade

As a result, there is a decrease in U.S. exports

(3) GHG emissions associated with global land-use change

Source: Dumortier and Elobeid, 2021.

Changes in trade patterns would, in turn, result in a reallocation of land use in other parts of the world, potentially leading to an increase of global GHG emissions from land-use change (of about 1.85% of total US emissions in 2017).

Case study three: Carbon-related climate risk disclosures in the agriculture sector[16]

Orbia provides specialty products and methodologies in the precision agriculture, building and infrastructure, and data communications sectors. It has supported the TCFD since 2020. The following text is an extract from Orbia's TCFD-aligned climate disclosure, provided in the TCFD status report 2021 showcasing the climate-related risks identified by the company.

[16] Source of information for this case study: 2021 *TCFD Status Report.* Available at https://www.fsb.org/2021/10/2021-status-report-task-force-on-climate-related-financial-disclosures

Box 4: Industry: Agriculture, food and forest products, materials and buildings

2.a: Climate-related risks and opportunities identified in the short, medium and long terms

Climate change is a core challenge as Orbia transforms into a future-fit and resilient set of businesses. Each business group regularly develops and adapts its strategy to ensure Orbia's products and solutions address risks and opportunities of climate change.

Risks As part of our business processes, we continually identify physical and transition risks, quantifying their potential financial impacts and time horizon. Those risks with higher financial impact are prioritized for action. See Table 1 for details.

Opportunities Further detail of identified opportunities can be seen in Table 2.

Financial impact ranges NOTE: impact range labels are aligned with categories used in carbon disclosure project reporting and reflect Orbia's reviewed risk management processes.

We have 5 levels to define substantive financial impact:

1. High: $50MM or greater USD
2. Medium-High: $37.5MM USD – $50MM USD
3. Medium: $22.5MM - $37.5MM USD
4. Medium-Low: $7.5MM - $22.5MM USD
5. Low: Less than $7.5MM USD

Time Horizons

- Short term: Up to 1 year
- Medium term: 1-4 years
- Long term: 5 years and above

Time horizon	Risk type	Classification	Risk description	Magnitude of financial impact	Reference/ further details
Short term	Physical	Chronic	Increased water stress and drought leading to reduced capacity, resulting in decreased revenues.	Low	CDP response section 2.3
	Transition	Policy and legal	Carbon pricing mechanisms leading to increased direct costs.	Low	Orbia 2020
	Transition	Policy and legal	Mandates on and regulation of existing products and services (e.g. The AIM Act, which was signed into law in Dec. 2020, and directs EPA to establish limits to production and consumption of HFCs in line with the Kigali amendment), leading to reduced demand for products and services and decreased revenues from HFCs.	Medium - low	Annual Report p. 22, 26, 27, 35, 36, 74, 115
Medium term	Physical	Acute	Increased severity and frequency of cyclones and floods, leading to reduced capacity and decreased production and revenues.	Medium - Low	

Note: Some content was reformatted to fit the page.

Source: Orbia, TCFD Report 2020, pp. 2–3.

Appendix II: Categories of physical climate hazards

Physical climate risks – the climate risks associated with the physical impacts of climate change – are caused by chronic or acute climate hazards. Chronic climate hazards refer to incremental, slow-onset changes in climate patterns. These include:

Source: Author, adapted from TCFD.

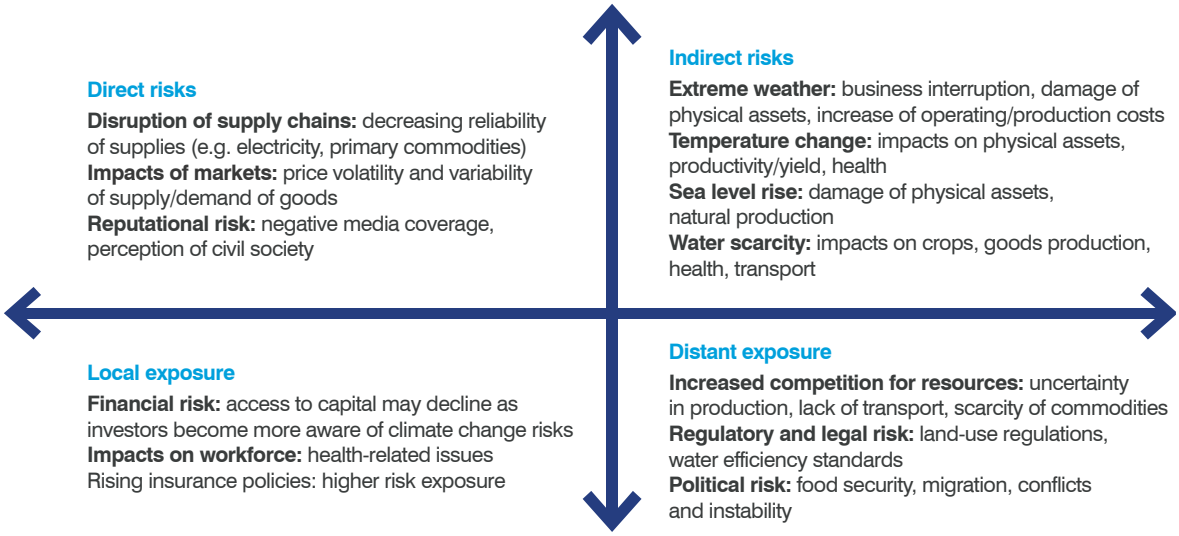
Acute climate hazards, on the other hand, refer to climate-event driven phenomena and are most often referred to as 'extreme weather events'. These include:

