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Pathways to climate-resilient net zero supply chains

A guide for global agrifood businesses

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The guide was authored by Neha Rai (FAO), James Smith (WBSCD), Julia Wolf (FAO), Daniela Solis (WBSCD), Catarina Angioni and Lapo Roffredi (FAO), with editorial oversight by Shane Harnett and Rebecca Abi Khalil. Technical review was provided from FAO by Martial Bernoux, Alexandre Meybeck, Sibyl Nelson, Mirella Salvatore, Laure-Sophie Schiettecatte, Paolo Prosperi, Krystal Crumpler and Aleksandra Wybieralska; and from UNDP by Shovon Kibria, Julie Teng, Farrah Adams and Bertrand Reysset.

The guide contributes to the implementation of FAO's Strategy on Climate Change (2022–2031) and its Action Plan (2022–2025), advancing its three key outcomes: adaptation and resilience, mitigation, and climate-resilient agrifood systems transformation. It is also aligned with UNDP's climate change strategy, which focuses on supporting low-carbon transitions, building resilience, and ensuring a just and equitable transformation. It complements the FAO and UNDP Private Sector Engagement Strategies, offering clear benchmarks and methodologies to ensure private sector climate claims – especially on climate adaptation and net zero – are science-based, credible, and aligned with the core values of integrity, transparency, and accountability. By doing so, it seeks to help unlock climate finance and innovation while safeguarding against greenwashing.

In addition, the guide informs IKI's Strategy up to 2030 and aims to inspire a new generation of projects by serving as a reference point for designing meaningful private sector engagement and unlocking the much-needed private finance critical for implementing NDCs and NAPs. Mobilizing private capital is essential to bridging the climate finance gap – particularly in transforming agrifood systems to be more resilient and aligned with net zero pathways. The guide also contributes to global climate policy frameworks, including the United Nations Framework Convention on Climate Change Global Stocktake (GST) and the New Collective Quantified Goal on Climate Finance (NCQG), by identifying the investment types and financial architecture required for systemic, climate-smart transitions. Finally, it provides agrifood companies with a clear pathway to align with the UN's Recognition and Accountability Framework, enabling them to set robust, transparent standards for their net zero and adaptation commitments.

Abbreviations

AFOLU	agriculture, forestry, and other land use
AR6	Sixth Assessment Report of the Intergovernmental Panel on Climate Change
AWD	alternate wetting and drying
BMUKN	Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety
CAVA	Climate and Agriculture Risk Visualization and Assessment
CCKP	World Bank Climate Change Knowledge Portall
CDP	Carbon Disclosure Project
COP	Conference of the Parties (of the UNFCCC)
CORDEX	Coordinated regional climate downscaling experiment
CPO	chief procurement officer
CSA	climate-smart agriculture
DSSAT	decision-support system for agro-technology transfer
ESG	environmental, social, and governance
FAO	Food and Agriculture Organization of the United Nations
FLAG	forestry, land use, and agriculture guidance of SBTi
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LCA	life-cycle assessment
MRV	monitoring, reporting and verification
NAMA	nationally appropriate mitigation action
NAP	national adaptation plan
NCQG	new collective quantified goal (on climate finance)
NDC	nationally determined contribution
PA	Paris Agreement
RCM	regional climate model
RCP	representative concentration pathway
SBTI	Science Based Targets initiative
SCALA	Scaling up Climate Ambition on Land Use and Agriculture through NDCs and NAPs
SDG	Sustainable Development Goal
S-LOCT	Supplier Leadership on Climate Transition Collaborative
SSP	shared socioeconomic pathway
TCFD	Task Force on Climate-related Financial Disclosures
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
USD	US dollars
WBCSD	World Business Council for Sustainable Development

Chemical formulae

CH_4	methane
CO_2	carbon dioxide
$GtCO_2e$	gigatonnes of carbon dioxide equivalent
$MtCO_2e$	million tonnes of carbon dioxide equivalent
N_2O	nitrous oxide

Glossary and definitions

Adaptation: Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their impacts (UNFCCC, 2012).

Agrifood supply chains: The chain of the agricultural and food industry, from agricultural production to food consumption.

Agriculture sectors: The Basic Act on Agriculture states that "agriculture means agricultural production, crops, livestock farming, forestry and such other related industries as prescribed by the Presidential Decree"(FAO, 2003).

Agrifood systems: Agrifood systems include all stages such as growing, fishing, harvesting, processing, packaging, transporting, distributing, trading, buying, preparing, eating, and disposing of food. Beyond food products, agrifood systems also cover non-food agricultural items that contribute to livelihoods. They involve all individuals, activities, investments, and choices that play a role in delivering these food and agricultural products (FAO, 2023a).

Climate action in agrifood systems refers to integrated strategies and measures that both mitigate greenhouse gas (GHG) emissions to achieve net zero (mitigation) and enhance the resilience of food systems to climate change impacts (adaptation).

Climate resilience (of agriculture systems): "The ability to prevent, anticipate, absorb, cope with or recover from disasters and crises in a timely, efficient and sustainable manner. This includes protecting, restoring and enhancing livelihoods in the face of threats that affect agriculture, nutrition, food security and food safety." (FAO, 2015).

Insetting: The direct investment of a company within its own value chain (up- and downstream) in order to reduce its footprint. A carbon reduction project, verified by an offset standard, which occurs within a company's supply chain or supply chain communities.

Net zero emissions in agrifood systems means that the GHGs released across the food supply chain are balanced by an equivalent amount of GHG removals, resulting in no net increase in atmospheric GHG concentrations. In practice, this requires dramatically reducing emissions from agriculture and food-related activities and offsetting any remaining emissions through carbon sequestration (e.g. storing carbon in soils, trees or other biomass) or other removal strategies (IPCC, 2018).

National climate plans: National climate plans include nationally determined contributions (NDCs) and national adaptation plans (NAPs) and long-term low emission development strategies (LTS). These plans include Important measures for countries to address and mitigate climate change and achieve the goals of the Paris Agreement.

Nationally determined contributions (NDCs): Documents in which countries declare how they will reduce their GHG emissions, adapt to climate change, and report on their progress. Since 2020, countries have had to submit

updated NDCs to the United Nations Framework Convention on Climate Change (UNFCCC) every five years to show how they are contributing to compliance with the Paris Agreement.

National adaptation plans (NAPs): Plans that help countries find ways to adapt to and address the short-, medium-, and long-term impacts of climate change by identifying measures to manage the risks and impacts of climate change.

Offsetting: A GHG or "carbon" offset is a unit of carbon dioxide-equivalent CO_2eq that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere. These offset credits, measured in tonnes, are an alternative to direct reductions for meeting GHG targets in a cap-and-trade system.

Pathways: structured trajectories that guide the evolution of systems toward sustainable, low-emission, and climate-resilient futures. In the context of this guidance, these include strategic sequences of actions and transformations enabling supply chains to achieve both climate resilience and net zero emissions.

Regenerative agriculture: describes holistic farming systems that, among other benefits, improve water and air quality, enhance ecosystem biodiversity, produce nutrient-dense food, and store carbon to help mitigate the effects of climate change. These farm systems are designed to work in harmony with nature, while also maintaining and improving economic viability (FAO, 2022). It is important to state that there is no internationally agreed definition of the term “regenerative agriculture”, but it is used in this document because it's widely used by major global agrifood companies that have set climate targets.

Scope 3 emissions: The GHG Protocol Corporate Standard categorizes a company's GHG emissions into three distinct scopes.

- Scope 1 emissions refer to direct emissions from sources that a company owns or controls.
- Scope 2 emissions encompass indirect emissions resulting from the production of purchased energy.
- **Scope 3 emissions** include all other indirect emissions that arise throughout the company's value chain,[1] both upstream and downstream, excluding those already accounted for in scope 2. For example, through agricultural production, processing, and distribution (GHG protocol, 2022).

[1] In this guide, the terms *supply chains* and value chains are used interchangeably, as they are closely related and often overlap in practice. Both refer to the network of activities, actors, and processes involved in producing, delivering, and adding value to agrifood products from farm to fork. While *supply chains* typically emphasize the flow of inputs, goods, and services, and *value chains* focus more on the value created at each stage, the two concepts are highly similar and interconnected. In the context of climate resilience and net zero strategies, actions such as decarbonizing production, engaging suppliers, and enhancing adaptive capacity are relevant across both. Therefore, for clarity and consistency, the guide does not distinguish strictly between the two.


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Executive summary

Global agrifood businesses have the potential to play a significant role in addressing climate risks within supply chains. Their investments, innovations, and supply chain influence could be instrumental in scaling climate solutions, mitigating emissions, and enabling more sustainable agricultural practices. However, in practice, the extent to which these businesses are driving meaningful climate action, especially within supply chains based in developing countries, remains uneven. While some progress has been made, many initiatives still fall short of achieving the systemic changes needed. Greater commitment, deeper integration of sustainability practices, and stronger collaboration with governments and local stakeholders in supplier countries will be crucial to address these gaps to implement the Paris Agreement (PA) and the Sustainable Development Goals (SDGs). **This guide, developed by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the World Business Council for Sustainable Development (WBCSD), is designed to support global agrifood businesses in advancing climate action within their supply chains – particularly in developing countries, where climate impacts are often the most severe.**

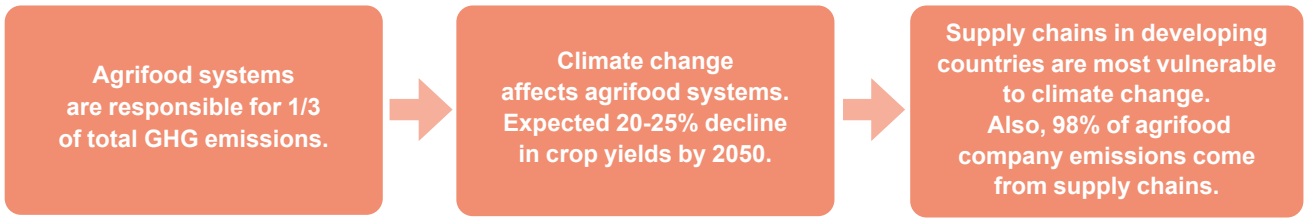
Agrifood systems are both heavily impacted by and significant contributors to climate change. Globally, they are responsible for approximately one-third of total anthropogenic GHG emissions (Crippa *et al.*, 2021; FAO, 2024).

Methane emissions from livestock and rice production alone account for 35 percent of agrifood emissions (FAO, 2021; IPCC *et al.*, 2022). More than half of all GHG emissions from agrifood systems are attributed to agricultural production and land-use changes within company and country value chains; the rest are off-farm emissions from input production, transport, processing, packaging, retail, consumption, and waste. Addressing these emissions requires a more integrated and ambitious approach across the entire agrifood supply chain.

Although some companies have advanced on climate commitments, effectively translating these into action across complex global supply chains remains a significant challenge. This is particularly true in the agriculture sectors, where a substantial portion of supply chains are in developing countries. These supply chains are not only highly vulnerable to climate impacts, but also major contributors to **scope 3 emissions** – i.e. those emissions which occur outside a company's direct control, for example, through agricultural production, processing, and distribution. In the food sector, scope 3 emissions can account for up to 98 percent of total emissions, making them a primary focus for climate action (CDP, 2020; FAO, 2022; FOLU, 2024a). Addressing these emissions requires coordinated efforts between agrifood companies, suppliers, and policymakers to align corporate action with the climate efforts of the countries that host the supply chains.

Agrifood systems are highly vulnerable to climate change. Increasing drought and extreme heat are predicted to cause a 10–25 percent decline in crop yields by 2050 (IPCC, 2019, 2021; see Figure 1), with agrifood systems predicted to bear 26 percent of the economic consequences of climate disasters and 83 percent of the burden from drought (IPCC, 2021).

FIGURE 1. Climate change risks in agrifood systems



Source: Authors' own elaboration.

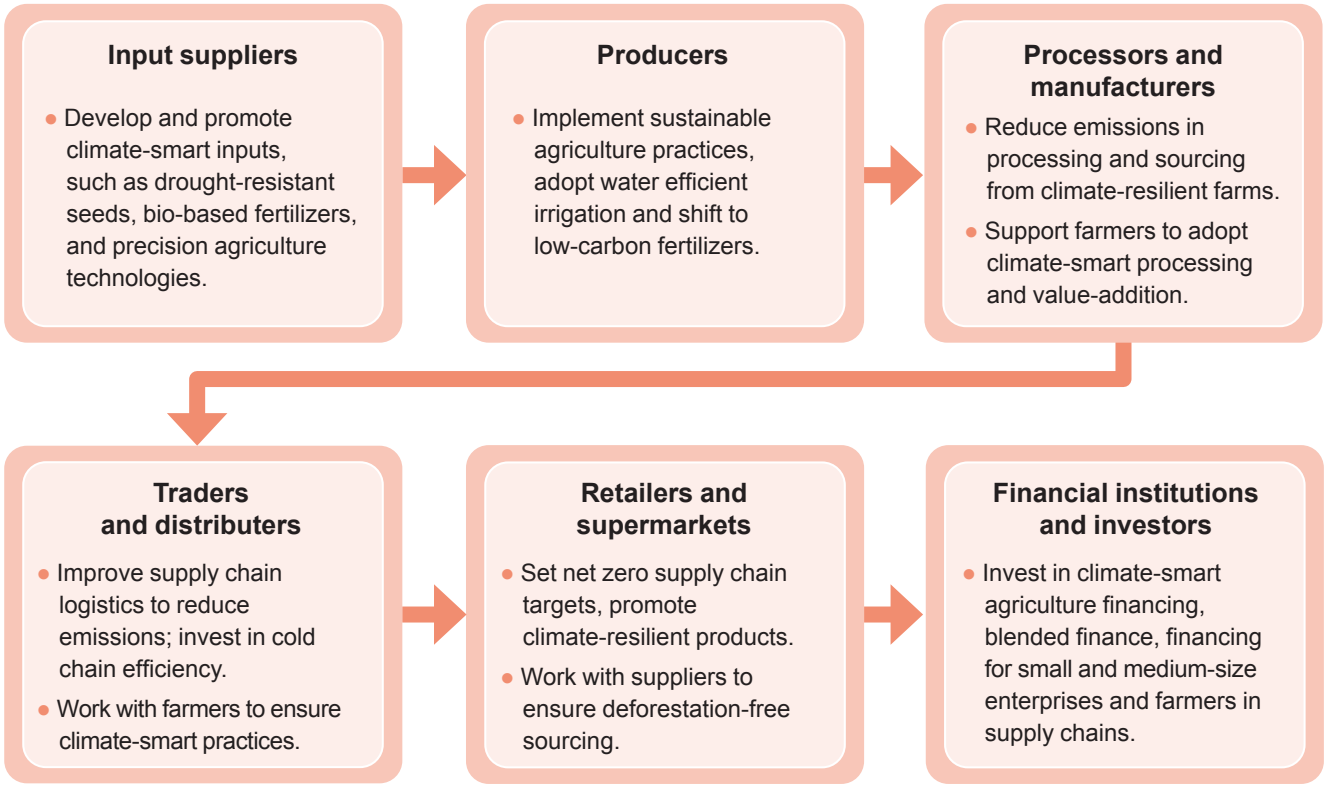
This guide emphasizes the importance of aligning company climate commitments – such as net zero commitments and climate adaptation targets – with the national priorities of the countries in which businesses operate. By doing so, companies are encouraged not only to help achieve national climate goals – such as those outlined in NDCs and NAPs – but also to strengthen their own resilience, manage climate risks more effectively, and enable more sustainable transitions within their supply chains. Agriculture and land use are increasingly recognized as important sectors for both reducing emissions and adapting to climate change, with most countries acknowledging their significance. Approximately 94 percent of second generation NDCs highlighted adaptation priorities in agriculture, with 86 percent incorporating mitigation measures for the sector (Crumpler *et al.*, 2024). Likewise, agriculture and food security continue to be among the most frequently mentioned priorities in developing countries' NAPs (UNFCCC, 2023, 2024a). As countries submit a new generation of NDCs in 2025 (NDC 3.0),[2] the global agrifood system holds immense potential to reduce nearly one-third of global GHG emissions through practical solutions. Beyond emissions reductions, these measures could offer additional benefits by enabling food security, enhancing the resilience of food systems to climate impacts, and ensuring that the transition does not disproportionately harm vulnerable populations. Yet, the effectiveness of NDCs depends not just on their ambition but on their ability to attract investment and drive real transformation. This points out the need for stronger collaboration between governments and the private sector to turn climate commitments into actionable, financeable opportunities that benefit both businesses and national economies.

How can agrifood businesses contribute to climate action in supply chains?

Companies can start by adapting their own operations, adjusting practices and processes to become more resilient to climate change impacts. Beyond their own operations, they can support adaptation in their supply chains, particularly by helping producers – especially farmers – adopt climate-resilient practices. Companies can also assess whether their products provide adaptation benefit to customers/society. Companies must also focus on reducing their own emissions, implementing measures to directly cut GHG emissions from production, processing, and distribution. However, since a significant portion of emissions come from supply chains, businesses will also need to work toward supporting emission reductions in their supply networks, incentivizing and collaborating with suppliers to adopt low-emission and sustainable practices. This guide therefore recognizes the diverse nature of agrifood businesses and their varying capacities to contribute to climate action and build climate resilient supply chains as illustrated in Figure 2.

[2] Under the 2015 Paris Agreement, NDCs are legally binding commitments that governments must update every five years. In 2025, Parties to the Paris Agreement are due to submit their third generation of NDCs, referred to as NDC 3.0.

FIGURE 2. **Global agrifood company types and the roles they play in building climate-resilient supply chains**



Source: Authors' own elaboration.

What does this guide offer?

This guide aims to support global agrifood companies to turn climate commitments into action by aligning their supply chain strategies with national climate priorities of countries which host these supply chains. It provides practical tools for integrating climate action into business operations, focusing on supporting NDCs and NAPs in sourcing countries. The guide is organized in three parts.

Chapter 1 explains the business case for climate action in supply chains.

Chapter 2 proposes a climate resilience and net zero framework that global agrifood companies can use to translate their commitments into solutions, identify climate risk hot spots, collaborate with suppliers, and track progress. The framework proposes four key steps to build climate-resilient, low-carbon supply chains:

Step 1: Build management commitment for climate action in supply chains
Step 2: Implement adaptation strategies in supply chains
Step 3: Reduce supply chain GHG emissions through targeted mitigation actions
Step 4: Track, evaluate, and disclose progress to ensure continuous improvement

Chapter 3 concludes with a forward-looking overview on strengthening alignment between corporate strategies and national climate policies, along with key takeaways to guide future action.

Further details on the methodology used to develop this guide can be found in Appendix A. An overview of supply chains, including relevant definitions, is available in Appendix B.

The approach to illustrating the proposed framework draws on real-world examples from global agrifood companies, based on interviews conducted during the guide's development. These interviews involved member companies of the WBCSD, representing diverse segments of the food and agriculture value chain. The examples highlight key initiatives and challenges companies face when implementing climate strategies and actions. However, it is important to note that these are illustrative, one-off examples meant to inspire action rather than demonstrate proven impact. Their effectiveness has not been systematically assessed. To ensure neutrality and avoid any perception of endorsement, company names have been anonymized, and the examples are not attributed to specific companies or relevant documents.

What this guide covers

Global agrifood companies committed to climate action must implement strategies across both their corporate operations and extended supply chains. Achieving net zero emissions and climate resilience requires reducing direct emissions (scope 1 and 2), transforming supply chains (scope 3), and adapting to climate risks across business activities (IPCC, 2018).[3] However, this guide focuses specifically on climate action within supply chains in sourcing countries – where companies often face the greatest climate-related risks and opportunities for lasting, systemic change. It covers:

- **Supply chain adaptation:** presenting strategies that help producers and landscapes adapt to climate impacts – improving resilience, protecting livelihoods, and safeguarding food security in vulnerable sourcing regions.
- **Scope 3 decarbonization through insetting:** emphasizing actions companies can take within their own supply chains – known as insetting – to reduce greenhouse gas emissions and enhance climate resilience at the source. Insetting offers a practical and impactful pathway to tackle scope 3 emissions while delivering measurable co-benefits for local communities and ecosystems. These include sustainable soil management, agroforestry, regenerative agriculture, and circular economy approaches. Insetting allows companies to meet scope 3 goals while delivering local environmental and social benefits.
- **Alignment with national climate plans (e.g. NDCs):** helping companies align insetting and adaptation efforts with country-led climate priorities, supporting broader sustainable development and policy goals.

What this guide does not cover

- **Scope 1 and 2 emissions reduction strategies,** such as energy efficiency in processing plants or low-carbon logistics.
- **Corporate-level adaptation measures,** like climate-proofing offices or corporate risk disclosures.
- **Offsetting strategies outside the value chain,** including investments in external carbon credits.

[3] According to the **IPCC Special Report on Global Warming of 1.5 °C (2018)**, reaching net zero emissions in agrifood systems requires a portfolio of actions: decarbonizing direct operations (scope 1 and 2), transforming value chains (scope 3), promoting regenerative practices, reducing waste, and – where necessary – investing in carbon removals or offsets. This guide contributes to that portfolio by addressing the transformation of scope 3 emissions and supply chain resilience at the source.

Urgency of climate action by global agrifood companies in supply chains

Multinational agrifood companies and financiers have a critical responsibility to act, given their significant influence and embedded role within supply chains. Four leading companies reportedly control 70 percent of the global agricultural commodity trade, by value (Hamilton, 2023), and commodity-driven agriculture is the main cause of deforestation and ecosystem degradation, especially in tropical regions (BNEF, 2024). The top 136 agrifood companies generated a total turnover of USD 5.2 trillion in 2022 and emitted 4.13 gigatonnes of carbon dioxide equivalent ($GtCO_2e$). Due to their strategic position, large agribusinesses have the opportunity and responsibility to mitigate the climate and environmental impact of commodity production. They provide a link between small producers and markets, and influence food production practices, profit distribution, and global food consumption patterns. These companies can raise sustainability standards throughout the supply chain and across the sector: investing USD 205 billion per year between 2025 and 2030 could cumulatively reduce up to 9 $GtCO_2e$ by 2030. While significant, these costs represent less than 2 percent of agrifood companies' projected total revenue (FOLU, 2024b).

Global agrifood companies are also facing increasing pressure to address their impacts on climate and nature. Slow progress by companies and industry actors in meeting their own environmental commitments in agrifood supply chains over the years has led policymakers to start leveraging voluntary standards as a basis for developing new regulations. For example, several European Union supply chain laws now require disclosure, due diligence, and compliance with environmental and social standards. Global companies are also increasingly under scrutiny for failing to establish robust and transparent standards for net zero scope 3 emissions. This concern was emphasized by the High-Level Expert Group at the UNFCCC's 27th Conference of the Parties (COP27) in Sharm El-Sheikh, which called for immediate action to strengthen the quality of corporate climate targets (UNHLEG, 2021). In response, the independent Co-Chairs of the Recognition and Accountability Framework Consultation issued several recommendations to improve accountability in voluntary net zero initiatives (UNFCCC, 2023). Notably, one recommendation urges the UNFCCC to bridge the information gap between non-state actors' net zero commitments and the NDC of countries (Raskin, S.B. & Leng, B., 2024)

Attention to climate action in agrifood systems has intensified within global climate negotiations. The joint work on implementation at COP 27 emphasized the importance of accelerating the implementation of agricultural priorities, which will require increased public–private investment. At COP 29, parties agreed to a New Collective Quantified Goal (NCQG) on climate finance, setting a target of at least USD 300 billion annually by 2035 to support developing countries' climate actions(UNFCCC, 2024b). This goal includes an additional layer aiming to mobilize up to USD 1.3 trillion, primarily from private financing sources. The establishment of the NCQG further highlights the growing expectation for both public and private actors to mobilize substantial resources to meet adaptation and mitigation objectives, particularly in developing countries. Companies that fail to stay aligned with these evolving policy signals risk business disruption when new regulations are implemented and penalties for failing to comply are enforced.

