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Technology Executive Committee

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Draft toolkit for scaling up climate technology solutions in agrifood systems

Cover note

A. Background

1. As per activity C.1.1 of its rolling workplan (2023-2027),[1] the TEC works to build on its previous work on climate-smart agriculture, analyse knowledge gaps on the water-energy-food systems and identify relevant adaptation technologies, including indigenous, innovative and digital technologies (e.g. early warning systems), to strengthen adaptation planning (NAPs) and NDC ambitions in the agriculture sector.

2. The TEC, in collaboration with the Food and Agriculture Organization of the United Nations (FAO), launched in 2024 the publication *Climate Technologies for Agrifood Systems Transformatio*n,[2] which consolidated evidence on the role of climate technologies in supporting agrifood systems transformation, with particular emphasis on adaptation, resilience and enabling conditions across agrifood value chains.

3. The publication identified persistent barriers to the development, transfer and uptake of climate technologies in agrifood systems, including constraints related to access to finance, institutional and technical capacity, and the limited availability of operational guidance to translate high-level policy priorities into implementable pathways.

4. At TEC 31, the TEC agreed to develop, in collaboration with FAO, a guidebook by 2027 to enhance technology development and transfer in agrifood systems, address identified barriers, and strengthen the availability and application of evidence-based solutions relevant to agrifood systems and climate-resilient development.

5. At TEC 32, the TEC considered a draft outline for this knowledge product and requested the open-ended activity group to prepare a draft toolkit for scaling up climate technology solutions in agrifood systems.

B. Scope of the note

6. The annex to this note contains the draft toolkit for scaling up climate technology solutions in agrifood systems.

[1] https://unfccc.int/ttclear/tec/workplan.

[2] https://unfccc.int/ttclear/tec/water-energy-food.html#agrifood.

C. Possible actions by the Technology Executive Committee

7. The TEC will be invited to consider the draft toolkit contained in the annex and provide guidance to the open-ended activity group to further develop the toolkit.

Annex

Draft Toolkit for Scaling Up Climate Technology Solutions in Agrifood Systems

How to use this toolkit

Why this toolkit?

Many countries have identified climate technology priorities through Technology Needs Assessments (TNA), Nationally Determined Contributions (NDC), National Adaptation Plans (NAP) and related sector strategies. Translating those priorities into implementable agrifood investments, however, remains difficult. The challenge is to connect national analysis with specific value chains, clearly defined intervention points, suitable technologies, enabling measures and realistic financing pathways.

This toolkit provides a practical roadmap for making those connections. It guides users through eight analytical steps, from understanding the national agrifood context and climate risks to selecting climate technologies, estimating investment needs and assembling a financing pipeline. The approach is designed to build on evidence that already exists and to make the assumptions, choices and remaining gaps visible to decision-makers.

Who should use it?

The toolkit is intended for policymakers, National Designated Entities (NDEs), technical and research institutions, farmers' organizations and cooperatives, project developers, financing institutions and investors. It is normally best applied by a small multidisciplinary team that combines agrifood, climate, technology, social inclusion, market and finance expertise. Different users may lead different steps, but the outputs should be reviewed together so that technical choices remain connected to national priorities and implementation realities.

- Ministries and policymakers: set priorities for the agrifood sector and align them with national plans, budgets and reporting processes.
- NDEs and TNA teams: give existing technology priorities an agrifood systems and value chain dimension and connect them to implementation and finance.
- Technical and research institutions: target research, extension and capacity development where the analysis identifies the greatest need.
- Farmers' organizations and cooperatives: document members' needs and shape how technologies, services and finance are delivered.
- Project developers, financing institutions and investors: develop a defensible pipeline of climate technology interventions and identify the preparation needed before financing.

How to use it: eight analytical steps and five decisions

The toolkit is organized into three stages and eight analytical steps. Together, those steps support five overarching decisions: where to focus, which climate problems and intervention needs to

address, what enabling conditions must be in place, which technologies to prioritize, and how implementation will be financed. The five decisions are a navigation aid rather than an alternative set of steps. Table 1 describes each decision pathway, while Figure 1 groups the steps by stage and highlights the primary decision focus of each chapter.