Source: Author, adapted from TCFD.

Physical climate risks are the direct result of rising temperatures and other climate-related hazards. They generate significant environmental, economic and social losses in all corners of the world.

As noted by Druce et al. (2016), physical climate risks can be either local or distant and either direct or indirect, as illustrated below.

Figure 11: Classification of climate-related physical risks

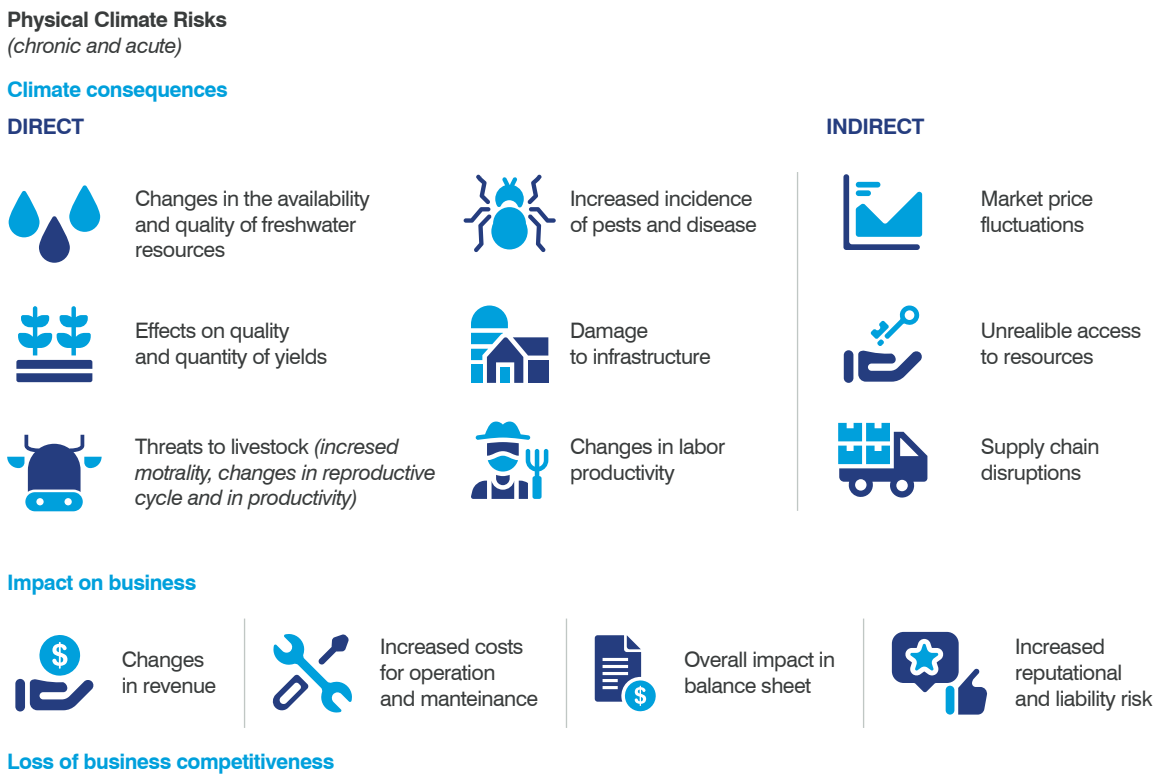


Source: Adapted from Paw, 2014, by Druce et al., 2016.

They can affect soil fertility, crop yields and product quality as well as lead to investment failure, premature physical destruction and degradation of assets and infrastructure, and therefore have significant negative impact on a sector's performance. This, in turn, can affect revenue, boost operational and maintenance costs, and ultimately affect farmers' balance sheets, reputation and ability to operate.