Reasons for implementation gaps

While there is some momentum in setting climate adaptation and net zero targets, there are gaps in the implementation of climate efforts in supply chains by global agrifood companies due to several interconnected challenges:

- **Complexity, length and heterogeneity of value chains:** The intricate, heterogenous and often lengthy nature of global agrifood value chains makes implementing and measuring the impact of climate action initiatives a challenge. These value chains span multiple geographies, actors, and production systems, making it difficult for companies to comprehensively track emissions and implement adaptation measures across their entire networks. The challenge is further compounded by the heterogeneous nature of value chains – climate mitigation and adaptation interventions vary in complexity depending on the commodity. For instance, addressing emissions or embedding adaptation measures in animal-based value chains tends to be more difficult than in crop-based ones, due to differences in biological cycles, emissions intensity, and land-use requirements.
- **Data gaps and knowledge barriers:** Agrifood companies often lack essential information on location-specific climate risks and emissions within their supply chains. This lack of data hinders effective risk planning and decision-making.
- **Financial and capacity constraints:** Many critical commodities are produced by smallholder farmers and small and medium-sized enterprises, which face financial and capacity constraints in adopting climate-smart practices. Additionally, greenhouse gas mapping can be particularly expensive and complex for value chains involving numerous suppliers spread across diverse geographies. The costs and risks associated with transitioning to climate-resilient and low-emission production systems, therefore, can be a significant barrier.
- **Limited leverage:** Companies at the end of the value chain often have limited leverage over upstream actors and practices. This can make it challenging to influence suppliers to collect climate data and implement climate change adaptation and mitigation measures.

Who is this document for and how can it be used?

This guide equips businesses to effectively navigate the challenge of an evolving landscape and capitalize on the opportunities presented by climate action. The guide can be used by staff and directors in global agrifood corporations with supply chains in developing countries; sustainability, procurement, and supply chain professionals; staff in international financial institutions; and policymakers in developing countries, as outlined in Figure 3.

FIGURE 3. Who can use this guide and how?

Executives	**Build a strong business case for incorporating climate action into supply chain strategies and demonstrate the value of aligning these actions with sourcing country NDCs and NAPs to secure buy-in from leadership and drive investment in climate-resilient and low-emission practices.**
Sustainability, procurement, and supply chain professionals	**Apply the climate resilience and net zero framework presented in this guide to business operations to communicate and promote their adoption by upstream and downstream partners.**
Public engagement and policy directors	**Identify opportunities to support the implementation of climate change mitigation and adaptation priorities outlined in sourcing country NDCs and NAPs to align corporate strategies with national climate goals and contribute to broader sustainable development objectives.**
Policymakers in developing countries	**Understand how to create an enabling environment that encourages private sector investment in climate action by developing policies and incentives that support the implementation of NDCs and NAPs, and facilitating access to finance, technology, and knowledge.**
Staff of financial institutions	**Assess the maturity of agrifood companies in mainstreaming climate change considerations and adapting to climate policies and regulations in the countries where they operate to inform investment decisions and encourage the flow of capital toward climate-smart agrifood systems.**

Source: Authors' own elaboration.

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1. Business case for climate action in supply chains

TABLE 1. Business case for engaging with supply chains and supporting NDC/NAP priorities

Business case for climate action	Benefits
1. Address supply chain disruptions	Secure climate-resilient commodity production and sourcing
2. Invest to reduce costs	Reduce supply chain costs through climate-smart practices
3. Identify and capitalize on new business opportunities	Develop climate-aligned products and services
4. De-risk value chain investments	Gain first-mover advantage and mitigate regulatory risks
5. Align with investor requirements	Avoid capital challenges, meet shareholder demands, and enhance shareholder value
6. Deliver upstream value chain and scope 3 climate commitments	Fulfill scope 3 and value chain-level adaptation and mitigation targets
7. Align with NDC/NAP priorities to ensure high-integrity targets and claims	Collaborate to identify hot spots for adaptation and mitigation action, and improve the rigour of corporate climate claims

Source: Authors' own elaboration.

Climate risks pose significant challenges to supply chains, increasing delivery costs, compromising product quality, and disrupting delivery timelines, which can lead to financial losses. Companies that fail to transition toward climate resilience face potential financial penalties and reputational risks. Conversely, mitigating these risks can improve supply chain economic performance, reduce carbon emissions, and strengthen the resilience of farms and communities. For example, a survey by the CDP (formerly the Carbon Disclosure Project) found that climate adaptation solutions could generate an additional USD 236 billion in revenue for companies in the agrifood sector (CDP, 2019; GCA, 2019). Similarly, addressing climate challenges in the agriculture and land-use sectors could unlock annual business potential worth USD 4.5 trillion by 2030 (FOLU, 2019).

To support businesses align with the climate plans – especially NAPs and NDCs – of sourcing countries, this chapter outlines the business case for investing in low-carbon, climate-resilient supply chains, as summarized in Table 1.

Address supply chain disruptions

The risks faced by businesses are expected to grow as the frequency and intensity of physical climate events continue to rise. Climate risks affect raw material availability and disrupt supplier operations. Acute physical risks – such as flooding, drought, and heatwaves – can reduce production efficiency, increase costs, and damage infrastructure. Chronic risks, including rising temperatures and changing rainfall patterns, further jeopardize agricultural yields or agrifood processes. For example, forecasts suggest that by 2050, almost half of the world's Arabica coffee-growing regions may become unsuitable for cultivation, with key coffee producers like Brazil and Viet Nam already experiencing significant crop losses. Similarly, in Colombia, one of the world's largest banana exporters, climate change threatens 60 percent of banana-growing areas by 2060 (WWF, 2015). In 2010, a global agrifood company reported a quarterly loss of USD 56 million in its sugar and bioenergy businesses due to severe

droughts that affected major producing countries, including Brazil (Oxfam, 2012). These examples illustrate how climate risks can lead to disruptions in supply chains, affecting raw materials, production efficiency, and overall business operations. The economic impact of climate risks extends beyond individual suppliers, influencing entire business models, market stability, and long-term profitability.

Invest to reduce costs

Investing in climate-smart practices in sourcing countries could reduce supply chain costs while enhancing long-term resilience. For example, companies participating in the CDP supply chain programme collectively reported USD 14 billion in cost savings while cutting GHG emissions by 551 million $MtCO_2e$ (CDP, 2018). While the direct causal relationship between these savings and emissions reductions is complex, the improvements were linked to greater resource efficiency, investment in farmer programmes, lower energy consumption, and waste reduction across supply chains.

Local investments in sustainable agriculture have also demonstrated promising benefits. For example, a global agrifood company invested in cashew processing facilities in Côte d'Ivoire, in line with the National Plan for Agriculture Investment, reducing the need to export raw cashews for processing, cutting transport-related emissions and costs, and potentially creating local jobs (World Bank, 2025). In addition, a study in Colombia suggests that adopting climate-smart farming methods – including efficient water use, soil conservation, and organic fertilizers – could lower coffee production costs to USD 2.50 per unit, compared to USD 3.15 per unit using conventional methods. These savings are attributed to reduced fertilizer dependency, lower input costs, and minimized environmental damage (Solidaridad, 2019), though further analysis is needed to confirm long-term impacts.

While more evidence is needed to quantify the full financial and environmental benefits, these examples indicate that integrating sustainability into supply chains can put the company in the direction of cost savings, reduced emissions, strengthened supplier stability, and alignment with national climate priorities. As global agrifood businesses navigate evolving climate policies and supply chain risks, investing in resilience may offer both strategic and economic advantages.

Identify and capitalize on new business opportunities

As governments strengthen their strategies to address climate change, opportunities arise for agrifood companies to develop and introduce products and services that align with national mitigation and adaptation goals, such as efficient irrigation systems, drought-resistant crop varieties, low-emission agricultural practices, and other climate-smart solutions. FAO analysis of second generation NDCs (NDC 2.0) found that countries highlighted a variety of climate-smart interventions in their NDCs to meet their adaptation and mitigation targets – for example, 75 percent identified afforestation, reforestation, and ecosystem restoration as key priorities for climate action; 90 percent emphasized ecosystem and biodiversity conservation; and 62 percent recognized on-farm soil and water moisture conservation as essential climate solutions (Crumpler *et al.*, 2025). Further details can be found in Figures 11 and 13 of this document.

Aligning their strategies with national priorities could help companies strengthen their competitiveness in evolving markets for climate services and products. A few initiatives illustrate how businesses are exploring new opportunities in climate-smart solutions. For example, Colombia's national bio-inputs programme promotes agroecological and regenerative farming practices, and a few companies are collaborating to improve biofertilizers and integrate bio-inputs into agrifood systems to enhance resilience to pests, diseases, and shifting climate conditions (Colombia's Ministry of Agriculture, 2023). Similarly, Thailand is shifting away from traditional transplanted puddled rice in favour of alternate wetting and drying (AWD) techniques. AWD involves periodic draining and re-flooding of rice fields, which has been shown to reduce water use by approximately 19–30 percent and methane (CH_4) emissions by 30–70 percent, without compromising yields. Investing in these approaches would align with the national target of cutting rice-related emissions by 26 percent (Bhatt and Kukal, 2015; NAMA, 2019). While these figures are promising, it's important to note that the effectiveness of AWD can vary based on local conditions and implementation practices. Moreover, while AWD primarily targets water management during the cultivation period, its impact on pre-cultivation practices, such as land preparation and transplanting methods, remains less clear. Although these initiatives offer valuable insights into emerging business models, evidence of their impact and scale remains to be fully assessed. However, they point to opportunities for businesses to unlock evolving revenue streams and explore climate-smart innovations that align with national climate goals and an increasing demand for sustainable agricultural solutions.

De-risk future investments

National climate priorities are expected to increase in ambition over time, with more countries including agricultural and land-use strategies to speed up climate action through their NDCs and NAPs. Being in sync with these evolving commitments allows businesses to adapt to policy changes and avoid potential risks, such as higher regulatory burdens, which could affect competitiveness or market share (USCIB, 2018). Such an alignment could also open the door for private sector involvement in policy discussions, incentive schemes, and other measures that support activities aligned with a country's NDCs or NAPs. This kind of engagement can boost the effectiveness and efficiency of scaling up private sector initiatives in sourcing regions. Key legislation and policies in developed countries are starting to impact supply chains more directly, requiring suppliers to mitigate negative impacts, such as GHG emissions. For example, the European Union's Corporate Sustainability Reporting Directive requires companies to improve the quality and comparability of their environmental, social, and governance (ESG) reporting, while the European Union's directive on corporate sustainability due diligence will require companies to assess and address negative environmental and human rights impacts in their value chains, both inside and outside Europe (EC, 2022). Finally, the European Union's law on deforestation-free products is mandating compliance for large companies and listed small and medium-sized enterprises, emphasizing the importance of supply chain transparency and engagement for effective disclosures (EU, 2022).

Companies that actively adapt to such requirements are better positioned to reduce transition risks. With around 50 000 companies falling under the Corporate Sustainability Reporting Directive reporting obligations, it is clear that robust, credible disclosures, backed by supply chain engagement, will be crucial for global companies sourcing from developing countries.

Align with investor expectations

In cases where companies fail to actively assess, manage, report, and disclose climate risks, they may find it increasingly difficult to raise capital and maintain shareholder value. Risks include both **physical risks** that agrifood companies are particularly vulnerable to, such as direct impacts from extreme weather events, droughts, and floods; as well as **transition risks** arising from the shift toward a lower-carbon economy, including regulatory change, shifts in market preference, and technological advancements (TCFD, 2020).

As public awareness of climate change grows, institutional investors are pushing for stricter targets to limit global warming to 1.5 °C and 2 °C and address climate risks. They are also demanding greater transparency and more detailed climate and environmental disclosures, including on nature conservation. For example, in 2021, 733 investors managing over USD 52 trillion in assets – more than half of all assets managed worldwide – published a statement calling on governments to end fossil fuel subsidies, phase out coal-fired power generation, and enforce mandatory climate risk disclosures by companies (Ceres, 2021). Although it targets governments, the statement also highlights that investors expect companies to show how they assess and manage both transition and physical climate risks.

Investors support mandatory climate risk disclosures in line with Task Force on Climate-related Financial Disclosures (TCFD) recommendations and are urging governments to include these in their regulations. Regulations from the United States of America and Switzerland mandating climate risk and GHG disclosures reflect this shift (Confédération Suisse, 2022; SEC, 2022).

Some investors now view a lack of climate action as a material risk to corporate performance and factor ESG concerns into their decision-making. By aligning corporate strategies with sourcing country climate mitigation and adaptation efforts, companies can show shareholders and stakeholders that they are addressing climate risks in supply chains by tackling local challenges and priorities, identified by national and local stakeholders.

Deliver on upstream value chain and scope 3 climate commitments

Around 98 percent of emissions from food manufacturers and retailers fall into scope 3 – which covers all indirect emissions that occur across a company's value chain, excluding those from sources owned or directly controlled by the company. In the agrifood sectors most of these emissions come from upstream production processes, value chain activities, and land management (CDP, 2020; FAO, 2022; FOLU, 2024a).

As a result, a global company's ability to meet its scope 3 climate targets is heavily influenced by external factors, such as policy changes affecting agricultural land use and the rural economy they source from. For example, in India, the world's second-largest rice consumer after China, the extensive use of synthetic nitrogen fertilizers in rice cultivation contributes significantly to GHG emissions. But despite opportunities to reduce emissions without compromising yields, government-subsidized fertilizer costs make it difficult to incentivize farmers to reduce usage. This presents a challenge for companies sourcing rice from India, as it limits their ability to reduce emissions associated with upstream rice production. Such examples show the importance of aligning private sector mitigation efforts with national policy environments (Systemiq and IFA, 2022). To make progress on scope 3 targets, companies will benefit from engaging in dialogue with governments and advocate for policy

reforms that incentivize more sustainable land-use practices. Proactive engagement with policymakers can create enabling conditions for change in upstream value chains, which is essential for delivering on downstream corporate climate commitments.

Align with NDC and NAP priorities to ensure high-integrity climate targets and claims

Aligning with NDCs and NAPs and collaborating with national climate policy authorities enables private sector actors to identify key mitigation and adaptation hot spots in supply chains, specific commodities, or regions where investments can better secure future sourcing and enhance business value. Addressing physical climate risks to agricultural production requires in-depth, landscape-level analysis. Companies with global supply chains can benefit from country analyses conducted for their NDCs and NAPs, particularly on a regional or domestic level.

By acting in their supply chains, companies can substantiate their climate-related commitments and show integrity in scope 3 targets and supply chain adaptation through alignment with local needs at national, regional, or landscape levels. However, with only 7 percent of all second-generation NDCs developed with active private sector engagement, examples such as Colombia's efforts to engage businesses in its NDC processes stand out from the rest. The country has co-developed at least three nationally appropriate mitigation actions (NAMAs) in consultation with the business sector, and its government has hosted workshops with businesses and associations to explore opportunities for carbon trading, technology collaboration, and public–private partnerships (Colombia NDC, 2020). Its carbon tax has advanced national climate goals while encouraging the private sector to reduce GHG emissions and invest in innovative carbon projects.

Ultimately, aligning corporate climate strategies with national priorities presents an opportunity for businesses to not only mitigate risks but also unlock new investment possibilities within their supply chains. For global agrifood companies, this means rethinking supply chain strategies to integrate climate resilience, capitalize on emerging markets for climate-smart solutions, and strengthen partnerships with sourcing countries. Chapter 2 delves into the tangible steps businesses can take to operationalize these opportunities – building a strong business case for climate action within supply chains, securing long-term value, and reinforcing their role in a rapidly evolving global economy.

2. The climate resilience net zero framework

This chapter introduces a structured framework to help companies integrate climate action in their supply chains in a practical and measurable way. Climate resilience involves managing climate risks (adaptation) and reducing GHG emissions while transitioning to a net zero future (mitigation). Addressing both requires a systematic and sustained approach across supply chains, balancing short-term operational needs with long-term sustainability goals.

While some companies have begun integrating adaptation and mitigation efforts in their supply chains, progress is uneven, particularly in supply chains that span multiple countries with varying climate policies and resource constraints. Building resilience goes beyond securing supply chains; it also involves strengthening natural ecosystems, working with smallholders, building capacities, and supporting local communities that are essential to food production.

Purpose of the framework

This framework is designed to provide companies with a practical stepwise approach to making their supply chains more resilient to climate risks while reducing emissions, in alignment with the NDCs and NAPs of the countries where they source, produce, buy, and sell products.

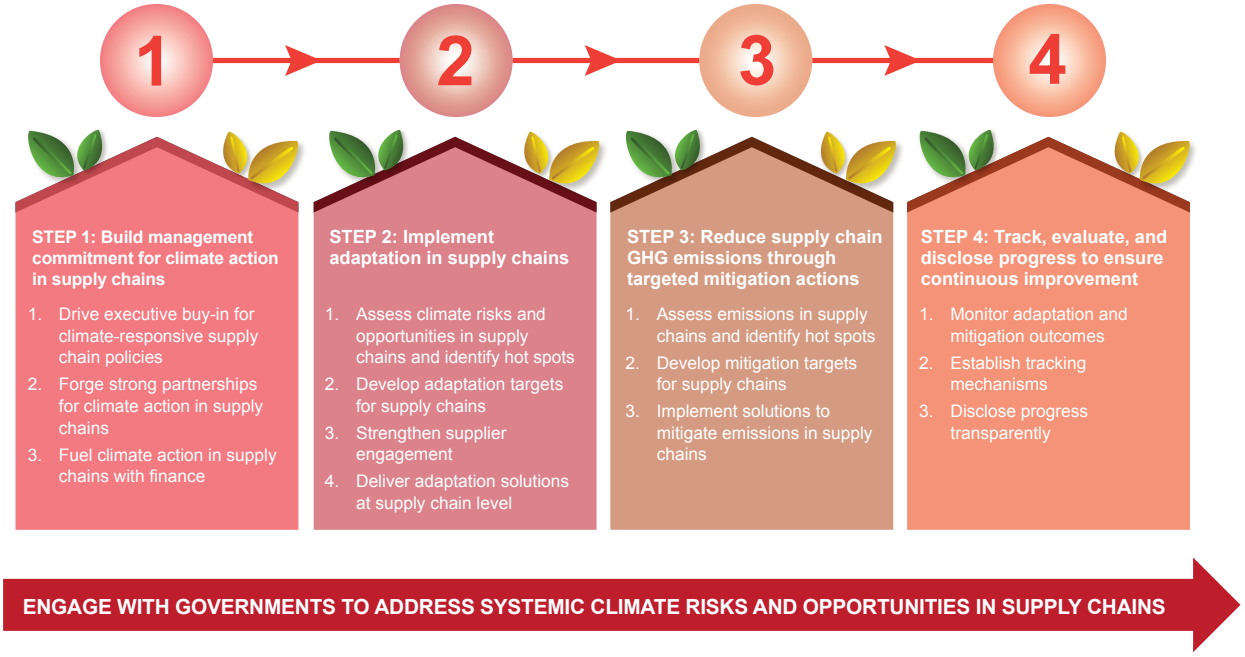
At its core, this framework helps businesses move beyond high-level climate commitments and translate net zero and resilience goals into concrete actions that align with national priorities. Many agrifood companies have pledged to reduce emissions and enhance sustainability, but the challenge lies in operationalizing these commitments within their complex, multilayered supply chains. This framework provides a structured way to navigate these challenges, identify climate risks, and implement effective solutions that contribute to both corporate sustainability targets and national climate goals.

Recognizing the interconnected nature of food and agriculture supply chains, the framework emphasizes the importance of collaborating and working with suppliers, producers, policymakers, and other stakeholders to scale climate solutions.

Structure and key steps

The climate resilience and net zero framework (Figure 4) outlines four steps global agribusinesses can take to develop corporate climate commitments, align with agrifood priorities in NDCs and NAPs, assess climate risks, set targets, implement solutions, and monitor progress. These practical, action-oriented steps are tailored to help companies navigate the complexities of climate adaptation and mitigation in supply chains.

FIGURE 4. Climate resilience net zero framework



Source: Authors' own elaboration.

Step 1. Build management commitment for climate action in supply chains

This step covers how global companies can establish a strong foundation for climate action in their supply chains, by securing executive-level ownership and oversight to ensure alignment with the national climate priorities of the developing countries where they operate. The section outlines how to develop a compelling business case that highlights the benefits of contributing to NDCs and NAPs and how to integrate climate goals into corporate strategies and management commitment to align with both national and global climate targets.

Strong management commitment is required to weave climate action into corporate systems, building a solid foundation to tackle climate risks and ensure responsible agricultural supply chains. It requires robust buy-in at leadership level to enable strategies that address climate risks and align with national climate priorities. Companies can drive this forward by securing executive-level support to steer, oversee and champion climate action within their supply chains. This means developing a clear business case and rationale that shows how these actions benefit both the business and its supply chain, and highlight cost savings, risk reduction, competitive advantages, and overall benefits for wider farming communities in developing countries. Agrifood companies can demonstrate their commitment by following the substeps outlined in this section.

TABLE 2. Building management commitment for climate action in supply chains: who, how, and what?

Who should take this step?	Senior leadership and executives, chief procurement officers, sustainability and procurement teams, and key decision makers who oversee or influence supply chain policies and strategies.
What should it involve?	Securing executive-level oversight, developing a compelling business case for climate action, and integrating national climate priorities (NDCs/NAPs) into corporate policy and strategy by: 1. Establishing or integrating a policy for climate commitments along supply chains; 2. Forging strong partnerships for climate action in supply chains; and 3. Fueling climate action in supply chains with finance.
What is the final output?	A clearly defined policy on supply chain climate commitments, endorsed by senior management, that aligns with sourcing/supplying countries and global climate targets and guides companywide climate action.

Source: Authors own' elaboration.

Substep 1.1: Drive executive buy-in for climate-responsive supply chain policies

Securing strong leadership support is essential for integrating climate strategies into business operations and allocating resources effectively. Chief procurement officers play a crucial role in driving sustainability by ensuring climate considerations are embedded in procurement decisions and supply chain engagement.

Some businesses have gained executive buy-in by showcasing the financial implications of climate risks, including potential losses, the cost of inaction, and savings from emissions reductions. Demonstrating the impact of emerging climate regulations and the benefits of sustainability investments can also strengthen the case for prioritizing climate action within supply chains.

Companies with climate-responsible boards are 4.8 times more likely to establish upstream scope 3 emissions targets aligned with a 1.5 °C transition plan. Additionally, organizations that actively engage their suppliers on climate-related issues are 6.6 times more likely to set such targets (BCG, 2024). These insights highlight the influence of company governance structures and supplier engagement policies on achieving comprehensive climate objectives across supply chains.

Chief procurement officers (CPOs), stand out as key change agents. Statistics indicate that CPOs who receive climate-related incentives are 58 percent more likely to have targets linked to supplier outcomes. Also, 62 percent of CPOs are targeting climate mitigation efforts, and 60 percent assess suppliers on sustainability metrics to some extent according to the same analysis (Deloitte, 2023). This shows the increasing alignment between procurement incentives and supplier-related climate targets. According to CDP, companies that directly engage with their suppliers on climate-related issues are 2.3 times more likely to receive emissions disclosures from those suppliers (CDP, 2022). This statistic shows the role of proactive supplier engagement in promoting transparency and data sharing.