The methodology follows a sequential workflow (Figure 1), with each chapter building on the outputs of the previous one. Applying the steps in sequence provides the clearest audit trail from evidence to investment priorities. The methods may nevertheless be adapted to national circumstances, the scale of the exercise and data availability, and individual steps may be used separately where a specific analysis or output is required.

Table 1. The toolkit structure: what each stage decides, what it produces and where to find it

Stage	Step	Key decision it answers	Main output	Where in this toolkit
Stage 1: Establish the evidence base	Step I–III	Decision 1: Where should climate technology investments focus?	Priority agrifood subsectors and value chains, with the rationale for selecting them	Chapter 2
		Decision 2: What climate problems need to be addressed, and where in the chain?	Climate risk and vulnerability profile	
		Decision 3: What needs to be in place for solutions to be adopted and scaled?	Policy, institutional and stakeholder readiness assessment	
Stage 2: Identify and Prioritize interventions	Step IV–VII	Decision 4: Which technologies are most suitable for the identified challenges and value chains?	Prioritized technology options with expected benefits, trade-offs and safeguards	Chapter 3
Stage 3: Build financing pathways	Step VIII	Decision 5: What is needed to move from technology priorities to implementation?	Costed investment bundles and a climate technology financing pipeline	Chapter 4

Figure 1. The toolkit workflow: stages, analytical steps and the outputs each stage produces

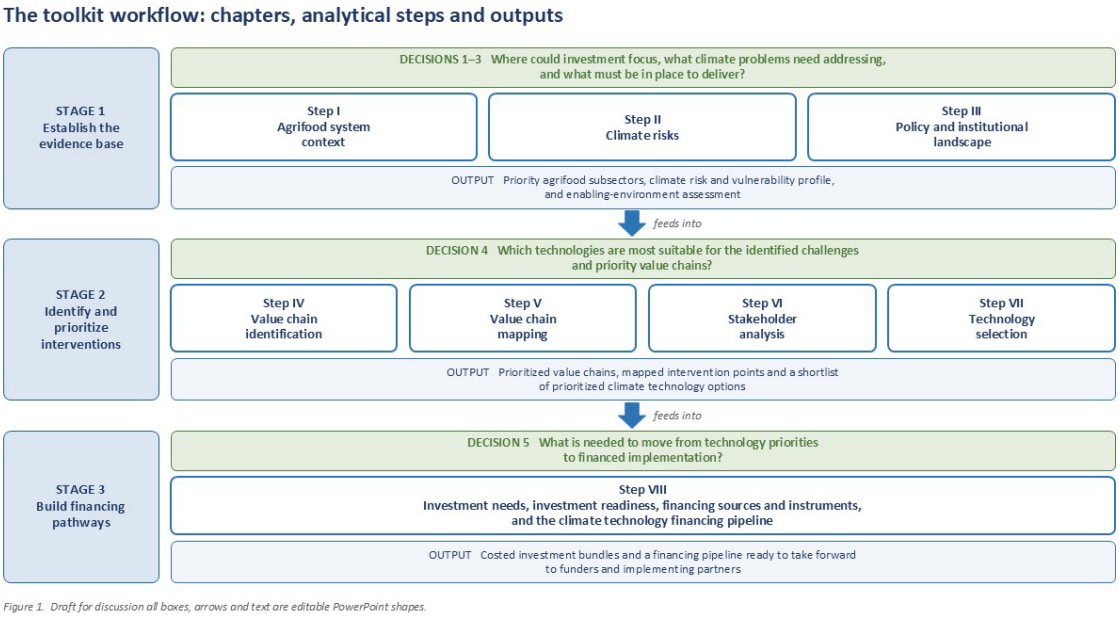


Figure 1. Draft for discussion all boxes, arrows and text are editable PowerPoint shapes.