As summarized in Figure 12, physical risks generate material risks to businesses and so affect their overall competitiveness. These risks will be further explored in the following subsections of this Chapter.

Figure 12: Physical climate risks and key impacts on agribusinesses



Source: Graphic developed by the authors of this report.

Appendix III: Case studies of physical risks

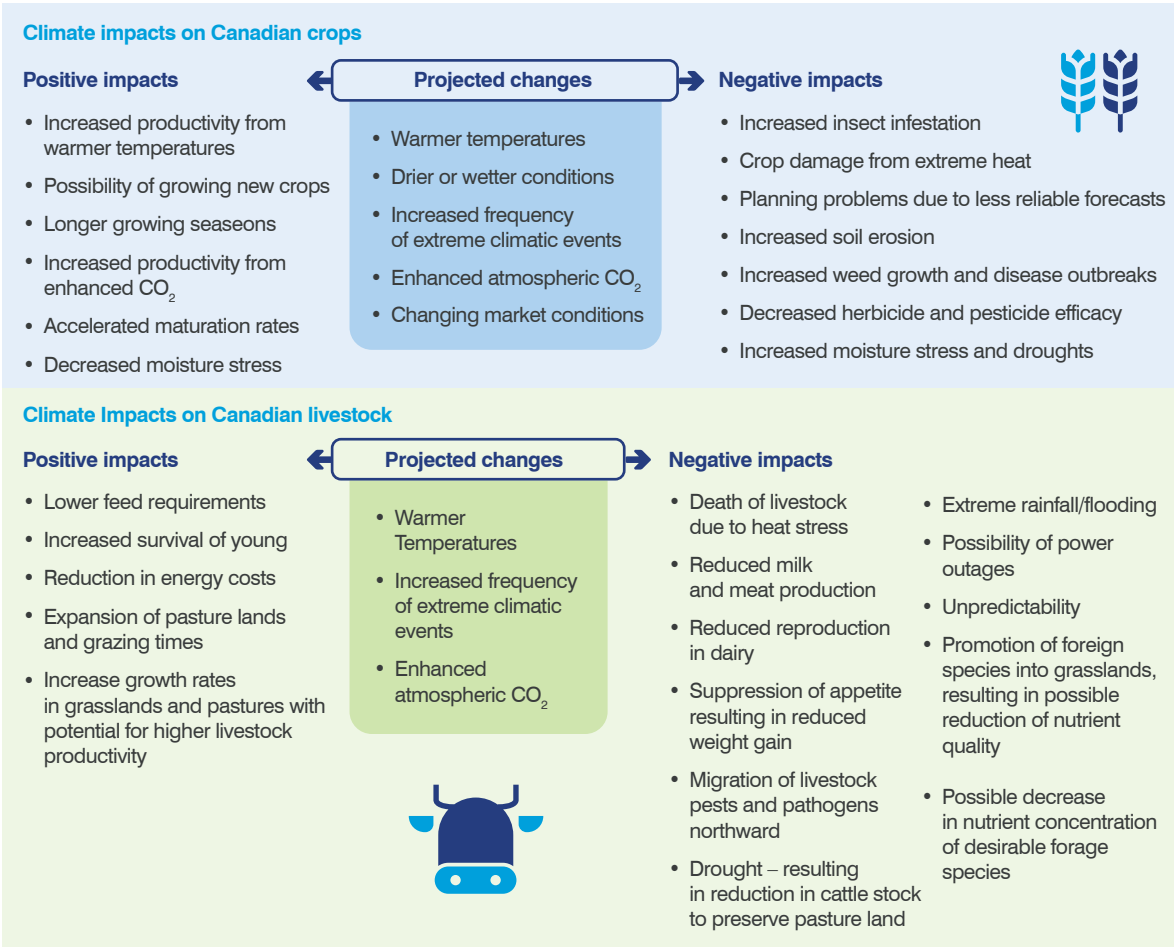
Case study one: Can climate change benefit agriculture and livestock?[17]

Warmer conditions are projected to benefit food production in certain areas of North America. One of the most important positive effects of higher temperatures is that the conditions for crop growth may improve through i) a longer potential growing season, ii) a shorter growing period required by crops for maturation and iii) an increased possibility of completing two or more cropping cycles during the same season.

On the other hand, higher temperatures in warmer/lower-latitude regions are expected to accelerate the respiration rate at which plants release CO2, causing less-than-optimal conditions for net growth and increases the evaporation rates, reducing moisture availability. In other words, crop growth in most developed countries (middle and higher latitudes) will benefit from the increase in temperature while more developing countries in lower latitudes will be negatively affected.