A common challenge in advancing supply chain sustainability, however, is the lack of alignment between sustainability teams, procurement teams, and corporate finance departments. Without internal buy-in – particularly from treasury teams and senior leadership – initiatives struggle to receive the financial backing they need for implementation. Some companies are overcoming this challenge by demonstrating: the financial risks of climate change, including potential supply disruptions, price volatility, and operational losses; the cost-saving potential of emissions reductions, such as improved energy efficiency and lower resource consumption; and the competitive advantages of aligning supply chains with sustainability expectations from investors, regulators, and consumers.

To ensure a structured and strategic approach to supply chain decarbonization and resilience, companies can develop a **climate policy** that covers both mitigation and adaptation, mainstreaming them across sustainability, procurement, and finance teams. Ideally, the policy would:

- Secure board-level approval and assign clear accountability to senior leadership;
- Be informed by internal and external expertise and engage relevant stakeholders, particularly in sourcing countries;
- Define clear expectations for employees, business partners, and suppliers regarding climate action;
- Ensure transparency by making the policy publicly available and clearly communicating it to all relevant stakeholders;
- Integrate into broader business growth strategies, ensuring sustainability and procurement objectives complement corporate expansion plans; and
- Ensure the company's policy and sustainability objectives are aligned with the national climate targets outlined in key sourcing or supply country NDCs and NAPs.

This alignment demonstrates a commitment to supporting local climate priorities and opens avenues for collaboration within supply chains. Also embedding climate action into a company's overarching business plans and growth strategies ensures that supply chain sustainability objectives align seamlessly with broader growth and strategic goals.

Substep 1.2: Forge strong partnerships for climate action in supply chains

Agrifood companies operate in complex global supply chains where climate risks – such as extreme weather events, shifting agricultural zones, and water scarcity – affect the availability and cost of raw materials. Many of these risks are concentrated in developing countries, where a significant share of agricultural production takes place. As a result, supply chain climate action must be coordinated with sourcing country NDCs and NAPs, supplier capacity-building efforts, and multistakeholder initiatives.

Partnerships give companies the policy alignment, industry collaboration, and local buy-in they need to effectively implement climate strategies. Businesses that fail to collaborate with partners risk supply chain disruptions, higher costs from climate-related losses, and increasing regulatory pressure, whereas proactively engaging in partnerships can unlock opportunities such as preferential access to green finance, early compliance with evolving regulations, and stronger supplier relationships.

Focusing on the following key strategies will help companies establish meaningful and effective collaborations for supply chain climate action:

Engage with policymakers: Working closely with policymakers in countries where their key supply chains are based helps companies understand national plans, priorities, and expectations for climate action in the agrifood sector. This allows companies to align their business efforts with national strategies, anticipate regulatory changes, and create opportunities for productive partnerships.

➔ **EXAMPLE:**[4] A multinational agrifood company sourcing coffee in a Latin American country partnered with government agencies to pilot climate-resilient farming techniques in line with the country's NDC targets. This collaboration provided farmers with better climate forecasting tools and access to drought-resistant coffee varieties, helping the company put in place ways to secure a stable, high-quality supply chain while supporting national climate goals.

Participate in industry initiatives: Climate challenges in supply chains are often too complex for individual companies to solve alone. Joining industry-led climate initiatives and forums allows companies to share knowledge, collaborate on solutions, and commit to collective action at the supply chain level.

➔ **EXAMPLE:** The Sustainable Rice Platform, a multistakeholder alliance, helps rice producers adopt low-emission cultivation practices aligned with national commitments. Companies sourcing from farmers supported by the platform aim to reduce their scope 2 and 3 emissions while contributing to national methane reduction targets.

Communicate commitments: Transparency is key to enabling accountability in supply chain climate action. Companies should clearly articulate their climate commitments and share them with all stakeholders – shareholders, employees, customers, consumers, value chain partners, business associations, civil society, and local communities – to build trust and accountability.

➔ **EXAMPLE:** A leading global food retailer has made its deforestation-free commitments public, ensuring that suppliers understand the standards they must meet. By publishing progress reports and supplier scorecards, the company aims to build credibility while driving continuous improvement in its supply base.

Strengthen engagement with business partners: Companies can integrate corporate climate policies into contracts and agreements with business partners, tailoring expectations to match their capacities and building long-term relationships to encourage the adoption of climate-smart practices.

➔ **EXAMPLE:** An agribusiness sourcing cocoa established long-term agreements with cooperatives that adopted agroforestry practices, linking supplier payments to sustainability performance and rewarding producers who improved soil health and reduced deforestation.

Build capacity and support suppliers: Many suppliers lack the resources to transition to sustainable practices on their own. Investing in supplier capacity building, by offering training and support to suppliers, especially smallholder farmers, can help them meet sustainability goals and adopt climate-resilient practices.

➔ **EXAMPLE:** A global food company sourcing cocoa invested in climate-smart farming techniques by providing smallholder suppliers with subsidized agroforestry training. While the actual results are yet to be seen, the company anticipates improvement in yields, increase in supply chain stability, and carbon sequestration in cocoa farms to achieve emissions targets.

[4] As outlined in the methodology, most examples in this report are based on interviews conducted with a wide range of companies. Company names have been anonymized.

Substep 1.3: Fuel climate action in supply chains with finance

Setting ambitious climate targets and integrating sustainability policies into supply chains is only effective if backed by adequate financial resources. Without dedicated funding, even the most well-intentioned policies risk remaining unimplemented. Many agrifood companies struggle to translate climate goals into tangible supply chain action due to a lack of financial incentives, budget allocations, and clear investment pathways. Ensuring financial commitment from senior management, procurement teams, and finance departments is essential to drive climate action across supply chains. However, prioritizing supply chain financing for climate action brings long-term cost savings, improved resilience, and stronger relationships with suppliers.

Focusing on the following key strategies will help companies adopt a multifaceted financial strategy that includes direct investments, incentive structures, and integration into corporate financial planning to ensure it effectively directs its financial resources toward supply chain decarbonization and resilience.

Set aside dedicated funds for supply chain climate action: A dedicated budget for supply chain climate action ensures long-term financial planning rather than treating climate-related projects as ad hoc initiatives. This funding can support investments in low-emission technologies, such as energy-efficient processing and sustainable packaging; capacity-building programmes for suppliers, helping them adopt climate-smart agriculture practices; supplier transition support, such as subsidies for adopting renewable energy or deforestation-free sourcing methods; and climate risk mitigation projects, such as improved irrigation systems, reforestation programmes, and biodiversity conservation.

➔ **EXAMPLE:** A multinational agrifood company launched a USD 200 million climate-smart sourcing fund to help smallholder farmers in its supply chains transition to regenerative agriculture. This initiative provided grants for cover cropping, reduced fertilizer application, and water conservation technologies, aligning with the climate goals of major sourcing countries. By securing board-level approval for such funding, companies signal a serious commitment to climate action, increasing investor confidence and ensuring supply chain resilience.

Integrate climate performance into financial incentives: Companies can link financial rewards to climate performance to drive accountability and accelerate progress toward sustainability goals. Strategies include tying executive compensation to supply chain sustainability targets; incentivizing procurement teams by linking supplier performance on climate action to purchasing decisions; and rewarding suppliers for meeting sustainability benchmarks through preferential contracts or financial incentives.

➔ **EXAMPLE:** Data shows that 38 percent of listed companies globally include supply chain emissions and environmental performance as factors in executive pay (Cohen *et al.*, 2023), a growing trend as investors demand greater corporate accountability on climate action. One leading global food company has tied 50 percent of executive compensation to reducing scope 3 emissions across its supply chain, with a focus on cutting deforestation and transport emissions, while a dairy company links 20 percent of its executives' annual bonuses to supply chain sustainability performance, particularly supplier compliance with climate-smart agriculture (CSA) practices.

These examples illustrate that, by strategically allocating resources and aligning financial incentives, businesses can ensure that climate action moves beyond policy statements into tangible, measurable results.

Conclusion: Securing strong management commitment is the first and most critical step in embedding climate action into supply chains. Without top-level buy-in, efforts to decarbonize operations and build resilience can remain fragmented and underfunded. By aligning supply chain climate strategies with national policies, companies not only reduce risks and strengthen supplier relationships but also unlock opportunities for green finance and market competitiveness. This step isn't just about ticking sustainability boxes – it's about making climate action a core business strategy that delivers long-term value.

Step 2. Implement climate adaptation strategies in supply chains

This step outlines actions global agrifood businesses can take to enhance adaptation strategies and practices in supply chains. It explains how to assess climate risks to identify hot spots and set targets and priorities for intervention, and how to set specific adaptation goals and collaborate with value chain partners to implement targeted solutions in developing countries.

Companies that take proactive steps to adapt their supply chains are protecting their business and opening new opportunities in climate-smart markets while supporting the farmers and communities that rely on them. So, how can businesses make their supply chains more resilient? First, they have to identify key climate risks and understand how changing weather patterns, extreme events, and shifting growing conditions impact sourcing regions. Next, they need to develop targeted adaptation strategies, working closely with suppliers to introduce climate-smart practices, such as drought-resistant crops, better water management, and improved soil health techniques. And finally, they need to put those solutions into action, ensuring that resilience-building measures are integrated across procurement, logistics, and production processes.

By following the steps outlined in this section, companies can turn climate risks into opportunities, protecting their bottom line while helping build a more sustainable and secure food system.

TABLE 3. Implementing adaptation strategies in supply chains: who, how, and what?

Who should take this step?	Sustainability teams, procurement teams, supply chain managers, and executives responsible for climate risk management. Collaboration with suppliers, farmers, and local stakeholders in supply chain countries is essential.
What should it involve?	Identifying climate risks and vulnerabilities in supply chains, aligning adaptation strategies with NDCs/NAPs, implementing tailored adaptation solutions, and enabling collaboration with suppliers and value chain partners to enhance climate resilience by: 1. Assessing climate risks and opportunities in supply chains and identifying hot spots and vulnerabilities across supply chains using historical data, climate projections, and local risk assessments; 2. Developing adaptation targets for supply chains, setting clear, measurable goals for reducing supply chain vulnerability and increasing resilience and develop business opportunities, aligned with national climate priorities; 3. Developing and designing adaptation solutions at supply chain level, such as improved water management, crop diversification, CSA practices, and enhanced supply chain logistics; and 4. Strengthening supplier engagement by working closely with suppliers to integrate adaptation practices, providing training, and offering incentives for climate-resilient practices.
What is the final output?	A comprehensive adaptation strategy embedded in supply chain operations, prioritizing climate resilience, supplier engagement, and alignment with national climate priorities. The strategy should include concrete actions such as improved water management, crop diversification, CSA practices, and strengthened farmer support programmes.

Source: Authors' own elaboration.

Substep 2.1: Assess climate risks and opportunities in supply chains and identify hot spots

Before companies can implement effective climate adaptation strategies, they must first gain a comprehensive understanding of the vulnerabilities within their supply chains and identify opportunities to offer goods and services in climate-resilient markets. Climate disruptions can lead to unstable supply chains, lower yields, and higher costs for businesses that rely on agricultural commodities. For companies sourcing from climate-sensitive regions, assessing risks and vulnerabilities in supply chains is no longer optional – it is a business necessity. Companies need to evaluate where climate risks are highest and how they could impact production, sourcing stability, and long-term supplier resilience.

A comprehensive climate risk assessment should include: mapping the supply chain to identify where key commodities are grown, processed, and distributed; assessing risks at different supply chain points and locations to understand exposure to extreme weather events, changing temperature and precipitation patterns, and long-term environmental degradation; and identifying climate-vulnerable hot spots to understanding how these risks play out, recognizing which regions and commodities face the highest risks and evaluating potential impacts on yields, quality, and supplier stability (Groot *et al.*, 2019; OECD-FAO, 2023; WBCSD, 2015).

Analysing sourcing country NDCs and NAPs can help companies prioritize climate-sensitive commodities and geographic regions for action. In addition to outlining government priorities for climate action, these documents include sector-specific risks and adaptation strategies. By aligning supply chain assessments with national climate strategies, businesses can target interventions where they are most needed and ensure their adaptation efforts support national resilience goals.

Map the supply chain: First, companies need to identify the aspects of the supply chain that are most at risk, by analysing vulnerabilities to changing weather patterns and understanding how climate factors influence supply chain stability. Mapping the supply chain involves identifying all key stages, from raw material sourcing to final retail distribution, gathering comprehensive data on the environmental conditions at all locations and any known climate hazards that could impact operations.

A well-mapped supply chain provides a clear visualization of the value chain, actors, processes, and climate-sensitive resources. This helps businesses understand who is involved in the supply chain, how different components interact, and which areas are most exposed to climate threats. Companies should also differentiate actors based on company size, gender dynamics, socioeconomic factors, and other characteristics that can influence climate vulnerability and resilience.

Ultimately, mapping helps pinpoint high-value supply chain locations and areas that rely heavily on climate-sensitive inputs. By taking a structured approach to supply chain mapping, agrifood companies can make informed decisions about where to focus adaptation efforts, reducing risks and ensuring long-term sustainability.

Assess climate risks across supply chains and identify key climate threats: After mapping the supply chain, the next step is to assess climate risks across different locations and supply chain segments. This means identifying key climate variables that impact sourcing regions, transport routes, and processing hubs. This does not mean responding to today's weather shocks; rather, it is about anticipating long-term shifts that could reshape supply chains in the near future. To do this, companies need to evaluate historical disruptions, current weather patterns, and projected climate risks, using a combination of climate data, supplier insights, and scenario analysis. A thorough risk assessment should answer key questions, such as:

- What climate hazards are most relevant? Heatwaves, floods, droughts, storms, or something else?
- Which supply chain nodes are most exposed? Production sites, transport routes, or storage facilities?
- How severe are the risks? Will they cause temporary disruptions, or could they fundamentally alter supply availability?
- What is the likelihood of these events worsening over time? Are risks projected to increase due to climate change?

For example, a retailer sourcing seafood from Southeast Asia might focus on the impact of rising ocean temperatures on fisheries, while a company relying on vanilla from Madagascar could analyse the increasing risk of cyclones damaging crops and disrupting global supply chains. By conducting a structured climate risk assessment, businesses can move beyond general climate concerns and focus on specific, high-risk supply chain vulnerabilities.

A practical approach is to categorize risks into chronic and acute climate threats (Table 4). Chronic threats, such as increasing temperatures and shifting rainfall patterns, develop gradually but can significantly impact long-term agricultural productivity. Acute threats, such as hurricanes, wildfires, and heavy rainfall events, occur suddenly and can lead to immediate disruptions.

TABLE 4. Chronic and acute threats affecting agrifood supply chains

Climate threat	Effect on supply chains	Example
Chronic threats		
Rising temperatures, heat stress	Reduces crop yields, lowers livestock productivity, increases water evaporation, raises energy costs for cold storage	Lower Arabica coffee yields in Brazil and Ethiopia; lower dairy production in India and United States of America
Changing rainfall patterns, water scarcity	Reduces water availability, increases competition for water, makes rainfall more erratic, raises irrigation costs	Rice production in India, Thailand, and Viet Nam is affected by water scarcity; beef production in Australia faces declining grazing water
Land degradation, soil erosion	Reduces agricultural productivity, increases fertilizer needs, lowers raw material quality, raises input costs	Soil degradation in sub-Saharan Africa threatens wheat and maize yields; declining palm oil yields in Indonesia
Sea-level rise, salinization	Saltwater intrusion into freshwater supplies, floods coastal farmlands, threatens port infrastructure	Saltwater intrusion in Bangladesh and Viet Nam reduces rice production; coastal fisheries affected in Southeast Asia
Increased pest and disease pressure	Expands pest and disease ranges, increases reliance on pesticides and antibiotics, affects biodiversity	Coffee leaf rust spreads in Latin America due to warmer temperatures; locust swarms threaten crops in East Africa
Acute threats		
Hurricane, cyclone	Destroys crops and farmlands, disrupts transportation and logistics, damages food storage and processing facilities	Hurricane Maria (2017) devastated banana and coffee crops in Puerto Rico, disrupting supply chains for months
Flooding, heavy rainfall	Leads to soil erosion, damages infrastructure, delays harvest, contaminates water sources, disrupts food distribution	Pakistan floods (2022) submerged millions of acres of farmland, leading to massive wheat and rice losses
Drought, water shortage	Reduces soil moisture, lowers crop yields, increases feed and water costs for livestock, affects irrigation systems	California droughts (2020–23) led to lower almond and grape production, affecting global exports
Wildfire	Destroys farmlands and forests, reduces air quality for agricultural workers, disrupts logistics and supply chains	Australian bushfires (2019–20) destroyed vineyards and grazing lands, reducing livestock populations
Heatwave	Causes heat stress in crops and livestock, affects farm labour productivity, increases spoilage of perishable foods	Europe heatwave (2022) damaged wheat production in France and Spain, reducing yields and increasing prices

Source: Authors' own elaboration.

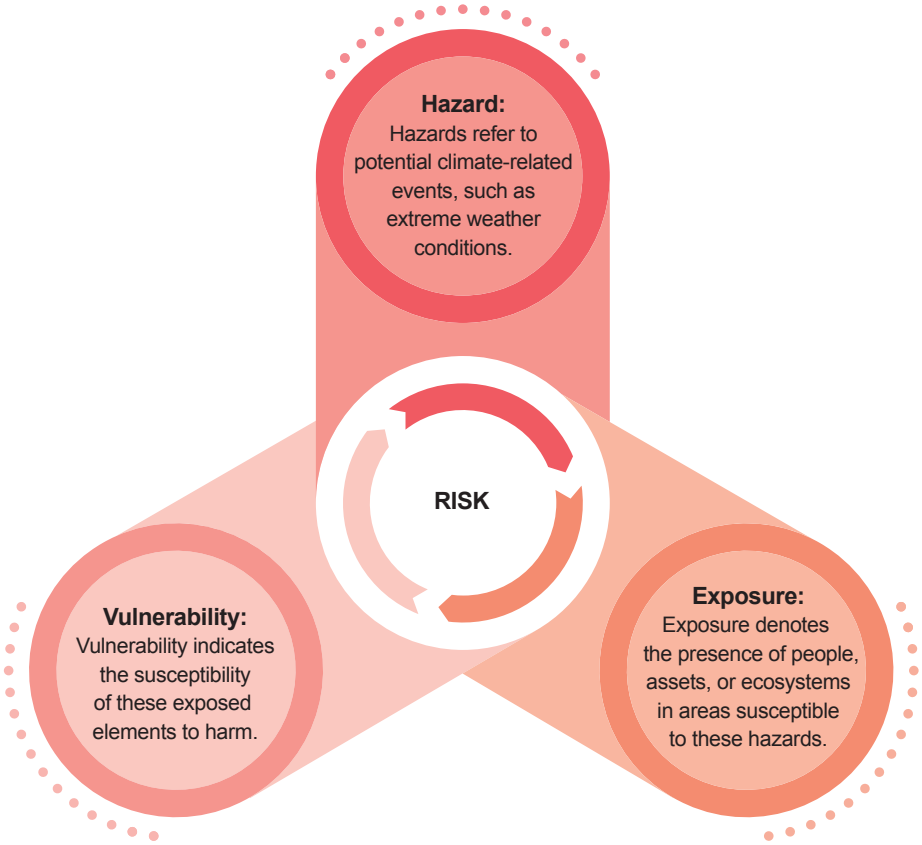
Estimate the current threat level: Understanding past climate impacts on supply chains is a crucial step in assessing vulnerability. Companies can begin by analysing historical disruptions caused by climate-related events, asking key questions such as: what weather hazards have affected us in the last five to ten years? And which climate risks are most common in sourcing regions?

To identify high-risk locations, businesses can use climate-risk information contained in sourcing country NDCs, NAPs, national climate databases, regional impact maps, and past climate hazard studies. Examining national adaptation strategies can provide insights into which agricultural commodities and production areas are most vulnerable to climate risks. Comparing this data across multiple sourcing regions enables businesses to determine how their supply chains may be exposed to physical climate risks in different locations. Identifying historical climate trends – such as frequent floods, prolonged droughts, or shifting rainfall patterns – allows companies to recognize high-risk supply chain areas, such as flood-prone zones or drought-sensitive agricultural regions.

For a more structured approach to evaluating risks, companies can apply a **risk calculation formula** to quantify vulnerability levels and determine where adaptation efforts should be prioritized. Climate risk arises from the interplay of three key factors: hazards, exposure, and vulnerability (Figure 5). Businesses must analyse the complex relationships between these variables to accurately assess climate risks.

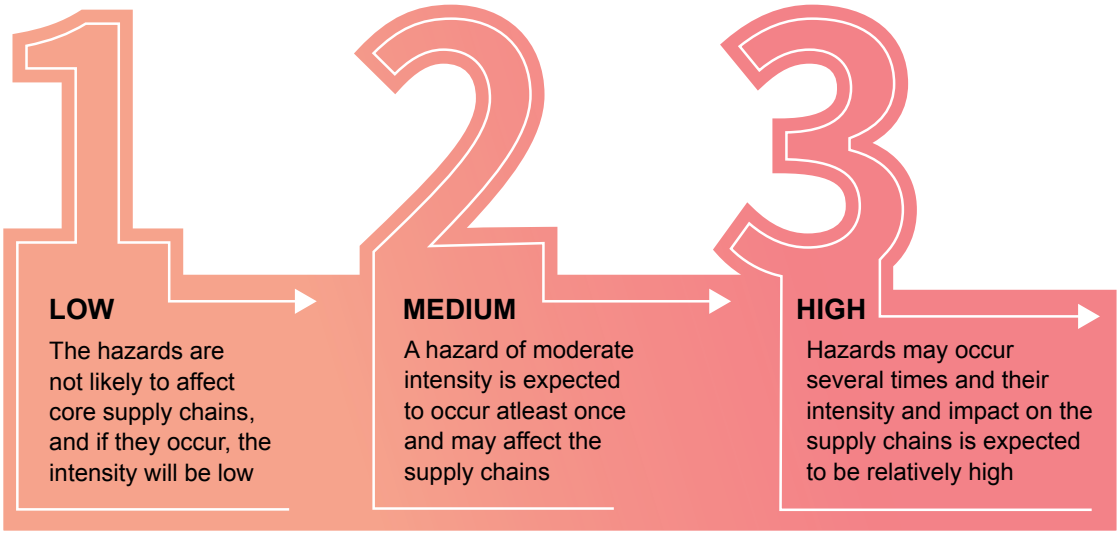
FIGURE 5. Climate risk interplay

RISK: The negative event or outcome is determinated by the interplay of three factors: hazard, exposure and vulnerability.



Source: Authors' elaboration based on **IPCC.** 2020. *The concept of risk in the IPCC Sixth Assessment Report: a summary of cross working group discussion*. https://www.ipcc.ch/report/ar6/wg2/figures/chapter-1/figure-1-005a

FIGURE 6. **Hazard severity**



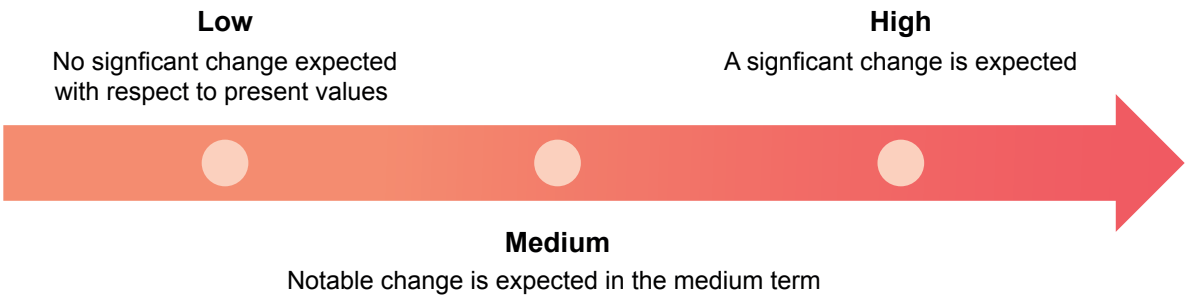
Source: Authors elaboration based on **World Bank.** 2023. *Climate toolkits for Infrastructure PPPs.* See link.