What each step looks like

Each step follows the same structure so that users can quickly understand what the step is for, how to complete it and how its outputs will be used:

- Why this step matters – the reason the analysis is needed and the consequence of omitting it;
- Decision supported – the specific choice the step enables users to make;
- Purpose – what the step aims to achieve;
- Key analytical questions – the issues to be addressed;
- Suggested analytical methods – recommended approaches;
- Suggested data sources – examples of relevant information;
- Expected outputs – the results that provide inputs for subsequent steps;
- **Working with the evidence you have**

The toolkit is not intended to duplicate a comprehensive national assessment. It shows how existing national analyses, policy documents, statistics, climate information, market studies and stakeholder knowledge can be organized into a transparent planning process and translated into actionable pathways for climate technology uptake at national and subnational levels.

Users are not expected to assemble every possible indicator before proceeding. Where relevant, the tables identify core information that should normally be available for a defensible decision and additional information that can strengthen the analysis. When evidence is limited, expert judgement and stakeholder consultation may be used, but the source, assumption, level of confidence and validation process should be recorded so that the decision can be revisited when better information becomes available.

Use a simple evidence register throughout the exercise. For every indicator or judgement, record the source and year, geographic coverage, any important limitation, and whether the entry is based on measured evidence, expert judgement or an assumption. Apply consistent definitions

and reference years wherever possible; where data sources conflict, explain which source was selected and why.

Table 2. Suggested evidence register

Output or indicator	Source and year	Coverage	Evidence type / confidence	Assumption, limitation or validation

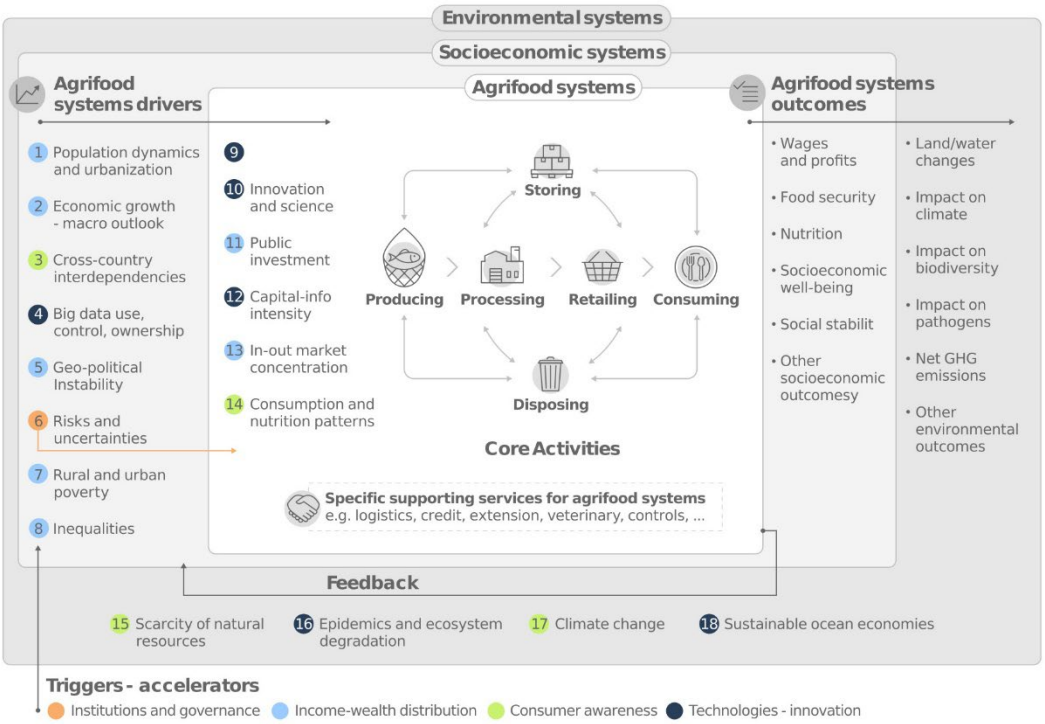
1. Why this toolkit is needed and what it delivers

1.1 Introduction

Agrifood systems are central to livelihoods, food security, and economic development, yet they are increasingly exposed to the impacts of climate change. Rising climate variability, more frequent extreme weather events, and long-term changes in temperature and precipitation threaten agricultural productivity, supply chains, and rural livelihoods.