Similarly, increasing temperatures may positively or negatively affect livestock, according to the magnitude of change (and hence the location). The two figures below summarize positive and negative impacts of rising temperatures on crops and livestock.

Climate change may generate certain production advantages and positive impacts, but these will only be material to businesses that also manage climate risks effectively.



Source: Author, adapted from Government of Manitoba, n.d.

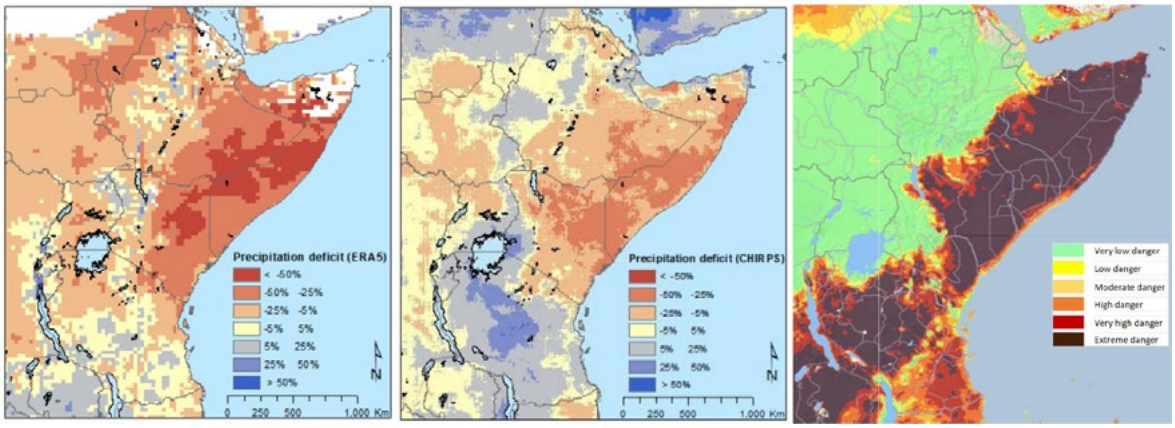
[17] Source of information for this case study: Government of Manitoba (Canada) (n.d.), *Agriculture and Climate change*. See https://www.gov.mb.ca/agriculture/environment/climate-change/agriculture-and-climate-change.html.

Case study two: The impacts of drought on food prices and food security[18]

Long-lasting drought conditions affecting East Africa are pushing 17 million to 18 million people across Kenya, South Sudan, Sudan and Uganda into greater food insecurity. As noted in (Figure 13 , left and centre panels), the precipitation deficit between July 2020 and July 2022 had the greatest impact in Somalia. However, but other geographies – such as northern Ethiopia, northern United Repubic of Tanzania and southern Uganda – were also affected.

This deficit in precipitation, along with a persistent drought, have generated a serious moisture deficit in the soil and increased the incidence of wildfires (Figure 13, righthand panel).

Figure 13: Drought in East Africa



Note: Left and centre: Precipitation deficit percentage compared to the reference period (1981–2020) for the period July 2020–July 2022 according to two different datasets. Right: Fire danger forecast expressed by the Fire Weather Index up to 16 August 2022 issued on 9 August 2022.

Source: Global Wildfire Information System.

Impacts on agriculture include:

- Below-average vegetation conditions and loss of yields
- Death of livestock and reduced milk production
- Reduced water for irrigated crops
- More challenging living conditions for pastoralist communities

Higher cereal prices in East Africa in 2022 stemming from an exceptional four-season drought were exacerbated by the impacts of the global economic downturn, the effects of the COVID-19 pandemic and the Russian invasion of Ukraine.[19] Other sources suggest maize prices in Kenya doubled in a year.[20]

As a result of this and similar price spikes, import-dependent countries in East Africa are facing higher-than-average levels of civil unrest and conflict.

[18] Source of information for this case study: EU Science Hub (2022). Drought in East Africa: August 2022 GDO Analytical Report. The European Commission. Available at https://edo.jrc.ec.europa.eu/documents/news/GDODroughtNews202208_East_Africa.pdf

[19] According to Save the Children (2022), 72% of wheat imports in East Africa come from Russia and 18% from Ukraine. Available at https://www.savethechildren.net/news/horn-africa-drought-fears-mount-rains-failing-fourth-time-and-war-ukraine-sends-food-prices.