By applying a qualitative scoring system (Figure 6), companies can assess hazard severity based on intensity and frequency, allowing them to make data-driven decisions about adaptation strategies.

Estimating future climate threat levels: Looking ahead, agrifood companies need to anticipate how climate risks will evolve in supply chains. Future climate projections help in understanding emerging risks and changes in weather patterns that may impact supply chains. Engaging with stakeholders and experts can provide insights about which climate variables are most relevant for decision-making – for example, temperature shifts, precipitation trends, or extreme weather events. Recent climate shocks which affected a company are a good starting point to embark with stakeholders on this process.

For acute hazards, companies can assess future risk levels by combining current hazard intensity with projected trends. For example, if a supply chain faces a medium hazard level with an increasing trend, it is reasonable to expect that this risk will escalate to high in the coming years. For chronic threats, companies can use scoring systems to rate the severity of risks based on how rapidly primary climate stressors are expected to change (Figure 7). Many of these projections rely on climate scenario models, which use data from global or regional climate models (Box 1). Additional details on scenario tools can be found in Table 5.

FIGURE 7. Severity of risk



Source: Authors elaboration based on **World Bank.** 2023. *Climate toolkits for Infrastructure PPPs*. https://www.worldbank.org/en/topic/sustainableinfrastructurefinance/brief/climate-toolkits-for-infrastructure-ppps.

BOX 1. Applying climate scenarios to model risks in agrifood sectors

Climate scenario analysis enables businesses to anticipate risks and opportunities by exploring various possible futures. Agrifood companies can leverage Regional Climate Models (RCMs) and Coordinated Regional Climate Downscaling Experiment (CORDEX) data to model climate risks and develop adaptive strategies within their supply chains. By using CORDEX downscaled data, companies can assess future climate conditions in specific sourcing regions, such as temperature fluctuations, shifting rainfall patterns, and extreme weather events that directly impact crop yields, water availability, and supply chain stability. For example, CORDEX climate projections can be integrated with hydrological models to assess future water availability, guiding irrigation strategies, watershed management, and investments in water-efficient technologies. RCM-driven climate hazard projections also allow companies to evaluate logistics vulnerabilities and plan for climate-resilient infrastructure, cold chains, and distribution networks.

For example, in regions like Ukraine and India, where agrifood companies source wheat, climate change predictions suggest significant impacts. Scenario models project potential declines in wheat yields of 15–20 percent by 2050, driven primarily by more frequent and intense heatwaves and droughts. In Ukraine's Steppe zone, which already faces low precipitation and extreme summer heat, these conditions exacerbate water and heat stress, further limiting crop yields. In India, particularly in the major wheat-producing area of Punjab, projections indicate a concerning reduction in wheat productivity, possibly by 10–15 percent, primarily due to heat stress during the crucial grain-filling stage. In some cases, wheat yields in Punjab could decrease by as much as 20.5–30 percent under various climate scenarios by the 2050s.

Integrating CORDEX and Decision Support System for Agrotechnology Transfer (DSSAT) models offers significant advantages for analysing climate change impacts on agriculture. DSSAT is a well-established tool for simulating crop growth and yield under diverse management practices and environmental conditions. CORDEX, with its regional climate projections at higher spatial resolutions compared to global models, is more suited for assessing localized impacts on agricultural systems. Combining these tools provides a more realistic and detailed understanding of how climate change will affect crop productivity at the regional level.

Gunawat, A., Sharma, A., Dubey, S.K. & Sharma, D. 2022. Assessment of climate change impact and potential adaptation measures on wheat yield using the DSSAT model in the semi-arid environment. *Natural Hazards*, 111: 2077–2096. https://doi.org/10.1007/s11069-021-05130-9

Despite the clear advantages, many agrifood businesses still do not integrate scenario analysis into their long-term planning. Instead, they focus on short-term fixes, adjusting operations year by year rather than preparing for fundamental shifts. This lack of foresight can lead to maladaptive investments, as companies take decisions that seem smart today but fail under future climate conditions.

To avoid these pitfalls, agrifood companies can integrate climate scenario analysis into their business strategy, using the WorldClim Database, Cordex database, the IPCC Sixth Assessment Report (AR6) Climate Risk Frameworks, the TCFD Framework, and other tools (see Table 5).

➔ **EXAMPLE: Identifying supply chain vulnerabilities using climate scenario analysis**

A global agrifood company assessed that by 2030, extreme weather events could significantly impact financial performance, particularly due to supply chain disruptions. Recognizing that ad hoc responses were not enough; the company formed a climate risk task force to conduct a structured vulnerability analysis using the TCFD framework. Through climate scenario analysis, it evaluated future climate risks under different warming scenarios and developed heat maps (Figure 8) to visualize the geographic distribution of risks and highlight regions where flooding, drought, and heat stress could disrupt supply chains. The financial impact assessment projected a decline in sales post-2030 due to these disruptions, necessitating urgent adaptation measures.

FIGURE 8. Risk exposure heat map

Climate Risk Factor	Supply Chain & Procurement	Manufacturing	Distribution	Customers
Floods, storms	High Risk	Moderate Risk	Moderate Risk	Moderate Risk
Hurricanes	High Risk	High Risk	Moderate Risk	Low Risk
Wildfires	Moderate Risk	High Risk	Moderate Risk	Low Risk
Heatwaves/drought	High Risk	High Risk	Moderate Risk	Low Risk
Temperature rise	High Risk	High Risk	Moderate Risk	Moderate Risk
Sea-level rise	High Risk	Moderate Risk	Moderate Risk	Moderate Risk

Integrating risk assessments across procurement, manufacturing, distribution, and customer networks, the company identified key hot spots requiring targeted interventions. The findings revealed that certain supplier locations were highly vulnerable to extreme weather, emphasizing the need for sourcing diversification to minimize disruptions. High flood and drought risks also threatened raw material procurement and manufacturing sites, highlighting critical weaknesses in the company's operational strategy. The analysis also identified opportunities for resilience investments, such as shifting to climate-smart sourcing practices in lower-risk regions. By embedding scenario-based risk analysis into business planning, the company attempted to move beyond reactive responses and develop a proactive, data-driven adaptation strategy. By visualizing risks across its supply chain, the company sought to prioritize adaptation investments in high-risk zones and develop targeted strategies to enhance resilience. A key measure was diversifying supplier networks by shifting sourcing to lower-risk regions, reducing exposure to climate-induced disruptions. To strengthen distribution networks, it took steps to implement early warning systems and adaptive logistics strategies, enabling real-time risk assessment for responsive supply chain adjustments.

Source: As outlined in the methodology, most examples in this report are drawn from interviews with a broad range of companies. To maintain neutrality and avoid any perception of endorsement, company names have been anonymized and examples as above are not attributed to specific firms or related documents.

➔ **EXAMPLE: Balancing physical and transition risks in a volatile market**

A multinational agrifood company adopted a comprehensive approach to climate risk analysis, recognizing that both physical risks (climate impacts) and transition risks (policy, regulatory, and market shifts) could shape its long-term business sustainability. To understand potential vulnerabilities, the company conducted a physical risk assessment extending to 2040, focusing on how extreme weather events could disrupt raw material procurement. Simultaneously, it analysed transition risks up to 2030, considering how carbon pricing policies, emissions regulations, and evolving consumer demand could influence operational costs and supply chain dynamics.

The assessment revealed that certain core commodities faced significant climate risks. Coffee, which generates 20 percent of the company's annual revenue, appeared particularly vulnerable to rising temperatures and shifting growing conditions, with Arabica yields projected to decline, while Robusta remained relatively resilient. Cocoa and palm oil supply chains could experience geographical production shifts and potential yield losses, while water scarcity was expected to intensify, posing risks for processing and production facilities.

On the transition side, carbon pricing mechanisms and stricter scope 3 emissions regulations emerged as major uncertainties, with the potential to make emissions-intensive supply chains more expensive and less viable, increasing operating costs by USD 6.5 billion and capital expenditure by USD 0.56 billion. Regulatory shifts could also alter supplier relationships, requiring greater investment in climate-smart sourcing and lower-carbon production methods, making emissions-intensive sourcing more expensive and less viable.

Despite some progress in mitigating physical risks through supplier engagement and regenerative agriculture, the company recognized gaps in addressing transition risks. To enhance long-term resilience, it needed to quantify external political risks, allowing for more accurate forecasting of regulatory changes that could impact production costs and market positioning. Developing carbon pricing strategies was also essential to prepare for evolving emissions regulations and minimizing exposure to financial penalties. The company also sought to establish stronger metrics for tracking adaptation progress, ensuring that climate scenario analysis translated into concrete, measurable actions rather than broad, speculative planning. By embedding climate scenario analysis into investment decisions, the company attempted to make some shifts in procurement, financial planning, and sustainability commitments.

These examples illustrate the practical value of data-driven climate scenario analysis, demonstrating how companies can use forward-looking risk assessments to strengthen resilience. Integrating these tools into their decision-making can help companies: avoid maladaptive investments; enhance supply chain resilience by anticipating extreme weather disruptions and adjusting sourcing strategies accordingly; prepare for regulatory and market shifts in advance to reduce exposure to sudden cost increases and compliance risks; and leverage climate risks as opportunities, using climate-smart practices to enhance competitiveness.

Table 5 signposts examples of existing guidance tools for climate risk assessment, scenario modeling, and adaptation planning.

TABLE 5. Useful resources for the preliminary identification of climate hazards and risks in supply chains

Resource	Description	Link
Climate and Agriculture Risk Visualisation and Assessment (CAVA) developed by FAO and the Universidad de Cantabria	CAVA provides access to historical and future climate data and facilitates its use, together with impact assessments, to provide long-term climate services relevant for agriculture. It comprises of two key components: the CAVA Platform is a user-friendly, open-access platform for accessing climate and impact information; while CAVA Analytics is a dedicated package that facilitates advanced analyses and ensures harmonized access to the raw data used by the CAVA platform.	https://cavaplatform.com/
Climate and disaster risk screening tools developed by the World Bank Group	These tools provide a structured approach to evaluating both immediate and long-term climate risks within projects and broader sectoral or national planning efforts. With two levels of screening – a rapid evaluation to identify key climate vulnerabilities and a more comprehensive assessment that delivers detailed risk reports – the tools are designed for organizations and policymakers gain a deeper understanding of potential climate and disaster risks at national and project scales.	https://climatescreeningtools.worldbank.org/
Climate Change Knowledge Portal (CCKP) developed by the World Bank Group	CCKP provides a wealth of climate-related information, through datasets on climate variability, disaster risks, and socioeconomic factors. It includes tools such as the Climate Risk Country Profile, which outlines climate hazards and their projected impacts. CCKP offers historical and future climate projections based on different climate models, covering temperature-related metrics and precipitation patterns, which companies can use to anticipate climate-driven disruptions in their supply chains and develop proactive adaptation strategies.	https://climateknowledgeportal.worldbank.org/
Cordex database	CORDEX (Coordinated Regional Climate Downscaling Experiment) is a framework developed by the World Climate Research Programme (WCRP) to evaluate the performance of regional climate models (RCMs). It consists of a series of coordinated experiments designed to generate high-resolution regional climate projections. CORDEX aims to provide more detailed and localized climate information by downscaling global climate models (GCMs) to regional scales. This enables the assessment of climate impacts at finer spatial resolutions, crucial for understanding regional climate variability and extreme events.	https://cordex.org/data-access/
TCFD Framework	The Task Force on Climate-related Financial Disclosures framework helps companies disclose climate-related risks and opportunities more effectively as part of their existing reporting processes. It provides a structured approach for integrating climate risks into corporate financial planning and investor communications. Post 2023, TCFD has been disbanded and the IFRS Foundation has taken over the monitoring of the progress of companies' climate-related disclosures.	https://www.ifrs.org/content/dam/ifrs/supporting-implementation/issb-standards/progress-climate-related-disclosures-2024.pdf
Think Hazard	ThinkHazard.org is a free, user-friendly, open-source tool designed to help project planners identify natural hazards in their project areas and understand how to mitigate their impact. Offering detailed risk assessments for 11 types of hazards down to the district level, ThinkHazard! supports project planners and managers in ensuring their projects are resilient both now and in the future.	https://www.gfdrr.org/en/videos/thinkhazard#:~:text=ThinkHazard.org%20is%20a%20free,Tap%20to%20unmute
WorldClim Database	A global database providing high-resolution climate data and future climate projections based on SSPs that is valuable for agrifood companies seeking localized climate risk assessments to inform supply chain adaptation strategies.	https://www.worldclim.org/
IPCC AR6 Climate Risk Frameworks	Developed as part of the latest IPCC assessment report, this framework offers science-backed climate projections to inform risk assessments. It helps companies evaluate physical and transition risks across different warming scenarios and supports long-term climate resilience planning.	https://www.ipcc.ch/report/ar6/wg2/figures/chapter-1/figure-1-005a
Climate scenario analysis and application guide: food, agriculture and forest products	This guide, developed by the World Business Council for Sustainable Development, provides detailed guidance on how (and why) agrifood companies should conduct climate risk assessments through climate scenario analyses.	https://www.wbcsd.org/resources/climate-scenario-analysis-and-application-guide/

Source: Authors' own elaboration.

Identifying climate vulnerability hot spots in supply chains: Once the climate risks have been assessed, companies will need to identify climate vulnerability hot spots within their supply chains to determine where they are most exposed to climate-related disruptions and where they require targeted adaptation strategies.

Companies should evaluate business-critical commodities, sourcing regions, and supply chain nodes based on key climate vulnerability factors, such as:

- Exposure to climate hazards – identifying areas where production occurs in floodplains, drought-prone zones, or regions expected to experience extreme weather events;
- Dependence on climate-sensitive resources – assessing reliance on rainfed agriculture, irrigation systems, or natural water sources that may become scarce due to climate change;
- Observed and projected climate hazards – reviewing past climate events and projected trends, such as increasing droughts or unpredictable rainfall; and
- Adaptive capacity of supply chain actors – evaluating whether farmers and suppliers have access to climate adaptation resources, such as drought-resistant seeds, irrigation, or financial support for resilience measures.

After identifying the hot spots, the next step is to create a climate adaptation priority list for focus areas, key agricultural products, and sourcing locations. This should include:

- High-risk commodities and sourcing regions – prioritizing products and areas with a high degree of climate vulnerability and supply chain importance;
- Sectors with limited resilience capacity – identifying suppliers or smallholder farmers who lack resources to adapt and are at higher risk of disruption;
- Opportunities for public-private collaboration – aligning company adaptation efforts with national agricultural policies, NDCs, and NAPs to maximize impact;
- Evaluation of adaptation measures – assessing the effectiveness of existing strategies, such as climate-smart farming techniques, irrigation investments, and weather monitoring systems; and
- Identification in some cases of options to diversify or shift sourcing to less vulnerable regions.

Assessing climate policies in key supply chain hot spots/regions to maximize impact: For agrifood companies operating across diverse geographies, understanding the climate policies of key sourcing regions or identified hot spots is crucial. These policies shape national mitigation and adaptation priorities, influencing everything from farming regulations and land-use policies to financial incentives for sustainable agriculture.

Agrifood company sustainability teams are best placed to conduct this assessment. They should take a structured approach, assessing the climate policies of specific supply chain countries, starting with a quick review of their NDCs, NAPs, and long-term strategies to get a high-level understanding of national climate priorities and agrifood-related targets. Recommended areas of focus include adaptation goals for agriculture and food systems and exploring the country's priority measures for building climate resilience in farming and food production. They can also explore whether regions or geographic areas identified as climate hot spots have specific resilience or mitigation priorities.

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➔ **EXAMPLE:** Bangladesh's NAP emphasizes enhancing flood resilience in rice farming due to the increasing frequency of extreme weather events, outlining strategies such as integrated and participatory water management, strengthened early warning systems, and flood and erosion protection schemes to enable agricultural resilience (MOEF, 2022). Understanding these policy priorities can help a global rice-importing company align its climate strategy to support these NAP objectives, thereby enhancing farmers' adaptive capacity and ensuring long-term supply stability amid climate risks. Possible adaptation solutions could include supporting the development and dissemination of early warning systems to help farmers prepare for and mitigate the impacts of extreme weather events, reducing potential disruptions in the supply chain, and encouraging suppliers to adopt flood-tolerant and high-yielding rice varieties to reduce crop losses during floods. Both these approaches would contribute to a more stable supply chain.

Beyond national climate strategies, many countries have sector-specific policies that directly impact agrifood supply chains, such as national sustainable agriculture policies (agroecology, low-carbon farming, etc.), land-use regulations, such as zero-deforestation laws and soil conservation mandates, water management frameworks, such as irrigation efficiency incentives, and renewable energy incentives for food processing and transport. Systematically mapping these policies would help companies understand the climate targets within them and where these align with their own corporate climate goals.

➔ **EXAMPLE:** Brazil’s Forest Code enforces strict monitoring of deforestation in agricultural supply chains (CPI, 2023). A soy trader sourcing from Brazil would therefore need to ensure its suppliers comply with eco-deforestation commitments or risk losing market access.

Governments and international institutions are gradually beginning to fund climate initiatives in the agrifood sector, creating opportunities for private sector engagement. These include carbon credit schemes that reward sustainable farming and land restoration, subsidies for CSA – such as incentives for regenerative farming and drought-resistant crops – and green finance mechanisms, such as sustainability-linked loans or blended finance for adaptation investments.

➔ **EXAMPLE:** Kenya’s CSA Strategy provides a framework for mobilizing resources for guiding implementation of conservation tillage and agroforestry practices (MALF, 2017). A global agribusiness therefore investing in Kenyan supply chains could partner with local governments to co-finance farmer training and equipment upgrades, benefiting both suppliers and corporate sustainability targets.

After reviewing relevant climate policies, companies can create a country-specific inventory summarizing the most important regulations, financing mechanisms, and strategic priorities affecting agrifood supply chains, as illustrated in Table 6.

TABLE 6. Climate entry points in policy documents: country-specific inventory

Policy document	Type	Sector coverage	Government entity in charge
NDC	National climate plan. Both adaptation and mitigation	Agriculture, land use, water. Targets and specific measures such as sustainable agriculture, water efficiency, etc.	Ministry of Environment, Agriculture
NAP	Adaptation strategy or plan	Food security, climate resilience, and cross cutting	Climate Change Commission, Rural Development Agencies
Land-use and deforestation policies	Regulatory framework	Agricultural expansion, forest conservation	Forestry Commission, Environmental Ministries
Climate finance incentives	Funding mechanisms	Agri finance, carbon markets	National Green Finance Institutions

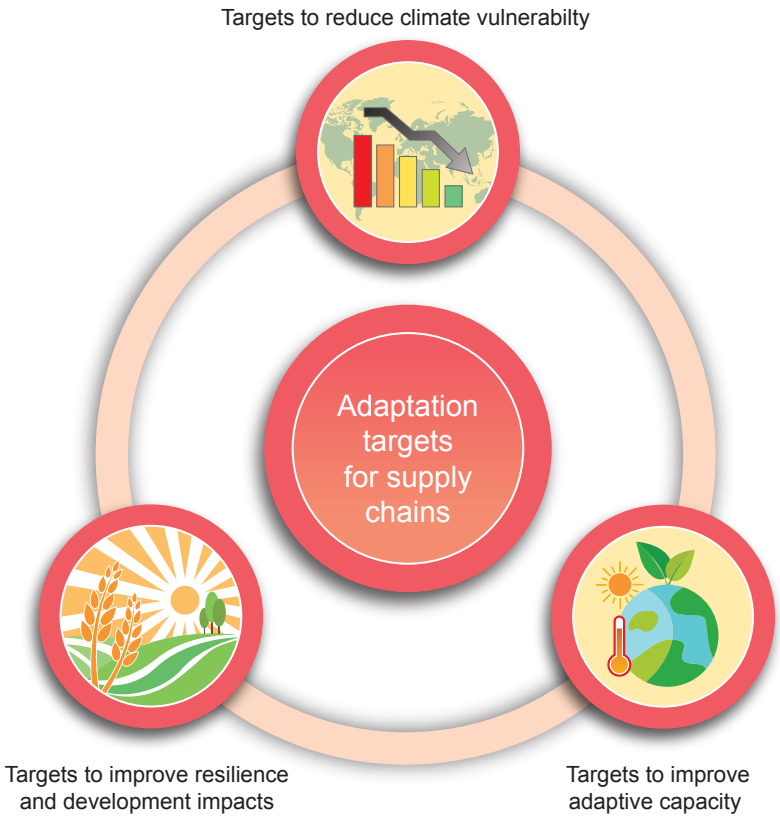
Source: Authors' own elaboration.

Substep 2.2: Develop adaptation targets for supply chains

After identifying climate risk hot spots and key supply chain locations, companies should focus on setting targets that actively reduce climate vulnerability, improve adaptive capacity, and strengthen resilience – aligning with the global goal on adaptation of the Paris Agreement (UNFCCC, 2016). Setting clear adaptation targets is essential for building climate resilience within supply chains. Companies could align their supply chain adaptation goals with the NDCs and NAPs of the countries they source from and supply to, ensuring that their adaptation efforts contribute to national climate priorities. Adaptation targets can be qualitative or quantitative, depending on observed and projected climate risks under different warming scenarios. Corresponding to the global goal on adaptation, companies can focus on three key areas to set adaptation targets (Figure 9; Table 7):

- **Reducing vulnerability in supply chains:** Companies can set goals that enhance ecological productivity, economic stability, and social well-being, which they can meet by improving farmer income to adopt climate-smart practices, improving health, reducing poverty, enhancing nutrition, and investing in infrastructure to make supply chains more resilient to climate hazards.
- **Enhancing adaptive capacity in supply chains:** Companies can set measurable objectives to build absorptive, adaptive, and anticipatory capacities, which they can meet by investing in training, climate-smart agricultural practices, and supply chain modifications to build long-term resilience.
- **Improving resilience and development outcomes:** Businesses can meet this target through well-being improvements, enhanced agricultural productivity, and reduced losses from climate-induced disasters.

FIGURE 9. Adaptation targets for suply chains



Source: Authors' own elaboration.

TABLE 7. Examples of supply chain adaptation targets

Reducing vulnerability in supply chains	Enhancing adaptive capacity in supply chains	Improving resilience and development outcomes
Reduce water stress: Ensure 80% of smallholder farmers in key sourcing regions have access to improved irrigation systems by 2030.	**Climate-smart training:** Train 250 000 farmers in climate-smart agricultural techniques by 2030.	**Reduce post-harvest losses:** Cut climate-induced losses by 40% by 2030 through improved storage and processing.
Soil health and land restoration: Implement regenerative agriculture practices across 50% of supply chain farmlands to enhance soil quality and prevent erosion.	**Early warning systems:** Ensure 100% of sourcing regions use real-time climate data by 2028.	**Food security:** Improve resilience of supply chains to contribute to food security for 10 million people by 2040.
Ecosystem conservation: Restore 500 000 hectares of degraded land through afforestation and agroecological practices by 2035.	**Resilient seed and inputs:** Ensure 75% of smallholder farmers in vulnerable regions have access to climate-resilient seed varieties by 2030.	**Sustainable production systems:** Increase agricultural resilience through regenerative and circular economy approaches.

Source: Authors' own elaboration.

Approaches agrifood companies are taking to set adaptation targets for climate hot spots and high-vulnerability commodities

A handful of agrifood companies are setting adaptation targets within their supply chains to address water scarcity, encourage sustainable land use, protect biodiversity and habitats, improve soil health, and promote sustainable agriculture. Although the full impact of these initiatives remains uncertain, they provide examples of adaptation target-setting that other companies can learn from and build on. By incorporating similar strategies, businesses across different sectors can build stronger, more resilient supply chains while supporting broader climate adaptation efforts.