Agrifood systems are complex, interdependent networks that span the entire journey of food and agricultural products from input suppliers to producers, and ultimately to consumers. These systems involve a wide range of actors and processes, from production, processing and distribution to consumption. Rooted within broader socioeconomic and environmental contexts, agrifood systems operate through dynamic feedback loops, as illustrated in Figure 2. They encompass all goods originating from crop cultivation, livestock, forestry, fisheries, and aquaculture.

Figure 2. Climate risk concept (Source: FAO, 2022)



These challenges are increasingly reflected in the international climate agenda. The Paris Agreement[1] recognizes the importance of technology development and transfer, while the first Global Stocktake[2] (GST) highlights the need to accelerate climate action in agrifood systems. In response, the Belém Technology Implementation Programme[3] (BTIP) was adopted in 2025 to,

[1] UNFCCC. 2015. *Paris Agreement.*
[2] UNFCCC. 2023. *Outcome of the First Global Stocktake. Decision 1/CMA.5.*
[3] UNFCCC. 2025. *Belém Technology Implementation Programme. Decision 18/CMA.7.*

inter alia, strengthen support for implementing technology priorities identified by developing countries.

Article 10 of the Paris Agreement establishes a long-term vision for technology development and transfer and confirms that the Technology Mechanism serves the Agreement. The Technology Executive Committee is the policy body of the Technology Mechanism, while the Climate Technology Centre and Network is its implementation body, providing technical assistance, access to information and support for collaboration. The first periodic assessment of the Technology Mechanism also identified continuing challenges in converting technology priorities into implementation, including access to finance, institutional capacity and links between technology and financial support.

Agrifood systems have also gained greater prominence in the climate agenda. The Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security[4] emphasizes context-specific action, coherence among institutions and finance providers, and attention to vulnerable groups, including women, youth, Indigenous Peoples and small-scale farmers. These principles are reflected throughout this toolkit in its value chain, enabling environment and inclusion analyses.

The 2024 FAO–TEC publication Climate technologies for agrifood systems transformation[5] concluded that technology choices should be supported by robust assessments across all stages of agrifood value chains, accompanied by capacity development and targeted financing, and connected to national climate policy processes. This toolkit operationalizes that recommendation by linking context analysis, technology selection and investment planning in one sequence.

What is generally missing is not ambition or analysis, but a clear route from national climate and agrifood priorities to specific, feasible and financeable interventions. The toolkit supplies that route through eight analytical steps. These steps support the five overarching decisions set out in Table 1 and Figure 1 and create a traceable chain from evidence, through technology selection, to an investment and financing pipeline.

1.2 Objective and focus

Objective

While international frameworks provide an important foundation for technology development and transfer, capacity-building, and financing, they remain largely high-level and offer limited operational guidance tailored to the distinct characteristics and needs of agrifood systems.

This toolkit addresses that gap by contextualizing climate technologies within agrifood systems and value chains and by linking technology interventions to concrete investment opportunities and financing mechanisms. By aligning climate and technology needs with specific agrifood contexts, the toolkit seeks to translate global technology and finance ambitions into actionable pathways that can accelerate sustainable and resilient agrifood system transitions at scale.

[4] UNFCCC, 2023. *Sharm el-Sheikh joint work on implementation of climate action on agriculture andfood security. Decision 3/CP.27.*

[5] FAO and UNFCCC. 2024. *Climate technologies for agrifood systems transformation. Placing food security, climate change and poverty reduction at the forefront.*

Focus

The toolkit focuses on climate technologies that support the resilience and transformation of agrifood systems. Interventions are contextualized within national and subnational settings and analysed through a value chain lens to assess the viability of climate technologies and to identify the investment requirements necessary for their implementation and scaling.