[20] UKR AgroConsult (2022). *'Kenya must avoid food shortages as maize prices double: Researcher.'* https://ukragroconsult.com/en/news/kenya-must-avoid-food-shortages-as-maize-prices-double-researcher/

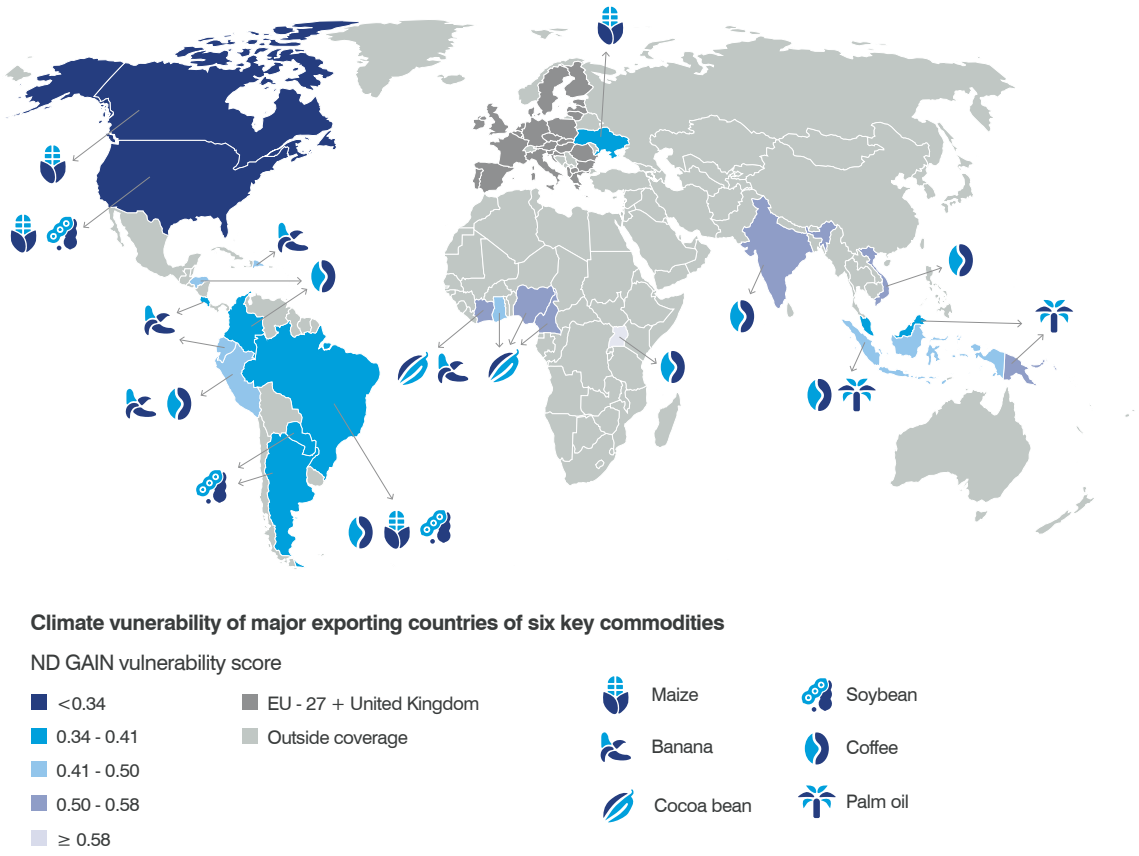
Case study three: Climate vulnerability of major EU exporting countries for six key agricultural commodities [21]

As noted by the European Environmental Agency (2021):

Europe is a major exporter of processed food and dairy products and, by and large, is self-sufficient in terms of the main staple foods such as grains (wheat, barley) and vegetables. This means that there are no immediate food security concerns in Europe related to climate change impacts elsewhere. However, Europe is heavily reliant on imports of products for animal feed (soybean and maize); products grown in tropical regions (e.g. cocoa, coffee, bananas); and commodities for secondary processing (e.g., palm oil, beet and cane sugar).

Figure 14 summarizes the European Environmental Agency's findings.

Figure 14: Climate vulnerability of major exporting countries of six commodities



Source: European Environmental Agency, 2021.

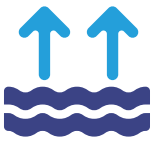
Figure 14 shows the major countries of origin of selected commodities imported into Europe and their climate-related vulnerability score, according to the Notre Dame Global Adaptation Initiative.