➔ EXAMPLE: **A beverage company addresses water scarcity**

A leading beverage company has committed to improving water availability and quality in high-risk regions by 2025, recognizing the critical role water plays in its operations, supply chain, and local communities. The commitment includes restoring watersheds, investing in water recycling, and making efficient improvements across its production sites. Beyond these operational measures, the company has also pledged to train all its direct suppliers on climate adaptation strategies, equipping them with the tools they need to manage changing rainfall patterns and drought risks.

➔ EXAMPLE: **A paper and packaging company strategy includes sustainable land use and biodiversity conservation targets**

A major paper and packaging company has committed to optimizing wood production while integrating biodiversity conservation in key sourcing regions. Given its reliance on forest-based raw materials, the company recognizes the importance of balancing resource extraction with ecological protection. The strategy includes sustainable forestry management, ecosystem restoration, and land-use planning that aims to mitigate supply chain disruptions while supporting biodiversity.

➔ EXAMPLE: **Habitat protection and farmland regeneration targets in the luxury goods industry**

A luxury goods company committed to habitat protection and farmland regeneration to secure long-term access to high-quality natural materials. Recognizing the growing risk of resource scarcity, the company is investing in restoring degraded pasturelands and promoting regenerative land management practices. As well as stabilizing supply chains, this commitment aligns with consumer demand for environmentally responsible luxury goods.

The company's approach suggests a growing industry shift towards more sustainable sourcing practices, particularly in high-value supply chains. But as with many adaptation initiatives, the challenge lies in ensuring long-term continuity and measurable impact, particularly in industries where market trends and sourcing needs evolve rapidly.

➔ EXAMPLE: **Soil health and smallholder training targets in commodity supply chains**

Recognizing the risks associated with land degradation, a major commodity company has committed to improving soil health, increasing nutrient efficiency, and enhancing water conservation. As part of its broader sustainability strategy, it has pledged to train 268 000 smallholder farmers in sustainable soil management and climate-resilient cultivation techniques.

This commitment highlights the importance of building climate resilience at production level, particularly for smallholder farmers, who are often the most exposed to climate shocks. But ongoing financial and technical support will be needed to ensure the training leads to widespread adoption of climate-smart farming practices.

➔ **EXAMPLE: Water use reduction and agricultural sustainability targets in the food ingredients industry**
A global food ingredients company has set a target to reduce water use by 30 percent in highly polluted manufacturing regions by 2030 and committed to supporting smallholder farmers to adopt efficient farming techniques across all sourcing regions by 2022. These goals are designed to enhance food security, minimize water waste, and promote sustainable agricultural practices. The extent to which these goals have been met is not yet fully clear, but they set a precedent for how companies in the sector can approach water-related climate risks.

Substep 2.3: Develop and deliver adaptation solutions at supply chain level

After setting adaptation targets, the next step is to translate these targets into concrete actions. This is where many agrifood companies are lagging: while many have set targets, they often struggle to develop adaptation solutions to achieve the targets. The key is to start with climate risks that can be addressed immediately, prioritizing adaptation solutions that are cost-effective and offer the most significant benefits for most vulnerable areas and commodities.

To be most effective, adaptation solutions could align with the agrifood priorities outlined in sourcing and supplying country NDCs and NAPs. Many governments have identified climate adaptation actions for agriculture, such as improving water efficiency, enhancing soil health, supporting climate-resilient seeds, and building farmer resilience. By aligning corporate adaptation efforts with national priorities, companies can contribute to national climate goals while safeguarding their own supply chains.

Companies can also work with suppliers and communities to find adaptation solutions. Approaches include helping farmers adopt climate-friendly practices, supporting suppliers' business continuity plans, investing in climate information systems and early warning systems, and partnering with cooperatives in their supply chains to manage risks and take action.

To translate their targets into action, companies can develop solutions that increase resilience, reduce vulnerability, and enhance adaptive capacity. Adaptation solutions can be broken down into the following three broad categories, as illustrated in Figure 10 (Brooks *et al.*, 2011; Fedele *et al.*, 2019):

- **Coping solutions:** Immediate responses to help supply chains withstand current climate variability, such as restoring irrigation systems after a drought or rebuilding supply infrastructure after an extreme weather event (Kates, Travis and Wilbanks, 2012);
- I**ncremental adaptation solutions:** Small adjustments to existing systems to improve resilience over time, such as modifying planting schedules, introducing more drought-resistant crop varieties, or adopting precision agriculture techniques (Adger and Jordan, 2009); and
- **Transformative adaptation solutions:** More fundamental shifts that enable long-term sustainability, such as changing a company's entire approach to sourcing, relocating critical supply chain assets, or investing in regenerative agriculture (Olsson, Galaz and Boonstra, 2014).

By integrating short-term coping measures with long-term transformative solutions, companies can create a climate-resilient supply chain footprint. This means making strategic investments in adaptation that not only protect supply chains but also provide benefits to farmers, suppliers, and the wider communities they depend on.

Adaptation solutions available to agrifood companies

Drawing on the IPCC AR6 recommendations, FAO has compiled a comprehensive set of adaptation solutions tailored to the agriculture sector (FAO, 2023b; IPCC *et al.*, 2022), which companies could adopt to build climate resilience within their supply chains. They include improving crop varieties and breeding practices; improving crop, livestock, and aquaculture management; converting crops, breeds, and cropping systems; improving water management; diversifying agriculture systems; and tailoring solutions to specific climate risks and needs. This subsection outlines how companies can leverage these solutions, and how different actors in the supply chain can support these efforts.

Improving crop varieties and breeding practices: This key adaptation strategy for building climate resilience in agriculture involves using both modern biotechnology and traditional breeding methods to develop crops, livestock, and aquaculture species that can better withstand climate-related stresses such as drought, heat, pests, and disease.

By investing in improved breeding techniques, companies can help ensure farmers in their supply chains have access to more resilient seed varieties and livestock breeds. Such adaptations can improve yields, quality, and resilience in the face of climate-induced shocks, ultimately securing long-term supply chain stability. For example, introducing drought-tolerant maize varieties in parts of Africa helps farmers maintain production levels despite increasing dry spells. Similarly, developing heat-resistant livestock breeds that can cope with rising temperatures ensures consistent dairy and meat production, even in hotter climates. Various stakeholders within the value chain can contribute to implementing these solutions. For example:

- **Input suppliers** can invest in research and development of climate-resilient crops, livestock breeds, and aquaculture species to develop and market drought-tolerant seeds, pest-resistant varieties, and heat-tolerant livestock breeds;
- **Buyers** can prioritize sourcing from farmers using climate-resilient varieties and provide price premiums or incentives to encourage adoption; and
- **Producers** can directly implement climate-resilient varieties and breeding practices on their own farms.

Improving crop, livestock, and aquaculture management: Enhancing the way crops, livestock, and aquaculture are managed is a crucial step in building climate resilience within agricultural supply chains. Adaptation strategies in this area focus on adjusting farming practices to cope with shifting climate conditions, such as unpredictable rainfall patterns, extreme temperatures, and changing pest and disease pressures. For crops, this could mean modifying planting schedules, adopting no-till or reduced-till farming, improving soil health, and optimizing irrigation techniques for more efficient water use. In livestock management, companies can support adaptive strategies such as adjusting stocking densities to prevent overgrazing, improving pasture management, and optimizing herd watering practices. In aquaculture, adaptation efforts can include modifying breeding cycles, managing water quality, and improving feed strategies to ensure resilience to temperature fluctuations and extreme weather events. Various stakeholders within the value chain can contribute to implementing these solutions. For example:

- **Input suppliers** can provide training and extension services on climate-smart agricultural practices, such as water-efficient irrigation, integrated pest management, and conservation agriculture, and offer tools and technologies, such as precision irrigation systems, drought-resistant seeds, and organic pest control methods, that enable farmers to adopt these practices effectively.

- **Buyers** can offer farmers technical assistance and training on climate-smart practices to help them integrate adaptation measures into their production systems, incentivizing adoption by offering preferential contracts, price premiums, or other financial mechanisms that reward suppliers for implementing sustainable practices.
- **Producers** can adopt climate-smart practices on their own farms, diversifying crops, planting climate-resilient varieties, and improving soil and water management; larger commercial farms can share knowledge and best practices with smallholder farmers in their sourcing networks to encourage widespread adoption.
- **Processors** can improve sourcing strategies to prioritize climate-resilient suppliers and invest in infrastructure that reduces climate-related losses, such as cold storage for perishable goods, improved transportation networks, and climate-proofed processing facilities.

Converting crops, breeds, and cropping systems: As climate conditions shift, converting crops, livestock breeds, and entire cropping systems is becoming a necessary adaptation strategy. Farmers and agrifood businesses need to transition toward climate-resilient species and systems that can withstand increased temperatures, changing rainfall patterns, and emerging pest and disease threats. This shift is already happening in several regions, where farmers are switching to drought-resistant grains, salt-tolerant rice varieties, and heat-resistant livestock breeds. This transformation requires collaboration across the entire supply chain, from input suppliers to buyers, producers, and processors.

- **Input suppliers** can develop and market climate-resilient seeds and livestock breeds suited for future growing conditions, and offer guidance, training, and extension services to help farmers understand how to transition to new crop varieties and livestock breeds.
- **Buyers** can facilitate market access for farmers adopting new crops and production systems, providing financial incentives, securing contracts, or offering price guarantees to reduce transition risks to encourage farmers to transition despite uncertain demand for alternative crops.
- **Producers** can embrace new cropping systems and livestock breeds that align with future climate conditions, whether switching from water-intensive crops to drought-tolerant alternatives, adopting intercropping or agroforestry, or raising breeds that are more resilient to heat stress.
- **Processors** can source from climate-resilient supply chains, invest in processing technologies suited to new crops, work with farmers to co-develop sustainable supply systems, and help establish stable markets for climate-resilient crops to ensure farmers who make the transition have viable sales channels.

Improving water management: Water scarcity and erratic rainfall patterns are major challenges for agriculture, making efficient water management a crucial adaptation strategy. Many farmers rely on rainfed systems, leaving them vulnerable to droughts, while others struggle with inefficient irrigation that wastes water. Addressing these issues requires a combination of improved irrigation techniques, better water storage solutions, and sustainable watershed management across the entire supply chain.

- **Input suppliers** can develop and market water-efficient irrigation technologies – such as drip irrigation, rainwater harvesting systems, and moisture-retaining soil treatments – and provide training and extension services to farmers on how to optimize water use and improve soil moisture retention.
- **Buyers** can invest in water infrastructure improvements in sourcing regions – such as community-based irrigation projects, watershed restoration, and improved drainage systems – and support farmers through technical assistance and financing programmes that enable the adoption of climate-smart water management practices.

- **Producers** can implement water-efficient irrigation and conservation techniques – such as precision irrigation, mulching, and cover cropping to retain soil moisture – on their farms and adopt sustainable groundwater management strategies to avoid over-extracting and depleting local water sources.
- **Processors** can reduce water consumption in processing facilities by investing in water recycling and reuse technologies, work with suppliers to implement water-saving measures across the production process, ensuring that food and beverage processing remains efficient and sustainable, and support certification programmes that promote responsible water use in supply chains.

Diversifying agriculture systems: This is a critical adaptation strategy for enhancing climate resilience, improving soil health, and reducing dependency on a single crop or commodity. Integrating multiple crops, livestock, and agroforestry practices allows farmers to spread climate risk, maintain productivity in changing conditions, and improve long-term sustainability. Various approaches – such as mixed cropping, intercropping, crop rotation, diversified field margins, agroforestry, and agroecology – help maintain biodiversity and ecosystem stability while increasing farmers' adaptive capacity.

- **Input suppliers** can develop and market a diverse range of inputs that support diversified farming systems, such as multicrop seed varieties, nitrogen-fixing cover crops, and organic soil amendments; they can also provide extension services to educate farmers on best practices for intercropping, agroforestry, and rotational farming to maximize yields while improving soil and water conservation.
- **Buyers** can source from farmers who practice diversified agriculture and create incentives – such as price premiums, preferential contracts, and certification programmes – that reward climate-smart production; they can also help farmers transition to diversified cropping systems through long-term partnerships and supply chain investments.
- **Producers** can adopt integrated farming systems, combining multiple crops, livestock, and forestry to reduce reliance on monoculture, improve soil fertility, enhance ecosystem resilience, and explore agroforestry and intercropping models to boost productivity while maintaining long-term sustainability.
- **Processors** can adapt processing facilities and supply chain logistics to accommodate diverse raw materials, enabling the sourcing of a wider range of climate-resilient crops and products; they can also develop value-added products that promote diversification – such as multicrop food blends or sustainable agroforestry-based commodities – and support sustainability certifications that encourage farmers to shift to diversified farming systems.

Tailoring solutions to specific climate risks and needs: Adapting to climate change is not a one-size-fits-all approach. Companies will need to tailor their strategies to the specific climate risks they face in their supply chains, considering both short-term vulnerabilities – such as sudden floods, droughts, or pest outbreaks – and long-term threats, such as shifting temperature patterns, soil degradation, and changing precipitation trends. To effectively manage these risks, businesses may want to consider a phased approach. This involves adopting short-term adaptation measures to focus on coping strategies that help manage immediate physical risks, such as improving irrigation efficiency, modifying planting schedules, or reinforcing supply chain logistics to mitigate extreme weather disruptions. It also calls for long-term adaptation strategies, which involve more systemic shifts, such as diversifying operations, transitioning to climate-resilient crops, investing in regenerative agriculture, and adopting innovative supply chain infrastructure that can withstand future climate variability. Table 8 provides a breakdown of climate change risks, their associated impacts, and corresponding adaptation solutions that agrifood companies can implement within their supply chains, tailoring them to specific geographic locations using the priorities outlined in NDCs, as illustrated in Figure 10.

TABLE 8. Adaptation options corresponding to climate risks and impacts

Climate change risks	Climate impacts	Coping solutions (short-term, reactive)	Incremental adaptation	Transformational measures (long-term, system-wide shifts)
Precipitation variability, temperature change, extreme weather events	Soil degradation, loss of soil fertility, reduced agricultural productivity, increased risk of desertification	Emergency soil rehabilitation (e.g. replanting vegetation, soil amendments), short-term erosion control techniques	Implementing conservation tillage and organic soil management, using precision agriculture to optimize soil nutrients	Large-scale adoption of regenerative agriculture, shifting to climate-resilient cropping systems
Increased frequency and severity of floods and storms	Infrastructure damage, crop and livestock loss, waterlogging and loss of arable land	Temporary flood barriers and drainage measures, emergency relief and recovery efforts	Building flood-resistant storage and processing facilities, strengthening supply chain logistics for extreme weather events	Redesigning entire supply chain infrastructure to account for future climate risks, relocating high-risk production areas
Changes in pest and disease distribution and prevalence	Increased pest infestations, higher prevalence of crop and livestock diseases, increased reliance on pesticides and antibiotics	Immediate pest control responses (e.g. spraying pesticides, emergency veterinary treatment)	Strengthening integrated pest management, expanding biological pest control and agroecological approaches	Investing in climate-resilient breeding for pest-resistant crop and livestock varieties, establishing ecosystem-based pest and disease prevention
Wildfires	Destruction of cropland and pastureland, loss of biodiversity and soil fertility, displacement of farming communities	Immediate fire suppression and recovery efforts, temporary relocation of livestock and farming operations	Promoting fire-resistant crops and landscape management techniques, establishing firebreaks and controlled burning practices	Large-scale adoption of agroforestry and ecosystem-based fire management, relocating vulnerable farming operations
Water scarcity	Reduced availability of water for irrigation and livestock, increased production costs due to higher water prices, crop failures and food shortages	Short-term water rationing and emergency irrigation, rainwater harvesting at farm level	Expanding water-efficient irrigation and conservation techniques (e.g. drip irrigation), investing in community-based water management programmes	Developing large-scale watershed restoration projects, integrating water resilience into national and corporate supply chain strategies
Impacts on raw material sourcing	Supply chain disruptions, price volatility of key agricultural products, market instability	Temporary diversification of suppliers to manage risk, stockpiling key raw materials	Developing long-term supplier partnerships for resilience, supporting local climate-resilient farming initiatives	Rethinking procurement strategies to favor climate-resilient commodities, building self-sufficient supply networks
Losses and damage to ecosystems	Habitat degradation, declining pollination and biodiversity loss, soil and water contamination	Immediate conservation actions (e.g. preventing deforestation in sourcing areas), short-term habitat restoration projects	Strengthening biodiversity conservation measures in agricultural landscapes, expanding pollinator-friendly farming practices	Large-scale ecosystem restoration (e.g. reforestation, wetland restoration), integrating biodiversity into supply chain policies
Impacts on distribution systems	Logistics delays and financial losses, increased spoilage of perishable goods, rising insurance costs for distribution networks	Short-term rerouting of supply chains, increased cold storage for perishable goods	Climate-proofing transportation networks, strengthening local food systems to reduce reliance on long-haul transport	Redesigning global supply chains for climate resilience, investing in climate-resilient storage and processing infrastructure

Disruptions to farmers and labour force	Increased migration due to climate-related shocks, loss of skilled agricultural labour, rising production costs	Emergency financial aid and relief programmes, short-term subsidies for affected workers	Building adaptive capacity through farmer training and support programmes, strengthening social protection systems for rural communities	Investing in new rural economic models to reduce climate vulnerability, strengthening regional labour mobility programmes
Altered growing conditions and seasons	Shortened or unpredictable growing seasons, yield variability and reduced food security, loss of traditional knowledge	Adjusting planting schedules based on short-term climate forecasts, short-term crop substitution	Strengthening climate information services and seasonal forecasting tools, expanding research on climate-resilient cropping systems	Establishing long-term agricultural innovation hubs for climate adaptation, supporting policy shifts toward adaptive agricultural planning
Loss of productive land	Soil erosion and desertification, declining land availability for cultivation	Immediate erosion control measures (e.g. planting cover crops, terracing), short-term land rehabilitation	Implementing large-scale soil conservation programmes, expanding agroecological and regenerative farming practices	Land restoration on degraded farmland, implementing climate-smart land tenure policies

Sources: **Oxfam.** 2012. PHYSICAL RISKS FROM CLIMATE CHANGE. A guide for companies and investors on disclosure and management of climate impacts. https://s3.amazonaws.com/oxfam-us/www/static/media/files/physical-risks-from-climate-change.pdf; **FAO.** 2023b. Climate change impacts and adaptation options in the agrifood system. [Cited 20 December 2023]. https://www.fao.org/3/cc5921en/cc5921en.pdf

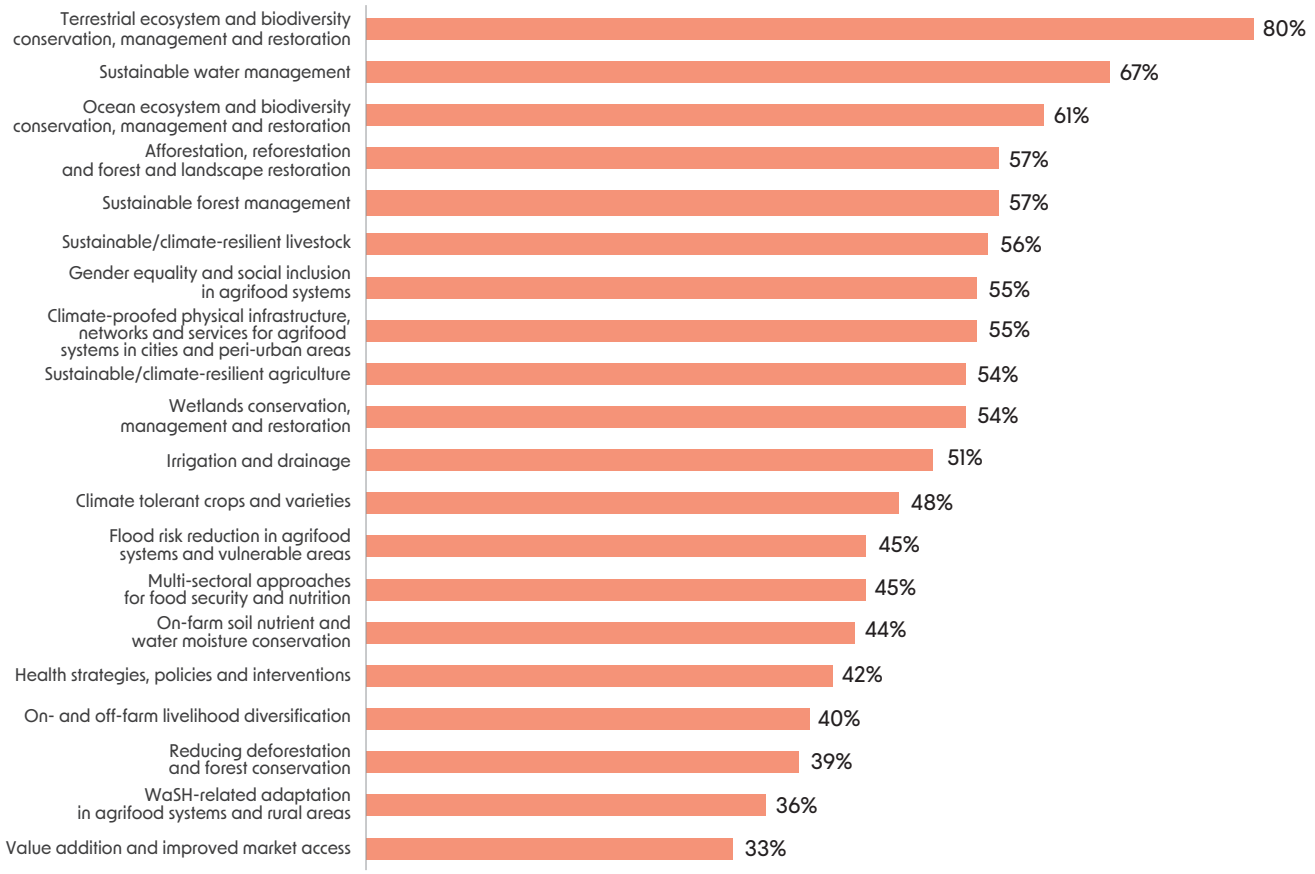
Aligning business adaptation efforts with national climate priorities: For agrifood companies looking to make meaningful and lasting progress on climate adaptation, aligning with national climate plans is essential. Countries have already laid out their climate risks and priority actions in their NDCs and NAPs. By ensuring that their adaptation investments support these frameworks, businesses can avoid working in isolation, amplify their impact, and help advance national climate goals, all while reducing risks to their supply chains.

Having mapped out national climate policies in sourcing regions to understand how governments are approaching climate adaptation in agriculture and created an inventory of climate entry points, the next step is to align adaptations solutions with those entry points, the hot spots, and climate risks in the company's supply chain. Many countries have already set clear priorities, and businesses can align their supply chain strategies to support and scale up these efforts. Some of the most common government-led adaptation actions include: enhancing water management systems to mitigate droughts and flood risks; promoting climate-resilient crop varieties and regenerative farming techniques; strengthening farmer resilience through training, financial incentives, and risk insurance; and improving soil health and biodiversity conservation in key agricultural landscapes.

Tying business adaptation strategies to national priorities creates shared benefits. As governments seek private sector collaboration to scale up adaptation efforts, aligning with national frameworks can also enhance a company's credibility, help it access policy incentives, and position it as a key player in climate action.

To align their strategies with climate entry points, companies can identify specific adaptation actions in their high-risk sourcing regions. Figure 10 provides a global overview of how NDCs are prioritizing agricultural adaptation, but businesses can refine this further with their tailored policy maps and action lists to focus on the most relevant, high-impact measures.

FIGURE 10. Top 20 adaptation solutions in agrifood systems as specified in NDC documents



Source: **Crumpler, K., Wybieralska, A., Roffredi, L., Tanganelli, E., Angioni, C., Prosperi, P., Umulisa, V., Dahlet, G., Nelson, S., Rai, N., Schiettecatte, L.S., Salvatore, M., Wolf, J. & Bernoux, M.** 2025 (Forthcoming). *Agrifood systems in nationally determined contributions: Global analysis*. Rome, FAO.

Turning climate adaptation into business opportunities

In addition to managing climate risks, climate adaptation is also about tapping into new business opportunities. As countries outline their adaptation priorities through NDCs, companies have the potential to align their strategies with these priorities, while expanding market opportunities. Developing drought-resistant seeds, improving water management, and deploying precision agriculture are some examples of key areas where businesses can provide climate solutions in response to the agrifood priorities of countries. Below are a few examples on how agrifood companies can turn climate priorities into business opportunities, drawing upon examples of interventions companies are starting to take.

Resilient seeds and crops. Developing and distributing seeds that can withstand drought, floods, and other climate-related stresses is essential for ensuring food security in a changing climate. Several companies are already taking steps in this direction, investing in climate-smart seed varieties. One European company, interviewed as part of this guidance, is developing short-stature corn hybrids that are more resistant to strong winds and offer higher yields. These hybrids can help farmers adapt to shifting weather patterns and improve overall productivity. Another agricultural company focuses on utilizing local resources and selecting resilient crop varieties, producing and selling only organic seeds to support sustainable farming. A potato breeding company has developed robust potato varieties that are water-efficient and capable of producing a high marketable yield across various soil types

and climates. In the forage and grain sector, a seed company has introduced a wide portfolio of sorghum varieties featuring IGROWTH technology, which enhances tolerance to herbicides while maintaining high productivity.

Precision agriculture: Precision agriculture uses technologies like sensors, drones, and data analytics to optimize resource use and improve crop yields in changing climate conditions. Some companies are investing in this space. One company is using an accelerated trait discovery and plant breeding platform to develop climate-resilient crops, such as Robusta coffee with reduced bitterness. Another is applying AI-enabled trait discovery to create salt-tolerant and heat-tolerant wheat. A Swiss-based company provides drones equipped with hyperspectral cameras to monitor crop health and improve soil treatment, supporting more efficient and sustainable farming practices.

Smart irrigation and water-saving technologies: With water scarcity a growing climate challenge for agricultural production, some companies are investing in climate-smart irrigation technologies that enhance water efficiency and support sustainable farming practices. A European irrigation technology company has expanded its portfolio to include automated irrigation systems, which optimize water use by analysing soil moisture and weather conditions. It has also developed rainwater harvesting technologies to reduce dependence on freshwater sources and introduced carbon credit-linked irrigation systems, enabling farmers to access financial incentives for adopting sustainable water management practices. Several other companies are also advancing precision irrigation solutions – for example, designing wireless precision irrigation automation systems and incorporating sensors and cloud-based platforms to improve efficiency; and real-time monitoring to help farmers adjust irrigation schedules based on soil moisture levels, temperature, and crop needs.

Providing **early warning systems and climate information services** is essential to help farmers adapt to changing weather patterns. This includes offering timely and accurate weather forecasts and climate information to support crucial decision-making related to planting, irrigation, and harvesting. Developing user-friendly mobile applications and digital platforms can be effective tools for disseminating this information and providing tailored agricultural advice. These systems can also provide information on pest and disease outbreaks linked to climate change.

These examples highlight how agribusinesses are investing in such products and services; however, they remain individual cases, and further scaling of such examples will be necessary to drive broader impact across global food systems.

Substep 2.4: Strengthen supplier engagement

To drive meaningful climate action across supply chains, companies need to establish effective mechanisms for engagement and collaboration. This means integrating sustainability into procurement policies, incentivizing sustainable practices, and working closely with suppliers to improve adaptive capacity across the value chain (SBTi, 2018). This section outlines how companies can leverage these solutions.

Implementing business models for sustainable practices: To build sustainable business models within their supply chains, companies could incorporate a cost for unsustainable practices or provide an incentive for improved practices. Assigning a monetary or internal price to land degradation or unsustainable resource use can create strong financial incentives for suppliers to adopt climate-friendly approaches.

Engaging suppliers for climate action: Companies can take a structured approach to engage suppliers in meaningful climate action by:

- **Identifying high-risk suppliers,** pinpointing those that are particularly vulnerable to climate change;
- **Defining engagement approaches,** which can be:
  - **compliance-based,** by requiring suppliers to meet sustainability standards (e.g. emissions reduction targets or deforestation-free sourcing), contractual requirements, etc.
  - **supportive,** by providing financial support or incentives, resources, information, or training to help suppliers comply with agreements and transition toward climate-smart practices (e.g. providing training to set targets, technical guidance, facilitating knowledge sharing between two suppliers, or offering third-party support software support); and
- **Creating cascading expectations**, by encouraging direct suppliers to extend climate requirements down their own supply chains to amplify climate action beyond Tier 1 suppliers.

A company could choose an approach that aligns with its influence and supply chain structure. High-revenue companies that have influence over their direct suppliers can adopt more compliance-based approaches than others.

Aligning procurement policies with climate goals: To ensure their procurement policies drive sustainability, companies can integrate climate-smart principles into purchasing decisions by:

- **Sourcing from suppliers with lower carbon footprints:** Even when supplier choices are limited, companies can work with existing suppliers to reduce emissions and improve resilience.
- **Transitioning to low-carbon and resilient alternatives:** Encouraging suppliers to adopt more sustainable raw materials or production methods can significantly lower climate risks; and
- **Prioritizing partnerships with climate-conscious suppliers:** Developing long-term contracts and incentives for suppliers who actively engage in climate adaptation and mitigation fosters mutual benefits.

Approaches agrifood companies are taking to implement adaptation in their supply chains

A handful of agrifood companies are beginning to experiment with climate adaptation solutions to increase supply chain resilience. These efforts range from water conservation initiatives to farmer support programmes and regenerative agriculture projects. These are innovative approaches, but their long-term impact remains uncertain, and they are largely one-off initiatives rather than industry-wide transformations. However, they offer inspiration for other businesses looking to integrate adaptation into their supply chains.

➔ **EXAMPLE: Water management adaptation solution**

A global confectionery company operating in water-scarce regions has taken steps to improve water conservation and efficiency in its production processes, implementing a water-saving project at one of its manufacturing plants in India. This has reduced consumption by 7 percent, even as production volumes have increased. This initiative highlights how businesses can cut water use without compromising productivity, setting an example for other companies operating in high water-risk areas. But while a 7 percent reduction is a step in the right direction, it remains unclear if similar water-saving practices have been extended across other facilities and supply chain partners.

➔ **EXAMPLE: Adaptation solutions to strengthen farmer resilience**

A major coffee supplier is working with farmers' organizations and supply chain actors to assess climate vulnerabilities and develop adaptation strategies. The company has partnered with 7 000 farmers to identify climate risks and implement climate-resilient farming practices. As shifting climate conditions have made traditional coffee crops unviable, the company has supported farmers to introduce alternative crops that are better suited to changing climatic conditions. This example demonstrates how direct farmer engagement to stabilize supply chains can seek to enable producers to adapt to climate pressures. However, the extent to which these efforts are scaled up to secure long-term resilience remains uncertain, and further evidence is needed to show full impact.

➔ **EXAMPLE: Supporting farmers in climate adaptation**

A leading cereal manufacturer has supported smallholder farmers and agricultural workers since 2010 to help them boost productivity, reduce post-harvest losses, and enhance economic resilience. The company has aligned its climate resilience initiatives with Argentina's national adaptation priorities to support farmers adopt sustainable land management practices and increase grain production. This initiative highlights how companies can work in alignment with national climate policies, leveraging government strategies to improve food security and farmer livelihoods. However, while these efforts show promise, the true test of impact lies in whether farmers can maintain productivity over the long term without external support; further evidence is needed to assess impact.

By learning from these adaptation initiatives, agrifood companies can develop their own tailored climate resilience strategies, ensuring their supply chains are robust, sustainable, and aligned with global climate goals. Table 9 summarizes some of the guidance available for companies.

TABLE 9. Additional sources for guidance on adaptation solutions and supplier engagement

Resource	Description	Link
Agrifood Systems in Nationally Determined Contributions: Global Analysis – Key Findings	Organized around the core NDC components, this report presents entry points for integrating agrifood systems, including a portfolio of climate solutions across all components and subsectors of agrifood systems that can be adapted to national contexts and priorities.	https://doi.org/10.4060/cd3210en
Value Chain Climate Resilience: A Guide to Managing Climate Impacts in Companies and Communities	This guide provides insights into managing climate impacts in companies and communities and building resilience along the value chain.	https://s3.amazonaws.com/oxfam-us/static/oa4/valuechainclimateresilience.pdf
CSA Smart Metric Guide	Aiming to promote the adoption of CSA as a critical solution for transforming food systems and addressing climate change, the smarter metric guide provides detailed advice for setting CSA targets.	https://www.wbcsd.org/resources/smarter-metrics-for-climate-change-and-agriculture/
FAO climate technologies paper	The report highlights the needs for robust technology assessments to underpin climate technology identification for agrifood systems transformation that addresses all stages of agrifood value chains.	https://doi.org/10.4060/cd2877en
FAO adaptation solutions paper	This paper details adaptation solutions tailored for the agricultural sector, helping companies integrate adaptation measures into supply chains.	https://doi.org/10.4060/cc9070en

Science Based Targets initiative (SBTi) guidance	SBTi provides valuable guidance on setting science-based targets and establishing supplier engagement practices to address emissions across the value chain.	https://sciencebasedtargets.org
Supplier Action Guide (Exponential Roadmap Initiative)	This guide provides instructions on how companies can halve emissions in their supply chain by working with their suppliers.	https://exponentialroadmap.org/supplier-action-guide/

Source: Authors' own elaboration.

In essence, driving adaptation within global agrifood supply chains requires a multi-pronged strategy. Companies can actively map vulnerabilities, pinpoint critical risk zones, and set measurable targets that directly address climate impacts. They can align these targets with national climate agendas, as outlined in NDCs and NAPs, to ensure cohesive action. Further, businesses must develop and deploy targeted solutions. This includes implementing adaptive measures, from incremental adjustments to transformative system-wide shifts, tailored to specific climate risks. Companies could also seize emerging market opportunities within climate-resilient sectors.

To achieve meaningful change, businesses will benefit from engaging suppliers proactively. They need to integrate sustainability into procurement, incentivize climate-smart practices, and enable collaborative partnerships. By aligning corporate strategies with national climate objectives, companies can amplify their impact.

Step 3. Reduce supply chain GHG emissions through targeted mitigation actions

This step provides guidance on reducing GHG emissions within supply chains. It covers ways for assessing emissions risks, identifying high-emission hot spots, and setting measurable reduction targets across all scopes. The section also discusses strategies for collaborating with stakeholders to develop and implement effective mitigation actions that drive progress toward decarbonization in developing countries.

Reducing GHG emissions across supply chains (Table 10) is a crucial step for agrifood companies in meeting their climate commitments and supporting global decarbonization efforts. The agrifood sector is a significant contributor to emissions, with key sources including land-use change, agricultural production, processing, transportation, and packaging. To align with NDC and corporate net zero goals, companies should attempt to assess, reduce, and monitor their supply chain emissions at every stage. By implementing targeted mitigation strategies – such as shifting to low-carbon inputs, improving energy efficiency, promoting regenerative agriculture, and transitioning to renewable energy sources – agrifood businesses can drive measurable reductions in their carbon footprint. This section outlines key steps for companies to assess, set targets, and implement effective mitigation.

TABLE 10. Reducing supply chain GHG emissions through targeted mitigation actions: who, how, and what?

Who should undertake this step?	Sustainability teams, procurement teams, supply chain managers, and executives responsible for climate risk management. Collaboration with suppliers, farmers, and local stakeholders is also essential.
What are the substeps?	1. Assessing GHG emissions and identifying hot spots by mapping the supply chain to identify emission sources at each stage, from raw materials to final retail distribution, conducting scope 1, 2, and 3 emissions assessments aligned with international standards – including GHG Protocol, SBTi and forestry, land use, and agriculture (FLAG) guidance – identifying major GHG hot spots, focusing on high-impact sourcing and supplying countries and commodities (e.g. livestock, rice, palm oil), and aligning supply chain assessments with sourcing country NDC priorities; 2. Setting mitigation targets by developing science-based reduction targets, particularly for scope 3 emissions, setting commodity-specific and regional reduction goals, ensuring alignment with sourcing country NDC, and engaging suppliers in target-setting through existing supplier initiatives; and 3. Developing and implementing mitigation solutions by deploying climate-smart practices, such as carbon sequestration techniques, promoting low-carbon alternatives in input supply, production, and processing, introducing deforestation-free supply chain policies for key commodities (e.g. cocoa, palm oil, soy), reducing methane and nitrous oxide emissions through sustainable livestock management, optimized manure handling, and targeted feed solutions, transitioning supply chain operations toward renewable energy, and reducing food loss and waste through process optimization and circular economy models.
What is the final output?	A structured mitigation strategy that identifies supply chain GHG hot spots, establishes ambitious and measurable targets for scope 1, 2, and 3 emissions, implements sector-specific mitigation actions, aligned with the agrifood sector and supplier country climate priorities, tracks progress transparently through international reporting frameworks, and ensures supply chain resilience and decarbonization, aligning corporate action with NDCs.

Source: Authors' own elaboration.

Substep 3.1: Assess GHG emissions in supply chains and identify hot spots

By implementing targeted mitigation strategies – such as shifting to low-carbon inputs, avoiding conversion of natural lands, improving energy efficiency, promoting regenerative agriculture, and transitioning to renewable energy sources – agrifood businesses can drive measurable reductions in their carbon footprint. This section outlines key steps for companies to assess, set targets, and implement effective mitigation measures, ensuring climate action throughout their supply chains.

Map the supply chain: Mapping the supply chain is a crucial first step in understanding and addressing GHG emissions. Before implementing mitigation strategies, companies need a clear picture of where emissions occur across their supply networks. By identifying high-emissions hot spots, businesses can prioritize mitigation efforts where they will have the most impact. Companies should outline their entire supply chain, breaking it down into raw material production, processing, conservation, transportation, packaging, distribution, retail, disposal and waste, as each stage has distinct emission sources that contribute to the overall emission footprint.

Assess GHG emission sources in supply chains: Companies need comprehensive and transparent disclosure of their emissions, covering scope 1 (direct emissions), scope 2 (indirect emissions from purchased energy), and scope 3 (indirect emissions across the value chain). Assessing GHG emissions across the supply chain is a crucial step in developing effective climate action strategies, particularly for agrifood companies that source from developing countries, where the majority of scope 3 emissions originate. These countries often have explicit references to agricultural emissions assessments and targets in their NDCs.

To build a credible and effective emissions reduction strategy, agrifood companies need to: identify key emission sources across the value chain, with a focus on high-impact sourcing regions; map historical and projected emissions in alignment with sourcing country NDC GHG emissions assessments; align their reporting with international frameworks such as the GHG Protocol;[5] and engage suppliers to collect emissions data and identify mitigation opportunity.

Just as companies assess climate-related risks in their supply chains, evaluating GHG emission sources allows them to prioritize sourcing countries, commodities, and supply chain segments. Identifying major GHG hot spots and areas with high reduction potential provides a strategic roadmap for collaboration with suppliers, where mitigation efforts can have the greatest impact (Exponential Roadmap, 2022). For example, agrifood companies that source rice or dairy – which have high methane emissions – must assess regional variations in emissions intensity and work with suppliers to implement targeted interventions, such as methane-reducing feed additives for livestock or alternate wetting and drying methods in rice cultivation.

Many agrifood companies seek validation for their climate targets through the SBTi, which sets sector- guidance on scope 3 emission reductions. According to the SBTi, companies with scope 3 emissions accounting for 40 percent or more of their total emissions are required to set scope 3 reduction targets. SBTi requires companies to cover at least 67 percent of their FLAG-related scope 3 emissions, submitting detailed data on their agricultural emissions, categorized by crop type and geographic sourcing region (Anderson *et al.*, 2022). The key components of an SBTi-validated forestry, land use and agriculture (FLAG) target submission are:

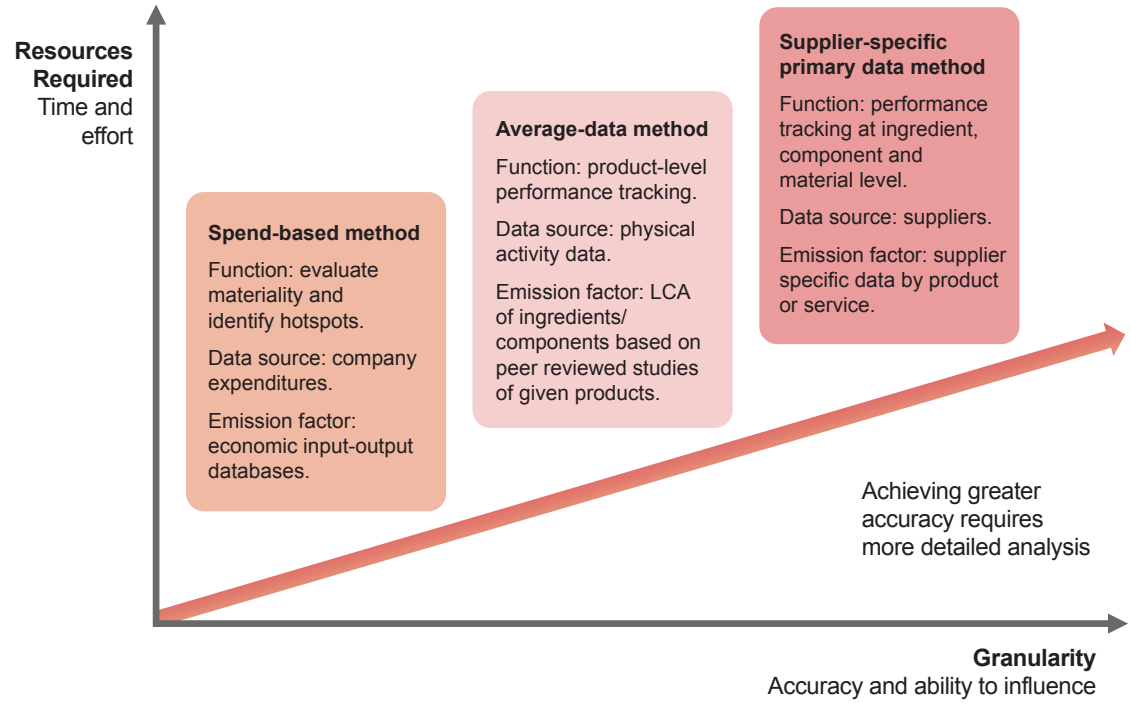
- **Developing an emissions inventory:** Identifying and quantifying emissions associated with land-use change, soil carbon, fertilizer application, and livestock and rice production;
- **Tracking emissions at a commodity level:** Reporting carbon dioxide emissions from land-use change, other emissions from soil and livestock management, and extraction-related emissions; and
- **Aligning emission reductions with climate science:** Companies must demonstrate that their reduction commitments align with a 1.5 °C pathway.

Collect scope 3 emissions data across the supply chain: Developing a scope 3 emissions inventory is critical for quantifying emissions from suppliers and tracking reductions. The process typically involves conducting a scope 3 screening to identify the most relevant source categories within the value chain, prioritizing high-impact emission sources and gathering primary data from suppliers where possible, and applying emission calculation methodologies (refer to Figure 11), such as:

- **Expenditure/spend-based method:** Uses financial spend data and industry-average emission factors;
- **Average data method:** Uses primary activity data combined with secondary emission factors for more refined estimates; and
- **Supplier-specific data method:** Involves direct supplier engagement to obtain product-level emissions data.

[5] The GHG Protocol Agricultural Guidance offers detailed methodologies for agrifood companies to track and report their emissions.

FIGURE 11. Methods to account for upstream scope 3 emissions



Source: Adapted from: **GHG protocol.** 2013. Technical Guidance for Calculating scope 3 Emissions. [Cited 16 December 2023]. https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf

Agrifood companies often rely on a mix of calculation methods when estimating scope 3 emissions, applying precise, supplier-specific calculations for major emission sources while using industry averages or model-based estimates for less significant contributors. This hybrid approach is particularly useful in complex, fragmented agricultural supply chains, where data availability varies across regions and production systems. However, inconsistencies in primary data collection, along with challenges related to smallholder farming and varied production practices, often lead companies to rely on modeled estimates rather than direct supplier data (OECD-WEF, 2023)

A key challenge in measuring scope 3 emissions is ensuring supplier participation in emissions tracking. Some companies propose using supplier-reported, product-level carbon footprint data to estimate total supply chain emissions. This involves multiplying the product carbon footprints provided by suppliers by the volume of products purchased (Pact, 2022). But without structured incentives, suppliers – especially in low- and middle-income sourcing countries – may lack motivation, capacity, or financial resources to invest in emissions measurement and reduction.

To address this, some companies are starting to incentivize suppliers to disclose and reduce emissions by embedding climate criteria into procurement policies and offering financial benefits for transparency and action.

➔ **EXAMPLE: How a multinational retailer is encouraging suppliers to disclose and reduce emissions**

One effective way some companies are tackling this challenge is through supplier incentive programmes, which reward suppliers for climate-conscious practices and emissions transparency. One multinational retailer has partnered with a financial institution to launch a preferential payment programme for suppliers that disclose their carbon emissions and commit to reductions. Under this programme, suppliers are classified into three tiers, each linked to increasing financial benefits: bronze or entry-level, which requires basic carbon footprint reporting; silver, which requires partial emissions disclosures and demonstrate commitments to reduction initiatives; and gold, which requires comprehensive emissions reporting and alignment with a 1.5 °C reduction pathway, ensuring long-term decarbonization. Suppliers with gold-tier status gain access to lower financing costs and preferential green loans, creating direct financial incentives for emissions transparency and reduction efforts.

This tiered approach not only seeks to encourage participation from a broad range of suppliers; it also aims to ensure continuous improvement, allowing companies to scale up emissions-tracking and reduction efforts across their supply chains. By linking climate disclosure with financial benefits, companies can aim to accelerate the adoption of climate-smart practices among suppliers, particularly in developing countries where scope 3 emissions are concentrated.

By embedding financial and procurement-based incentives into supplier engagement strategies, agrifood companies can achieve more consistent emissions reporting while supporting their global climate targets and national NDC commitments.

Identify GHG emissions hot spots and climate priorities in supply chains: Agrifood companies should prioritize decarbonization efforts by identifying high-emissions hot spots, evaluating GHG-intensive products, and considering country-specific climate policies and commitments, such as those specified in NDCs. This enables companies to target mitigation actions where they have the greatest potential impact. A hot spot analysis allows companies to pinpoint emissions-intensive areas within their supply chains. This can include:

- **GHG-intensive commodities and product categories:** Assessing emissions from different agricultural products to determine the largest contributors to the company's carbon footprint;
- **Geographical regions of high emissions:** Identifying supply chain locations where production, transportation, and processing generate the highest levels of emissions;
- **Supply chain activities with the highest footprint:** Evaluating emissions at various stages, from raw material extraction and farming to distribution and retail;
- **Policy and regulatory risks:** Considering future climate regulations, carbon pricing mechanisms, and fiscal measures that may impact emission-intensive supply chain segments.

Most agrifood supply chains operate across multiple countries, many of which have climate policies and national commitments that influence corporate mitigation strategies. Companies should align their GHG reduction priorities with sourcing country NDCs, particularly where agriculture is a key focus for national GHG mitigation. Some countries include sector-specific GHG reduction targets, such as livestock methane reduction or deforestation prevention.