It is important to note that production is concentrated in small parts of the world:

- 78% of EU palm oil imports is from Malaysia and Indonesia
- 72% of imported soybean is from Brazil and the United States
- 87% of imported soya oilcake comes from Brazil and Argentina
- 71% of imported maize is from Brazil and Ukraine

[21] Source of information for case study: European Environment Agency (2021) Global climate change impacts and the supply of agricultural commodities to Europe. See https://www.eea.europa.eu/publications/global-climate-change-impacts-and

Appendix IV: Climate data portals for physical climate risks

Hazard	Provider – portal / product name	Observed/ historical	Spatial resolution	Spatial coverage	Licensing and cost
 Coastal flood (exacerbated by sea level rise)	*Climate Central - Coastal Risk Screening Tool[11]		5 m U.S. 30 m excl. U.S.	Global	Free-to-use
	*Climate Central - Surging Seas Risk Finder[12]		5 m	U.S. and Caribbean	Free-to-use
	*Climate Central - Portfolio Analysis Tool (PAT)[13]		Property level	Global	Chargeable
	GFDRR - ThinkHazard![14]		~1 km	Global	Free-to-use
	Jupiter - FloodScore™[15]		3 m	Global	Chargeable
	PREP - PREPdata[16]		2 km	Global	Free-to-use
	WRI - Aqueduct Floods[17]		1 km	Global	Data: chargeable Map: free-to- use
 Flood	GFDRR - ThinkHazard![14]		1 km	Global	Free-to-use
	* JBA Risk Management - Flood Maps[18]		5–30 m	Global	Chargeable
	Swiss Re - CatNet®[19]		30 m	Global	Chargeable, free to Swiss Re clients
	UNEP / UNISDR - Global Risk Data Platform[20]	(1999–2007)	200 m (flood outline only; not flood depth)	Global	Free-to-use
	WRI - Aqueduct Floods[21]		1 km	Global	Data: chargeable Map: free-to- use
 Tropical cyclone (hurricane & typhoon)	GFDRR - ThinkHazard![22]		30 km	Global	Free-to-use
	NOAA - Historical hurricane tracks[23]	(1842–2019)	3.5 km	Global	Free-to-use
	Swiss Re - CatNet®[19]	(1891–2008)		Global	Chargeable, free to Swiss Re clients
 Extreme heat	GFDRR - ThinkHazard![22]		~5–10 km	Global	Free-to-use
	Jupiter - HeatScoreTM[24]		30 m – 1 km	Global	Chargeable
	KNMI - Climate Explorer[25]	(1901–2017)	5 km	Global	Free-to-use
	PREP - PREPdata[16]	(1950–2005)	25 km	Global	Free-to-use
	World Bank - Climate Change Knowledge Portal[26]	(1901–2016)	1 km	Global	Free-to-use
 Extreme precipitation	KNMI - Climate Explorer25	(1901–2010)	5 km	Global	Free-to-use
	World Bank - Climate Change Knowledge Portal[26]	(1901–2016)	1 km	Global	Free-to-use

Hazard	Provider – portal / product name	Observed/ historical	Spatial resolution	Spatial coverage	Licensing and cost
 Landslide	GFDRR - ThinkHazard![22]		~500 m	Global	Free-to-use
	PREP - PREPdata[16]	(2007–2018)	1 km	Global	Free-to-use
	UNEP / UNISDR - Global Risk Data Platform[20]		~0.75 – 1 km	Global	Free-to-use
 Drought	*PCA - Global Drought Risk platform[27]	(1950–2016)	25 km	Global	Free-to-use
	UNEP / UNISDR - Global Risk Data Platform[20]	(1980–2001)	~50 km	Global	Free-to-use
	World Bank - Climate Change Knowledge Portal[26]	(1980–2001)	1 km	Global	Free-to-use
 Water scarcity and stress	GFDRR - ThinkHazard![22]		1 km	Global	Free-to-use
	PREP - PREPdata[16]	(as per WRI)	1 km	Global	Free-to-use
	*WRI - Aqueduct Water Risk Atlas[28]	(1960–2014)	1 km	Global	Free-to-use
 Water scarcity and stress	GFDRR - ThinkHazard![22]		~50 km	Global	Free-to-use
	PREP - PREPdata[16]	(past week)	1 km	Global	Free-to-use
	Swiss Re - CatNet®[19]			Global	Chargeable, free to Swiss Re clients
	UNEP / UNISDR - Global Risk Data Platform[20]	(1995–2011)	~10 km	Global	Free-to-use

Source: UNEP Finance Initiative, 2018.

Appendix V: Climate finance instruments

Table 12: International initiatives for climate action financing

Mechanism	Finance programme
Financial opportunities under the UNFCCC	The Green Climate Fund Readiness and Preparatory Support Programme
	Least Developed Countries Fund
	Special Climate Change Fund
	UNFCCC Needs-based Finance Project.
Programmes managed by multilateral development banks	Climate Smart Agriculture Investment Plan
	NDC support programs, including African Development Bank's Africa NDC Hub, Inter-American Development Bank's NDC Invest, and World Bank's NDC Support Facility
	SPCR, under the Pilot Program for Climate Resilience
Bilateral donor-supported programmes	National Adaptation Plan Global Network - Canada, Germany, Ireland, the United Kingdom and the United States
	NDC Partnership
	International Climate Initiative - Germany
	GIZ
	UN Environment Copenhagen Climate Centre
	Commonwealth Climate Finance Access Hub
	Taskforce on Access to Climate Finance
	Vulnerable 20 Group

Source: IISD, 2022.[22]

Table 13: Climate funds

Fund name	Focus	Region	Sectors
Adaptation Fund	Adaptation	Africa	Agriculture, coasts, food security, risk reduction and management, rural development and resilience, water
Africa Climate Change Fund	Adaptation & Mitigation	Africa	Climate change
Amazon Fund	Mitigation (REDD+)	LAM (Brazil)	Forests
BioCarbon Fund Initiative for Sustainable Forest Landscapes	Mitigation (general & REDD+)	Global (Projects in Colombia, Mexico, Zambia, and Indonesia)	Agriculture, ecosystem services, forests, land use, policy and institution building, rural development and resilience
Global Environment Facility	Not specified	Global	Climate change, biodiversity, food security, forests, gender, LULUC
Green Climate Fund	Adaptation & Mitigation (general & REDD+)	Least developed countries and small island developing States	Agriculture, ecosystem services, energy, food security, forests, low-C development, policy and institution building, rural development and resilience, sustainable land management, technology transfer, transport and infrastructure, water
Livelihoods and Food Security Fund	Adaptation	Southeast Asia	Financial inclusion, social protection

Source: Climate Change, Agriculture and Food Security, n.d.[23]

[22] Source: IISD (2022). The landscape of financing strategies for adaptation in developing countries. See https://www.iisd.org/publications/report/financing-strategies-adaptation-developing-countries

[23] Climate Change, Agriculture and Food Security (n.d.) Funding for climate change and sustainable agriculture. See https://ccafs.cgiar.org/funding-climate-change-and-sustainable-agriculture

Table 14: Impact investment funds

Fund name	Focus	Region	Sectors
&Green	Mitigation	Global (tropical forested countries)	Agriculture, forests and peatlands, rural development and resilience
Africa Food Security Fund	Resilience	Africa	Agriculture, agronomic services, food security, rural development and resilience
Agri-Business Capital Fund	Adaptation	Asia, sub-Saharan Africa, Latin America	Agri-business, rural development, youth investment and employment
Agri3 Fund	Adaptation and mitigation	Global	Agriculture, forests, rural livelihoods
Althelia funds	Mitigation	Global	Climate change, biodiversity, forests, rural development
Conservation International	Not specified	Oceania, sub-Saharan Africa, Southeast Asia, Latin America	Climate change, food security, forests, livelihoods, oceans, water
Dutch Fund for Climate and Development (DFCD)	Adaptation and mitigation	Global	Food security, forests, land restoration and conservation, water
eco.business Fund	Adaptation and mitigation	Caribbean, Latin America, sub-Saharan Africa	Agriculture, agribusiness, ecotourism, fisheries and aquaculture, forestry, rural development
Ecoenterprises Fund	Not specified	Latin America, North America, Europe	Agriculture, agroforestry, aquaculture, ecotourism, rural development, certified forestry, wild-harvested products
ERSTE WWF Stock Environment	Adaptation and mitigation	Global	Forests, energy, transportation, waste management, water
IFC forests bond	Mitigation	Global	Forests
Mirova funds	Not specified	Global	Social inclusion, sustainability
Soil & Water Outcomes Fund	Not specified	North America	Agriculture, soil, water
Sustainable India Finance Facility	Adaptation and mitigation	South Asia (India)	Agriculture, energy, forests, land use, restoration
Sustainable Irish Forestry Fund	Mitigation	Europe (Ireland)	Forests
Terra Bella Colombia Fund	Mitigation	Latin America (Columbia)	Agriculture, forests
The Moringa Fund	Adaptation and mitigation	Latin America and Southeast Asia	Agroforestry
Tropical Landscapes Finance Facility	Adaptation and mitigation	Southeast Asia (Indonesia)	Agriculture, aquaculture, forests, land restoration, social and community development

Source: Climate Change, Agriculture and Food Security, n.d.

Appendix VI: ITC institutional assessment

These more granular recommendations and guidance for strong BSO management and climate readiness across all of the TCFD areas can be identified by mapping this framework against the ITC benchmarking model for BSOs to assess their performance in four areas: leadership and direction, products and services, resources and processes, and results measurement.