By pinpointing GHG hot spots, companies can develop targeted reduction strategies, such as:

- Reducing emissions from high-impact agricultural commodities, particularly livestock, meat and dairy, rice and cereals;
- Optimizing logistics and transport networks to minimize fuel-related emissions;
- Working with suppliers to implement low emission practices in sourcing regions; and
- Aligning procurement policies with low-emissions products and alternative ingredients.

This structured approach enables agrifood companies to reduce their overall carbon footprint, ensure supply chain resilience, and stay ahead of evolving climate policies while making meaningful contributions to global climate goals.

➔ **EXAMPLE: How a multinational retailer identified GHG hot spots in its supply chain**

A global retailer recognized that over 90 percent of its total carbon footprint originated from indirect scope 3 emissions – mainly from its upstream and downstream supply chains. Using the GHG Protocol methodology, the company mapped emissions based on 2019 supplier and farm data. The analysis revealed several key emission hot spots:

- Upstream supply chain emissions (50 percent), with 30 percent coming from agricultural production, particularly livestock, cereals; and 20 percent linked to manufacturing, packaging, and fuel consumption; and
- Downstream emissions (40 percent), with customer product usage, particularly high-emission food products, contributed to the overall footprint.

By using footprint analysis and scenario modeling, the company assessed the financial and regulatory implications of mitigation strategies. Exploring potential taxation and regulatory measures on livestock production under a 2 °C climate scenario, the study found that beef has the highest financial impact due to its carbon intensity, followed by milk and chicken, due to their sourcing volumes.

TABLE 11. Useful GHG Protocol resources for assessing GHG emissions

Resource	Description	Link
FAO Statistics on GHG emissions	The FAOSTAT emissions database is composed of several data domains covering the GHG emissions from agrifood systems. Data are available by country, regional and global aggregates over the period 1961–2023.	• FAOSTAT Emissions totals • FAOSTAT Emissions shares
Corporate Value Chain (scope 3) Accounting and Reporting Standard	Provides a framework for companies to identify which part of their value chains they should target to reduce emissions	https://ghgprotocol.org/standards/scope-3-standard
Agricultural Guidance	A supplement to the GHG Protocol Corporate Standard covering all agricultural subsectors, including livestock, crop production, and land-use change.	https://ghgprotocol.org/agriculture-guidance
Scope 3 Evaluator Tool	Previously a web-based screening tool to facilitate scope 3 reporting by offering a rapid and approximate assessment of a company's GHG emissions, now integrated into the corporate value chain (scope 3) standard online course.	https://ghgprotocol.org/corporate-value-chain-scope-3-standard-online-course-0
Technical Guidance for Calculating scope 3 Emissions	A deep-dive supplement to the Corporate Value Chain (scope 3) Accounting and Reporting Standard, providing technical guidance on scope 3 emissions calculations.	https://ghgprotocol.org/scope-3-calculation-guidance-2

Source: Authors' own elaboration.

Substep 3.2: Develop mitigation targets for supply chains

According to the World Benchmark Alliance's 2023 analysis of 350 agrifood companies (WBA, 2023), only 46 companies have set GHG reduction targets that are aligned with the 1.5 °C target for scope 1 and 2 emissions (direct emissions from company-owned operations and purchased electricity). More notably, only 13 companies have extended their commitments to scope 3 emissions (indirect emissions from their supply chains). This marks a modest improvement from just seven companies in 2021, reflecting some – albeit slow – recognition of the importance of tackling supply chain emissions.

However, 165 companies – nearly half of those analysed – have not made any formal commitment to science-based emission targets, highlighting a significant gap in corporate climate action. Many of these companies operate in sectors where agricultural sourcing is a major driver of emissions, reinforcing the urgent need for broader industry engagement.

Setting clear and ambitious GHG emission reduction targets is a crucial next step for a company on a road to decarbonization, and the SBTi is working closely with businesses and experts to establish methodologies tailored to the agriculture sector. These targets should align with the climate priorities identified in Step 2 and focus on measurable, science-based goals that drive real impact across supply chains.

To set science-based targets, companies must first define a base year – a past calendar or financial year from which progress will be tracked. This should be no earlier than 2015 to ensure data reflects recent trends. Next, they need to set a target year, which should be a minimum of five and maximum of ten years from the date of submission to SBTi for validation.

To ensure credibility, companies need to select the appropriate level of ambition for scope 1 and 2 emissions. Targets must align with limiting global warming to 1.5 °C above pre-industrial levels, using either *absolute reduction targets* (reducing total emissions by a set percentage) or *intensity-based targets* (sector-specific intensity reductions based on production units).

For scope 2 emissions (electricity use), companies must procure at least 80 percent renewable electricity by 2025 and 100 percent by 2030 to be aligned with best practice.

Since scope 3 emissions (supply chain) often account for the majority of a company's total emissions, a **scope 3 screening** is necessary to identify major emission hot spots. The GHG Protocol Corporate Value Chain (scope 3) Standard provides a framework to assess emissions from different sources. Scope 3 targets can be *intensity-based targets* (reducing emissions per unit of economic output) or engagement targets (requiring a percentage of suppliers or customers to set their own science-based targets).

Once targets are set, companies must track progress, disclose results, and continuously refine their strategies.

Approaches companies are taking to set scope 3 targets in the food and beverage industry

Among the 13 companies with scope 3 targets analysed by the aforementioned World Benchmark analysis, eight are food and beverage manufacturers and processors. They tend to focus on emissions-intensive raw materials, such as dairy, livestock, and commodity crops, which are among the largest contributors to agricultural GHG emissions. While food processors and manufacturers are making some progress, input suppliers – companies that provide seeds, fertilizers, equipment, and so on – have yet to commit to scope 3 emissions targets. This is

a critical oversight because fertilizer production and application are some of the largest sources of nitrous oxide emissions, a potent GHG. Encouraging upstream suppliers to set targets could significantly improve overall supply chain decarbonization.

➔ **EXAMPLE:** One dairy company has taken a structured approach to supply chain decarbonization, setting a 63 percent reduction target for its scope 1 and 2 emissions by 2030, compared to a 2015 baseline. Recognizing that the majority of its emissions come from farming and feed production, it also set a scope 3 target to cut emissions per tonne of standardized raw milk and whey by 30 percent by 2030. This is significant because livestock production is a major source of methane emissions, and shifting to more sustainable feed and manure management practices can help reduce its carbon footprint.

➔ **EXAMPLE:** A major global food company has adopted a commodity-specific approach to setting supply chain targets, committing to achieve net zero emissions by 2050 with short- and medium-term targets to track progress. These include:

- 25 percent emissions reduction by 2025;
- Sourcing 20 percent of key ingredients from regenerative agricultural systems by 2025;
- 50 percent emissions reduction by 2030; and
- Ensuring 50 percent of key ingredients come from regenerative agriculture by 2030.

To address its biggest emissions hot spots, the company is targeting the dairy and livestock sectors – which alone are projected to contribute 50.6 $MtCO_2e$ emissions by 2030 – setting a goal of reducing these emissions to 29.3 $MtCO_2e$ by that time. Similarly, it aims to reduce emissions from land-use change, soil health, and deforestation – which were projected to reach 37 $MtCO_2e$ by 2018 – to 14 $MtCO_2e$ by 2030.

➔ **EXAMPLE: Companies working with suppliers to set emission targets**

Since most agrifood companies rely on third-party suppliers for their raw materials, many businesses are working to ensure their suppliers set their own science-based targets. One effective way to do this is through supplier engagement programmes that provide training, resources, and financial incentives.

A group of 20+ major agrifood companies launched S-LoCT in 2021. Originally founded by a few leading brands, this initiative equips suppliers with the knowledge and tools they need to measure emissions, set targets, and implement climate action plans. Through S-LoCT, participating suppliers gain:

- Training on setting science-based targets;
- Mentorship on emission reduction strategies;
- Resources for integrating climate-smart practices into their operations; and
- Support in aligning with national climate targets and NDC priorities of sourcing countries.

By empowering suppliers to establish their own targets, large agrifood companies are ensuring that scope 3 emissions reductions are scaled across their entire supply chain. Some companies have gone a step further, making supplier emissions reporting a contractual requirement. One multinational cereal brand has set a target for 75 percent of its Tier 1 suppliers to report carbon activities annually through the CDP Supply Chain Program. This ensures greater data transparency on emissions hot spots, more informed decision-making on reduction strategies, and incentives for suppliers to adopt low-carbon practices.

TABLE 12. Tools for setting GHG emission reduction targets

Resource	Description	Link
SBTi Getting Started Guide	This guide provides a step-by-step approach to help companies set near-term and net zero science-based targets that are aligned with SBTi criteria; it covers organizational readiness, target-setting steps, and key criteria for both near-term and long-term targets.	https://sciencebasedtargets.org/resources/files/Getting-Started-Guide.pdf
SBTi Net Zero Standard Criteria	This document outlines the specific criteria and recommendations for companies aiming to set net zero targets in line with climate science; it details requirements for target boundaries, timeframes, method eligibility, and minimum ambition levels.	https://sciencebasedtargets.org/resources/files/Net-Zero-Standard-Criteria.pdf
SBTi Forest, Land and Agriculture (FLAG) Guidance	Tailored for land-intensive sectors, this guidance helps companies set science-based targets that include land-based emissions reductions and removals; it addresses unique challenges in the agriculture and forestry sectors	https://sciencebasedtargets.org/sectors/forest-land-and-agriculture

Source: Authors'own elaboration, based on: **SBTI.** 2024a. *Getting started guide for science-based target setting. Version 1.1*. https://files.sciencebasedtargets.org/production/files/Getting-Started-Guide.pdf; **SBTI.** 2024. *Corporate Net-Zero Standard criteria V1.2*. https://files.sciencebasedtargets.org/production/files/Net-Zero-Standard-Criteria.pdf.**SBTI.** 2024b. *Procedure for Validation of SBTi Targets*. https://docs.sbtiservices.com/resources/ProcedureforValidationofTargets.pdf; **Anderson, C., Bicalho, T., Wallace, E., Letts, T. & Stevensen, M.** 2022. *Forest, land and agriculture science based target setting guidance*. https://sciencebasedtargets.org/resources/files/SBTiFLAGGuidance.pdf

The progress made by this handful of agrifood companies demonstrates that setting scope 3 targets is possible and effective – but much more needs to be done. Companies should bear the following in mind:

- GHG reduction targets must be specific, measurable, and time-bound (e.g. X percent reduction by 2030 compared to reference);
- Commodity-specific targets are key, as emissions vary widely by agricultural product and value chain;
- Engaging suppliers is essential, since scope 3 emissions dominate most agrifood value chains.

As regulatory pressure increases and investors demand greater corporate accountability, companies that proactively set – and achieve – science-based climate targets will be far better positioned for a sustainable and resilient future. Several resources are available to guide companies through the target-setting process, as illustrated in Table 12.

Substep 3.3: Develop solutions to mitigate GHG emissions in supply chains

Mitigating emissions in agrifood supply chains is crucial for achieving corporate climate targets and aligning with global and national climate commitments, including those outlined in key sourcing countries' NDCs. Companies must take a structured approach to reducing emissions by focusing on high-impact mitigation solutions, particularly in sectors where agriculture plays a major role in terms of contribution to land use-change, methane production, and ecosystem degradation.

The IPCC has identified several science-backed solutions to reduce emissions in agrifood supply chains-related sources, many of which align with NDC priorities (IPCC *et al.*, 2022). This subsection outlines mitigation strategies that are key areas where agrifood companies can take action, and how different actors in the supply chain can support these efforts. It also summarizes the efforts of some agrifood sector companies that are integrating mitigation strategies into their supply chains, aligning their actions with both corporate sustainability goals and national climate priorities.

Carbon sequestration to enhance soil health: Soil is a major carbon sink, and improving soil health through carbon sequestration can reduce emissions, improve food production, and enhance climate resilience. Sustainable agricultural practices such as regenerative farming, agroforestry, and cover cropping help capture carbon while increasing soil fertility.

- **Producers** can shift toward sustainable practices, such as reduced tillage, composting, and organic fertilizers.
- **Input suppliers** can develop and distribute bio-based soil amendments that enhance soil organic matter.
- **Buyers** can provide financial incentives for suppliers adopting carbon sequestration techniques.

Reducing methane and nitrous oxide emissions: Agriculture is a leading source of methane emissions, particularly from livestock and rice, and nitrous oxide emissions, primarily from fertilizers. By improving livestock management, adopting sustainable feed sources, and optimizing fertilizer application, companies can significantly lower emissions.

- **Dairy and meat producers** can implement sustainable feed programmes to reduce enteric fermentation (a key methane source).
- **Input suppliers** can develop precision agriculture tools that optimize fertilizer use and reduce nitrogen runoff.
- **Buyers** can support sustainable livestock and crop certification schemes.

Preventing deforestation and land conversion: A major driver of supply chain emissions is the conversion of forests and natural ecosystems into agricultural land. Sustainable land-use policies, reforestation efforts, and deforestation-free supply chains are critical for meeting climate goals.

- **Producers** can adopt agroforestry, silvopasture, and sustainable land-use practices.
- **Buyers** can implement deforestation-free procurement policies for high-risk commodities such as soy, palm oil, and beef.
- **Retailers** can work with suppliers to ensure full traceability of raw materials.

Ecosystem restoration, reforestation, and sustainable forest management: Reforestation and afforestation can offset emissions, restore biodiversity, and improve climate resilience. Companies sourcing timber, cocoa, coffee, or palm oil should integrate reforestation into their supply chain commitments, provided cropland hadn't been converted from natural ecosystems in the first place.

- **Input suppliers** can provide seedlings and funding for afforestation projects.
- **Producers** can implement agroforestry systems and restore degraded land.
- **Buyers** can invest in carbon offset programmes that focus on reforestation.

Reducing food loss and waste: Food loss and waste contribute significantly to supply chain emissions. Companies can implement strategies to optimize processing, distribution, and consumer engagement to minimize waste and maximize resource efficiency.

- **Processors** can improve storage, transport, and preservation techniques.
- **Retailers** can develop circular economy models to repurpose surplus food.
- **Consumers** can promote education campaigns on reducing household food waste.

Transitioning to renewable energy in supply chains: A large share of agrifood emissions comes from fossil fuel use in processing, transportation, and storage.

- **Companies** must transition to renewable energy sources such as solar, wind, and biogas, green hydrogen to meet net zero goals.
- **Processors** can install solar or biogas systems for on-site energy.

➔ **EXAMPLE: Investing in climate solutions to reduce emissions in supply chains**

A leading global chocolate and confectionery company is implementing a multipronged strategy to reduce scope 3 emissions, which make up the majority of its GHG footprint. Recognizing that cocoa production is a major contributor to deforestation and agricultural emissions, the company has designed the following targeted interventions to drive emissions reductions across its supply chain.

- **Optimizing procurement by embedding carbon intensity in supplier selection:** One of the company's key initiatives is embedding carbon footprint considerations into supplier selection criteria. By prioritizing suppliers with lower emissions intensity the companies aim to encourage the adoption of climate-friendly practices. The company closely tracks supplier performance based on ability to reduce emissions from land-use change, fertilizer application, and deforestation. It is also shifting its sourcing toward agroforestry and climate-smart cocoa production, moving away from conventional monoculture farming systems, lowering emissions and creating incentives for suppliers to innovate and implement more sustainable practices.
- **Reducing waste in production and supply chains:** Manufacturing inefficiencies often lead to significant emissions from raw material waste, energy use, and transport. To combat this, the company has optimized its ingredient use in product formulations to ensure that every unit of cocoa and sugar is used efficiently. It has also invested in artificial intelligence-driven quality control systems to minimize defective or low-quality batches, which would otherwise need to be discarded, while improvements in logistics efficiency have reduced unnecessary transport movements and excessive packaging materials. These measures contribute to both emission reductions and cost savings, making production processes more sustainable and resource-efficient.
- **Developing low-carbon product formulations:** Innovation in product development has played a central role in reducing the company's supply chain emissions. It has introduced more plant-based ingredients to reduce its reliance on high-carbon dairy products, while also replacing conventional ingredients with lower-emission alternatives, such as sustainably sourced sugar. The company has placed a strong emphasis on scaling up regenerative cocoa programmes, integrating mixed cropping, organic fertilization, and soil restoration practices that help sequester carbon and rebuild soil health.
- **Eliminating deforestation in cocoa and palm oil supply chains:** Recognizing the link between land-use change and emissions, the company has committed to a 100 percent deforestation-free supply chain for key raw materials such as cocoa, palm oil, soy, and paper-based packaging by 2025. This commitment is being realized by sourcing 100 percent certified sustainable cocoa, verified through independent third-party auditing. To further ensure compliance, it has invested in forest restoration programmes aimed at rehabilitating degraded lands in cocoa-growing regions. The company has also incorporated satellite monitoring and blockchain traceability to track raw materials from farm to factory, ensuring it meets its deforestation-free commitments.

These efforts align with global climate initiatives, including the European Union Deforestation Regulation and NDCs, particularly in major cocoa-producing countries, such as Côte d'Ivoire, Ghana, and Indonesia.

This case highlights how companies in emission-intensive supply chains can take a science-based approach to drive scope 3 reductions by integrating carbon criteria into procurement, reducing waste, innovating low-carbon products, and ensuring deforestation-free sourcing.

➔ EXAMPLE: **Embracing sustainability initiatives to lower emissions in supply chains**

A leading global food retailer is working to lower emissions across its supply chain through a range of sustainability initiatives. One of its core strategies includes supporting suppliers in setting net zero targets and encouraging them to align with science-based targets to ensure long-term emissions reductions. The company is also transitioning its production sites to renewable energy sources, significantly reducing emissions from its operations.

Recognizing the environmental impact of deforestation, the company has committed to ensuring all high-risk commodities, such as palm oil, soy, and beef, are 100 percent deforestation-free by 2025. It is also promoting sustainable agriculture practices by collaborating with vegetable suppliers to introduce low-carbon fertilizers that help reduce emissions at farm level. To accelerate the transition to sustainable production, the company has introduced sustainable financing mechanisms – including green bonds and credit facilities linked to environmental commitments – to incentivize suppliers to implement climate-smart practices while ensuring long-term resilience in supply chains.

➔ EXAMPLE: **Optimizing milk yield, investing in renrewable energy, and offsetting emissions**

A major dairy producer is ensuring feed, water, and other resources are used efficiently in its supply chain and in its own farms to minimize emissions per unit of milk produced. It has also adopted sustainable feed practices, sourcing livestock feed that is both environmentally friendly and lower in carbon intensity. The company is also investing in renewable energy, including using biogas to power its production facilities and farms, reducing its reliance on fossil fuels and cutting methane emissions. Finally, the company is exploring carbon farming initiatives, where farms implement soil carbon sequestration techniques to offset emissions. These strategies align with national and global commitments to reduce agricultural emissions and ensure long-term sustainability in dairy supply chains.

➔ EXAMPLE: **Sustainable livestock management and preventing deforestation**

A food and beverage company is implementing targeted strategies to lower emissions within its dairy and livestock supply chains, and addressing emissions from soil and forest degradation. One key approach has been adjusting animal nutrition to reduce methane emissions from digestion, a major contributor to agricultural emissions, by incorporating specialized feed additives and optimizing feeding strategies. The company has also committed to sourcing sustainable feed for livestock to reduce emissions linked to feed production and land use. This includes transitioning to deforestation-free soy and other feed crops. It is introducing manure management solutions to capture and repurpose methane emissions, further reducing the environmental footprint of dairy and meat production.

Beyond livestock management, the company is working to prevent deforestation in its supply chain and supports on-farm afforestation efforts, such as tree planting and diversified cropping systems. These measures aim to enhance soil health, improve biodiversity, and create long-term carbon sinks. It is further reducing emissions from farming operations and restoring soil health through regenerative agriculture.

TABLE 13. Tools for developing mitigation solutions

Resource	Description	Link
Food and Agriculture Roadmap (CEO Guide)	F&A roadmap is the implementation plan of the CEO guide to Food Systems Transformation. It outlines transformative agriculture strategies for climate action, resilience, and sustainability within company operations and collectively.	Food and Agriculture Roadmap CEO guide to food system transformation
OECD Guidance on Climate Change Mitigation in Agriculture	Provides insights into policy recommendations and best practices for reducing emissions in the agriculture sector.	Enhancing Climate Change Mitigation through Agriculture
FAO Sustainable Livestock Practices	Details sustainable livestock strategies for mitigating climate change.	Tackling Climate Change through Livestock

Source: Authors' own elaboration.

Aligning business mitigation efforts with national climate priorities

Countries have outlined their key emission sources and mitigation strategies in their NDCs, which they are updating in 2025. Similar to adaptation efforts, businesses can amplify the impact of these key climate plans, avoid duplicating efforts, and help drive national progress towards net zero goals – while also future-proofing their operations and enhancing supply chain sustainability.

Having mapped national climate policies in sourcing regions to understand how governments are addressing emissions in agriculture, and identified climate "entry points" across their operations, companies can now align their mitigation solutions to those hot spots and emission-intensive activities in the supply chain. As already shown, some countries have prioritized interventions such as reducing enteric methane emissions from livestock, shifting towards renewable energy, restoring degraded lands, and promoting low-emission agricultural practices. Businesses can tailor their mitigation strategies to reinforce and scale these priorities.

Figure 12 highlights the Top 20 mitigation solutions in agrifood systems as identified in global NDCs as assessed by 2024, ranging from improved manure management and agroforestry to sustainable rice cultivation and optimized fertilizer use. These solutions represent strategic opportunities for companies to reduce emissions across production, processing, and transport phases of their value chains.

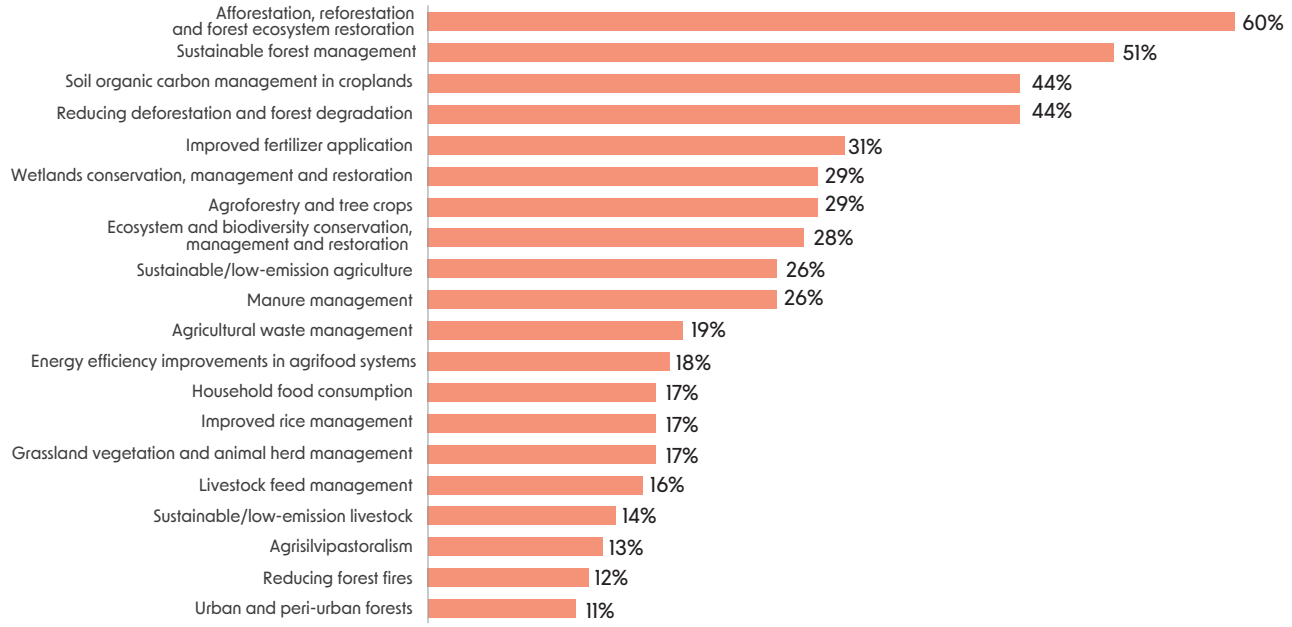
To operationalize this alignment, companies should use tools such as policy mapping, supply chain emission profiling, and cost-benefit analysis of mitigation options. Figure 12 offers a global entry point, but businesses can further refine their approach by prioritizing high-impact actions in regions where they have the greatest environmental footprint and influence.

Turning climate mitigation into business opportunities

NDC mitigation priorities outlined by developing countries present a diverse range of opportunities for agrifood companies to offer climate goods and services that directly address these national climate action plans, moving beyond solely focusing on reducing emissions within their own supply chains.

One crucial opportunity lies in providing soil **carbon management services and technologies in croplands.** This includes offering expertise and solutions for improving soil health through practices like conservation tillage, the use of cover crops, and the application of biochar, all of which can enhance soil carbon sequestration, a key mitigation strategy. Companies can offer satellite-based soil carbon monitoring services. AI now enables platforms for tracking carbon sequestration in small holder plots, and microbial inoculants or biochar products to enhance carbon retention.

FIGURE 12. Top 20 mitigation solutions in agrifood systems, as stated in NDCs



Source: **Crumpler, K., Wybieralska, A., Roffredi, L., Tanganelli, E., Angioni, C., Prosperi, P., Umulisa, V., Dahlet, G., Nelson, S., Rai, N., Schiettecatte, L.S., Salvatore, M., Wolf, J. & Bernoux, M.** 2024. *Agrifood systems in nationally determined contributions: Global analysis – Key findings*. Rome, FAO.

Agrifood companies can also provide valuable soil testing and analysis services to help farmers optimize their nutrient management practices, reducing the need for synthetic fertilizers and their associated emissions, while simultaneously improving soil health and carbon storage. Promoting the use of organic fertilizers and bio-based pesticides can further reduce the carbon footprint of agriculture. For example, a leading soil carbon project developer, provides remote sensing-based soil carbon measurement tools to partners like the World Food Programme and Farm to Market Alliance. They do not source crops directly but offer measurement services that can potentially enable carbon credits for smallholders across East Africa.

Providing improved fertlizer applicaton solutions, including both digital and physical products and services, also offers market opportunity. Digital nutrient advisory platforms, such as those offered by one global input supplier, provide farmers with data-driven insights for precise nutrient management. These platforms leverage remote sensing and soil data to optimize fertilizer application, reducing waste and improving efficiency. Enhanced-efficiency fertilizers, including slow-release formulations and those derived from green ammonia, address concerns about nutrient leaching and greenhouse gas emissions. These innovative fertilizers provide controlled nutrient release, ensuring optimal uptake by crops and minimizing environmental losses. Furthermore, the demand for agronomic services and mobile soil testing is rising. Farmers require expert guidance and accessible tools to assess soil health and tailor fertilizer applications to specific field conditions. Mobile soil testing services offer rapid and convenient analysis, empowering farmers to make informed decisions. This combination of digital platforms, advanced fertilizers, and expert services presents a promising avenue for earning within sustainable agricultural practices.

There is also a growing market opportunity for **sustainable livestock management solutions.** These include methane-reducing feed additives, such as those commercialized by some nutrition and health companies that offer a practical approach to mitigating enteric methane production in livestock. These additives can be readily

integrated into existing feeding practices, reducing the carbon footprint of meat and dairy production. Animal health products and diagnostics play a crucial role in improving feed conversion efficiency. By optimizing animal health, these solutions ensure that livestock utilize feed more effectively, reducing waste and minimizing the need for excessive feed inputs. Modular biodigesters, like those provided by a specialized bioenergy solutions provider, offer smallholder farms a sustainable way to manage manure. These systems convert livestock waste into biogas for clean energy and nutrient-rich fertilizer, reducing methane emissions and promoting circular agriculture.

Rice cultivation faces increasing pressure to reduce its environmental footprint, particularly water usage and methane emissions. This demand creates significant market opportunities for improved rice management solutions. **Alternate wetting and drying (AWD) irrigation tools,** such as field water tubes, offer a practical method for reducing water consumption and methane emissions in rice paddies. **Decision-support apps** provide farmers with data-driven insights for optimized water and fertilizer scheduling. These digital tools, developed by various tech companies, leverage weather data, soil information, and crop models to enhance resource efficiency and minimize environmental impact. **Methane monitoring services** offer a crucial tool for quantifying and managing greenhouse gas emissions from rice paddies. These services, utilizing advanced sensor technology and data analytics, enable farmers and policymakers to track progress and implement targeted mitigation strategies.

The increasing emphasis on renewable energy in agriculture creates a demand for **renewable energy solutions tailored for agricultural use.** This includes designing, installing, and maintaining solar-powered irrigation systems, which can significantly reduce reliance on fossil fuel-powered pumps. Providing biogas digesters for manure management not only helps reduce methane emissions but also generates a clean energy source for farm operations. Exploring wind-powered solutions for various farm activities also presents a viable opportunity. Furthermore, investing in agrivoltaics, which combines solar energy production with agriculture, allows for dual land use, increasing both food and clean energy production.

With the growing focus on carbon sequestration, agrifood companies can develop and offer **carbon sequestration and trading solutions.** This could involve creating projects that enhance carbon storage in agricultural lands and forests, generating carbon credits that can be traded. Facilitating access to carbon markets for farmers who adopt sustainable practices is another valuable service. Companies can also invest in technologies for measuring, reporting, and verifying (MRV) carbon sequestration in agricultural landscapes, making carbon credits more credible and accessible.

The increasing commitment of developing countries to reach their NDC targets and the growing impacts of climate change are likely to drive a significant increase in the demand for these types of climate goods and services, creating a strong business case for agrifood companies to invest in.

In conclusion, achieving substantial GHG emission reductions across agrifood supply chains requires a strategic and comprehensive approach. Companies must prioritize accurate emissions assessments, pinpoint key emission hot spots, and establish rigorous, science-based targets, particularly for scope 3 emissions. Moreover, they can try to actively engage suppliers, incentivizing them to adopt sustainable practices and align with national climate priorities outlined in NDCs. Beyond mere emission reduction, agrifood businesses can capitalize on emerging market opportunities by providing climate-smart goods and services, such as soil carbon management solutions, precision fertilizer technologies, and sustainable livestock management systems. By aligning corporate mitigation efforts with national climate goals and enable collaborative partnerships, companies can drive meaningful decarbonization to enhance supply chain resilience.

Step 4. Track, evaluate, and disclose progress to ensure continuous improvement

This step details how to monitor and evaluate progress in climate action. It focuses on measuring adaptation and mitigation outcomes and ensuring transparency through reliable disclosures. This section highlights the importance of continuous improveme through balanced and accurate reporting.

For agrifood companies, tracking, measuring, disclosing, and communicating climate action is essential to demonstrate accountability, ensure regulatory compliance, and build trust with investors, policymakers, and consumers. To monitor and evaluate adaptation actions, companies need to analyse and report on performance of corporate adaptation actions, monitor emerging mandatory and voluntary standards and their implications on corporate and supply chain adaptation, and continuously improve adaptation strategy. Transparent disclosure of emissions reductions – particularly across scopes 1, 2, and 3 – is also vital for measuring progress and ensuring alignment with global and national climate commitments.

Companies that proactively communicate their climate performance can gain competitive advantage, attract sustainable investments, and influence stronger climate policies. This section outlines how businesses can track, report, and engage stakeholders effectively.

How to track and disclose climate action

Tracking and disclosure must be clear, credible, and aligned with international reporting frameworks. Corporate climate disclosures should provide balanced and reliable information while demonstrating the effectiveness of adaptation and emissions reduction initiatives. This section outlines what agrifood companies should include in their climate disclosure strategy to ensure it is robust.

Emissions sources and progress reporting in supply chains: Agrifood companies operate across complex, multitiered supply chains where emissions originate at different points. These include scope 1, scope 2 and scope 3. For agrifood businesses, scope 3 emissions account for majority of their total carbon footprint, particularly in livestock farming, crop production, and packaging. Companies must clearly outline where emission reductions are occurring across these scopes.

➔ **EXAMPLE: Tracking supply chain emissions reduction in dairy production**

To track emissions, a global dairy company that sources milk from thousands of smallholder farmers across multiple countries has partnered with satellite-based monitoring platforms and farm-level data collection systems. These tools help measure methane emissions from dairy farms, track fertilizer application, and monitor land-use change. The company publicly discloses this data in its annual sustainability report, highlighting progress in reducing methane from dairy farms, shifting to sustainable feed, and improving manure management. By linking these initiatives with national methane reduction targets in sourcing country NDCs, the company can contribute to national climate tracking efforts.

Demonstrate how corporate action aligns with and contributes to NDCs and global climate commitments: Governments rely on emissions reporting to track progress against their national climate targets under the Paris Agreement. Many developing country NDCs focus on reducing emissions in agriculture, enhancing soil carbon sequestration, and improving water management. Agrifood companies that disclose emission reduction from their operations can directly contribute to governments climate reporting and investment planning. By actively engaging in national climate reporting frameworks, agrifood companies can strengthen government capacity to track emissions more accurately.

➔ **EXAMPLE: Tracking carbon sequestration in crop supply chains**

A multinational agribusiness sourcing wheat, maize, and soy from Latin America and Africa has integrated soil carbon sequestration into its sustainability programme. Tracking soil health improvements and measuring carbon capture on supplier farms helps the company ensure that its regenerative agriculture initiatives align with land-use change mitigation goals in sourcing country NDCs. It works with national governments, sharing emissions data to help improve national GHG inventories, which policymakers can use to refine strategies for scaling regenerative farming.

Integrating climate risks into corporate reporting: Investors and financial institutions are beginning to link climate action with business risk assessments. Companies that integrate climate disclosures into financial reports can secure better access to green financing, attract sustainability-linked investments, and demonstrate resilience against carbon pricing mechanisms.

➔ **EXAMPLE: Climate risk reporting in retail supply chains**

Since integrating climate-related financial risks into its corporate disclosures under the TCFD framework, a major food retailer's financial reports include:

- Projected costs of carbon taxes on emissions-intensive food products;
- Impact assessments of climate change on sourcing regions, particularly for coffee, cocoa, and palm oil;
- Revenue risks associated with supply chain disruptions due to extreme weather events in key sourcing areas; and
- Financial spending information on climate adaptation and mitigation activities

By transparently reporting these financial risks, the company aligns its business strategy with global climate risk disclosure standards, improving investor confidence and attracting sustainability-focused capital.

Embedding robust tracking and disclosure mechanisms allows agrifood companies to:

- Enhance transparency in meeting their climate commitments;
- Help governments improve climate reporting by aligning with NDC/NAP targets;
- Strengthen their financial positioning by showcasing sustainability-driven risk management; and
- Drive industry-wide supply chain transformation through supplier incentives and engagement.

Companies that track emissions rigorously, align with national policies, and disclose climate performance transparently will be best positioned to lead in low-carbon food systems while contributing to national and global net zero goals.

TABLE 14. Tools for reporting

Resource	Description	Website (if applicable)
Corporate annual reports and sustainability reports	Key metrics and narratives about emissions reductions and sustainability strategies.	Company websites
TCFD reports; now under Financial Stability Board	Reporting on climate risks, governance, and financial impact	
CDP	**CDP disclosure** serves as a one-stop shop for understanding and disclosure according to relevant market and regulatory demands.	https://www.cdp.net/en
World Benchmarking Alliance reports	Participating in global sustainability benchmarks – e.g. the Food and Agriculture Benchmark assesses 350 of the world's largest food companies on SDG contributions.	World Benchmarking Alliance reports
Press releases and social media	Public announcements to showcase climate progress and supplier engagement.	Company websites and social media channels
Partnership and coalition updates	Updates on corporate collaborations with governments, nongovernmental organizations, and climate alliances.	Company websites

Source: Authors' elaboration based on **IFRS.** 2024. *Progress on Corporate Climate-related Disclosures—2024 Report*; **CDP.** 2022. *CDP-Supply-Chain-Report-2022.pdf.*

Agrifood companies must view emissions tracking as both a corporate responsibility and a business opportunity – one that ensures compliance, enhances sustainability leadership, and secures long-term market competitiveness.

Companies can disclose their climate action through multiple channels (Table 14) to reach a diverse range of stakeholders, including investors, regulators, suppliers, and consumers. As well as disclosing emissions data, companies can showcase impact-driven case studies, key performance indicators, supplier engagement strategies, and challenges they have faced in achieving climate goals.

Why corporate disclosure matters for national climate action

- Policy influence: Transparent corporate climate reporting gives policymakers confidence that businesses are committed to decarbonization, encouraging more ambitious national policies.
- Public–private alignment: Disclosures help governments track emissions from corporate supply chains, supporting more robust climate accounting under the Paris Agreement.
- Investment signals: Countries with clear private sector engagement can potentially attract more climate finance and investment for agrifood sector transformation.

➔ **EXAMPLE:** A global agrifood company with a supply chain in multiple developing countries aligned its corporate GHG disclosure with the agricultural emissions reduction targets of its sourcing country's NDCs. Reporting on how its scope 3 mitigation strategies contributed to low-carbon farming practices in Latin America and Africa strengthened the company's public–private partnerships.

Key actions companies can take to support national climate reporting policies include aligning corporate climate risk assessments, adaptation reporting, and GHG accounting methodologies with country-level emissions tracking, and advocating for policy harmonization by ensuring alignment between corporate standards (GHG Protocol, SBTi, TCFD,) and national adaptation and GHG reporting frameworks.

Overcoming challenges in climate disclosure: While many companies recognize the importance of disclosure, they face several challenges to align corporate climate disclosures with evolving policy frameworks, ensure suppliers provide accurate emissions data in complex supply chains, balance climate reporting with financial performance pressures, and navigate carbon credit mechanisms and regulatory inconsistencies.

To overcome these challenges, businesses can:

- Strengthen supplier engagement and incentives to improve scope 3 emissions tracking;
- Integrate digital solutions – such as blockchain and artificial intelligence-driven data analytics – for better climate data transparency;
- Advocate for global climate policy alignment to reduce fragmentation in adaptation reporting carbon accounting; and
- Embed climate disclosures into financial decision-making to ensure credibility with investors.

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3. Moving forward strengthening corporate climate policy alignment

This guidance and proposed framework highlights the need for deeper collaboration across supply chains to enhance climate resilience and drive decarbonization efforts. With over 98 percent of agrifood emissions stemming from supply chains, companies must scale up engagement with their suppliers, policymakers, and financial institutions to accelerate progress toward net zero goals.

In addition, as countries submit their updated NDCs in 2025 (NDC 3.0), there is a noticeable shift towards not only setting more ambitious climate targets but also focusing on the practical aspects of implementation. This includes the development of comprehensive frameworks and investment plans for NDCs and NAPs. Such detailed planning enhances the clarity and bankability of climate actions, thereby creating more concrete opportunities for private sector engagement and investment.

While this document primarily provides guidance for the private sector on engaging with these evolving climate strategies, it's crucial to acknowledge the indispensable role of the public sector. Governments are instrumental in de-risking private investments through policy support, regulatory frameworks, and financial instruments. By creating an enabling environment, the public sector can facilitate and accelerate private sector participation in achieving national climate goals.

Recognizing the complementary roles of both public and private sectors, a forthcoming joint FAO–WBSCD paper titled, "De-risking private sector investment in agrifood priorities of national climate plans", delves deeper into enabling and de-risking strategies that the public sector can leverage in climate finance and policy implementation. Together, these insights aim to foster a collaborative approach, ensuring that both private and public entities are effectively mobilized to meet the challenges and opportunities presented by NDC 3.0 and NAPs.

As stated already, to achieve national and corporate climate commitments, agrifood companies will benefit from aligning their supply chain strategies with climate priorities of the countries hosting their supply chains. The framework presented in this guide offers clear, actionable steps to help companies translate their climate commitments into tangible solutions and adaptation and mitigation impacts, identify climate risk hot spots, collaborate effectively with suppliers, and track progress. By following these four key steps, agrifood companies can build climate-resilient, low-carbon supply chains that contribute to both business sustainability and global climate goals:

1. **Building management commitment for climate action in supply chains.** This entails establishing a strong foundation of leadership support to ensure climate considerations are embedded at every level of decision-making for supply chains.
2. **Implementing adaptation strategies in supply chains.** This involves taking proactive steps to adjust supply chain operations to the changing climate, safeguarding production and reducing vulnerability to climate risks.

3. **Reducing supply chain GHG emissions through targeted mitigation actions,** by prioritizing reducing GHG emissions in supply chains and by implementing carbon-cutting measures, focusing on the most impactful areas.
4. **Tracking, evaluating, and disclosing progress to ensure continuous improvement,** through continuously monitoring, assessing, and publicly reporting on progress to enable transparency, maintaining accountability, and driving ongoing improvements.

By embedding climate accountability, transparency, and public–private collaboration, agrifood companies can drive impactful emissions reductions, de-risk supply chains, and scale investment in sustainable agriculture – ensuring long-term corporate sustainability and global climate progress which can ultimately help in achieving a global climate-resilient and net zero world.

Appendices

Appendix A. Approach to develop this guidance

The following steps were undertaken to develop this guidance:

Landscape and gap analysis: A comprehensive landscape analysis was conducted to assess current, emerging, and near-future practices, policies, and tools for accounting, measurement, target setting, and climate-smart sustainability interventions – particularly with respect to global agrifood company efforts within their supply chains and the production level. This analysis identified gaps where key areas remain insufficiently addressed by stakeholders.

Framework development: Building on the landscape and gap analysis, a framework was developed to enhance private sector engagement in addressing climate risks within supply chains. The framework focuses on enabling climate solutions, accelerating the adoption of climate commitments (including net zero targets), and supporting the implementation of NDCs and NAPs in agriculture and land use.

Interviews: Interviews were conducted in 2022 and 2023 with global agrifood companies that are members of the WBCSD, representing diverse segments of the value chain. These discussions identified key challenges food and agriculture companies face in adopting climate strategies and actions.

Further deep-dive interviews with selected companies explored barriers and opportunities for private sector engagement in implementing NDCs and NAPs. These discussions also revealed preliminary examples of efforts agrifood companies are making toward climate action. The insights gained informed a mapping of private sector needs related to climate and sustainability pathways within their supply chains, as well as common approaches being adopted in certain countries.

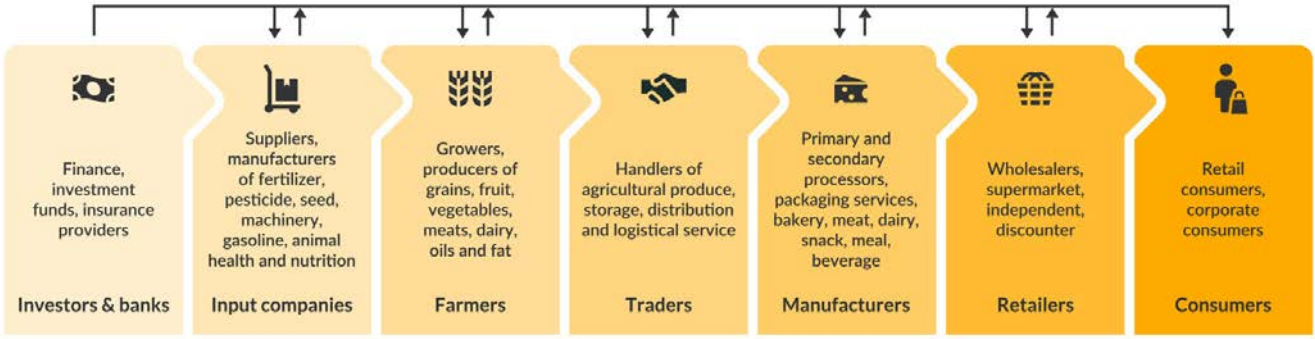
Sources of guidance

This guidance is based on multiple sources, including:

- Existing literature and relevant guidance.
- Webinars organized in 2023 examining barriers to climate-smart transitions, with participation from private and public sectors, as well as (inter)national associations.
- Consultations with WBCSD member companies.
- In-depth interviews with key food and agriculture stakeholders.
- Broader stakeholder consultations.
- Public disclosures (e.g. sustainability reports, TCFD reports, CDP reports, climate plans, and net zero reports of companies operating in or sourcing from developing countries – particularly those supported through the SCALA programme).

Appendix B. Food and agriculture value chains

FIGURE 1B. Agrifood value chain actors



Source: TEEBAgriFood Draft Operational Guidelines for Business - Capitals Coalition.

All stakeholders across the food and agriculture value chain play a critical role in the transition to more sustainable, inclusive, low-carbon, and climate-resilient agrifood systems. Figure 1B illustrates typical actors within the agrifood value chain. Actions specific actors can take include:

- **Investors and banks:** Develop a set of financial principles for food and land use; develop innovative finance instruments, included blended finance, to manage risks and leverage opportunities; and deploy innovative finance to reach currently underfinanced parts of supply chains.
- **Input companies:** Provide investment and technical assistance to scale regenerative, nature-positive approaches to food production; invest in new ways to use existing inp uts and resources more efficiently, transitioning to regenerative and circular production models to improve sustainability of crop production; reduce the need for chemical fertilizers and pesticides; and use innovative cropping practices to increase levels of organic soil carbon.
- **Farmers:** Adopt improved agricultural management practices that maintain or improve crop yields while reducing GHG emissions or sequestering carbon in soils and plant biomass; help conserve and restore nature; and reduce land degradation and vulnerability to physical climate change impacts by adopting regenerative and nature-positive practices.
- **Traders:** Develop supply chains focused on low carbon and climate-resilient commodities and food products that establish deforestation-free supply chains by identifying, investing in and scaling solutions that eliminate deforestation and land conversion, and incentivize sustainable land use.
- **Manufacturing:** Invest in technologies and infrastructure that process and manufacture foods and beverages with reduced energy and lower carbon emissions; develop novel food science techniques to improve food storage and freshness; reduce food waste; and enhance nutrition.
- **Retailers:** Offer customers purchasing diverse options including to diversify protein sources and support dietary shifts; promote nutritious sustainable choices through labelling and marketing; and tackle food loss and waste.
- **Consumers:** Shape social change movements, support the government and private sector and hold all parties accountable, e.g. through shareholder engagement; and signal demand for diverse and nutritious diets centred on sustainably grown and sourced products through produce choice and purchasing power.

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The Scaling up Climate Ambition on Land Use and Agriculture through Nationally Determined Contributions and National Adaptation Plans (SCALA programme) is a seven-year initiative led by FAO and UNDP, with funding from the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) through the International Climate Initiative (IKI). SCALA responds to the urgent need for increased action to cope with climate change impacts in the agriculture and land-use sectors. The 26 million euro programme supports more than a dozen countries in Africa, Asia and Latin America to build adaptive capacity and to implement low-emission priorities.

Country support includes strengthening policies, adopting innovative approaches to climate change adaptation and removing barriers related to information gaps, governance, finance, gender mainstreaming and integrated monitoring and reporting. To achieve this shift, the programme engages the private sector and key national institutions.

This guide is designed to help global agrifood businesses drive climate action across their supply chains, particularly in developing countries where climate impacts are most acute. It highlights how companies can align their climate commitments – such as net zero and adaptation targets – with the national priorities of the countries they operate in. By doing so, businesses can contribute to national climate goals outlined in countries' climate plans, while strengthening resilience, managing climate risks, and enabling more sustainable supply chain transitions.

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