Governance	
Mandate, common purpose and recognition	Review clarity on mandate and common purpose and values to define BSO materiality areas (scope of intervention)
Governance	Mentioned by TCFD, ensure relationships and responsibilities are clear and fully defined. Test engagement of key governance bodies to contribute to BSO sustainability stewardship and focus
Strategy development and implementation	Mentioned by TCFD, review strategy to ensure it is relevant and responsive to local and global conditions, including climate risks and opportunities.
Accountability and risk management	Mentioned by TCFD, accountability and risk management should be ensured including financial and non-financial audits. Audits should be used for improvement. Non-financial audits could include external studies or reports conducted independently.
Interaction with stakeholders and strategic partners	Stablishing trust and credibility with stakeholders and building, as required, new strategic partnerships and networks to increase BSO effectiveness to support MSMEs on climate-related initiatives. Communication and collaboration with stakeholders is key to deliver impact and should be proactive and constructive.

Resources and processes	
Structure and people	Review of the structure to optimize delivery of strategic goals. Including the creation of specific teams, working groups, divisions or sections to work on climate-related initiatives. Human resources function should support the organization to deliver on its objectives.
Further, staff should be supported to deliver on the strategic goals including specific indicators to ensure climate-related support is provided and targets are achieved. An individual assessment should be provided and staff development considered including training on climate-related topics.	Mentioned by TCFD, ensure relationships and responsibilities are clear and fully defined. Test engagement of key governance bodies to contribute to BSO sustainability stewardship and focus
Financial resources	Financial information should enhance decision-making and income-generation options be considered to support BSO financial sustainability.
Information and knowledge management	Capturing and sharing knowledge should be encouraged. This will become particularly important when upskilling the organization on key climate issues and their effects on MSMEs. Client information, including climate-related data, should be captured and used for improvement.
Physical assets and infrastructure	Physical assets and infrastructure should be appropriate and support and enhance service delivery. Environmental and social sustainability principles should be applied when acquiring, managing and disposing of physical assets.
Quality processes and value focus	Ensure processes are aligned and continually improved to support client service delivery. Use results for decision-making and resource allocation. This will become particularly important when supporting areas such as new services, markets and MSME business models to respond to climate risks and opportunities.
Internal communications	Internal communications should support and enhance activities.

Products and service delivery	
Understanding customer needs and developing a suitable portfolio of clients	Client information and business conditions should be used to determine and improve the portfolio of products and services. BSOs should understand the specific climate-related challenges faced by their member SMEs and evaluate the existing level of awareness on climate related opportunities of MSMEs. Client information and business conditions should be used to determine and improve the portfolio of products and services.
Further, the information should be used to refresh the services portfolio and client segmentation to ensure it is relevant with regard to climate risks and opportunities.	Mentioned by TCFD, ensure relationships and responsibilities are clear and fully defined. Test engagement of key governance bodies to contribute to BSO sustainability stewardship and focus
Relevance of the portfolio of products and services	BSOs should thoroughly evaluate the relevance of their portfolio of services. Such portfolio should be flexible enough to address current and future client needs and key strategic priorities.
Client management and delivery of products and services	Client management becomes critical for BSOs to ensure they offer targeted support to their members and clients. Acknowledging that MSMEs have different needs, BSOs should offer targeted services, information and support. This includes appropriate planning and delivery of climate-related services using resources in an efficient and effective manner.
In-market support	BSOs should re-think how they plan to support MSMEs in target export markets. This includes strategic considerations with regard to geographical coverage (changes in demand, export requirements, in-country production changes, political positioning, etc.), information requirements for MSMEs and key in-country partnerships.
Marketing and promotion	It will be critical for BSOs to communicate their climate-related offering to MSMEs, providing information that is easy to understand, access and share. Specific marketing activities could be put in place to communicate how the BSO will adapt its service offering to support MSMEs' sustainability transition and engage in new climate opportunities.
External communications and website	Stakeholders shall be at all times informed of changes and additional offerings and BSOs should ensure that all relevant communication is updated.

Measurement and results	
Scope and quality of measurement system	Mentioned by TCFD, measurement system should be refreshed to ensure it is aligned with strategy and objectives. When appropriate this might include reviewing and adopting disclosure frameworks such as TCFD or Global Reporting Initiative.
Measurement process and implementation	Measurement collection and reporting should be robust, consistent and reliable, especially given a potential increase in results scrutiny from shareholders.
Client satisfaction measurement	Client satisfaction should be used to improve product and service delivery. New climate-related services should be closely monitored to allow strategic pivoting and the incorporation of key learnings.
Achievement and analysis of results	Setting up and reviewing climate-related baselines, targets and indicators to measure achievement of results, analysis should be used to inform strategic decision-making and operations.

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