This toolkit complements, rather than replaces, the TNA process. TNAs identify and prioritize technologies, while Technology Action Plans describe the actions and enabling frameworks needed for uptake and diffusion. The present toolkit adds an agrifood systems and value chain lens and carries selected priorities further into market analysis, investment readiness, financing instrument matching and pipeline development.

Throughout this toolkit, climate technology means equipment, techniques, practical knowledge or skills used to support climate change mitigation or adaptation. It includes equipment and products (hardware), the knowledge, processes and practices required to use them (software), and the institutional and organizational arrangements that enable adoption and diffusion (orgware). A technology intervention may therefore combine equipment with extension, training, standards, data services, finance or other enabling measures.

1.3 Expected outcomes

Applied in full, the toolkit produces a connected set of practical outputs: a national agrifood and climate evidence base; a longlist and then a prioritized selection of value chains; maps of climate risks, actors, market conditions and intervention points; a prioritized set of technology options with expected benefits, trade-offs and safeguards; and an investment and financing pipeline setting out costs, readiness gaps, potential sources and instruments, lead institutions and timeframes.

These outputs are intended to inform national and sectoral planning, concept notes, project preparation and dialogue with financing partners. They do not by themselves constitute a feasibility study or an approved funding proposal; instead, they show which interventions are ready to advance and which require further technical, market, environmental, social, gender or financial preparation.

1.4 Scope and limitations

This toolkit provides a structured, evidence-based approach for identifying and prioritizing climate technology investment opportunities in agrifood systems. Rather than requiring a comprehensive national assessment, it guides users in compiling, organizing, and analysing existing information to support decision-making.

The methodology builds on earlier work and establishes methodological approaches, including those referenced in Annex A. It draws on available national strategies, policies, climate assessments, statistics, sector studies, and other relevant sources, complemented where necessary by expert judgement and stakeholder consultations.

Applying the toolkit does not require collecting every possible dataset or commissioning new studies at the outset. Existing evidence will often be sufficient to identify candidate value chains, characterize major climate risks, screen technology options and define preliminary investment

priorities. The depth of analysis should be proportionate to the decision being made and should increase as an intervention moves closer to financing and implementation.

The toolkit is a pre-investment planning framework. Detailed project preparation may still require site-specific technical appraisal, market research, cost–benefit or economic analysis, environmental and social assessment, gender analysis, stakeholder engagement plans, implementation arrangements and quantified climate impact estimates. These needs should be recorded as readiness gaps in Step VIII rather than assumed to have been completed.

2. Establishing the evidence base for climate technology investments

This chapter establishes the analytical foundation for identifying climate technology investment opportunities in agrifood systems. It examines the national agrifood system, climate risks and vulnerabilities, and the policy and institutional environment that shapes climate technology deployment. Together, these analyses provide the evidence base for identifying priority value chains and intervention areas in Chapter 3, where climate technology options are assessed and prioritized for investment planning.

What this chapter decides

Chapter 2 builds the evidence base for the first three decisions in the pathway: where climate technology investment could focus, what climate problems need to be addressed, and what has to be in place for solutions to be adopted. It does not yet select technologies. Its task is to narrow a national picture down to a defensible longlist of candidate value chains, a clear statement of the climate problem, and an honest assessment of the enabling environment.

What you will have at the end

- A profile of the national agrifood system and a screened longlist of candidate value chains, with the criteria used to include them (Step I).
- A structured account of the climate hazards affecting those chains, showing where in the chain, in which locations and for which groups the risks are greatest (Step II).
- An assessment of the policies, institutions and innovation system that will support or obstruct delivery, including the constraints that must be managed (Step III).

These three outputs are the direct inputs to Chapter 3. Where one of them is missing or rests on assumption, the prioritization in Chapter 3 will inherit that weakness, so it is worth recording what is evidenced and what is judged.

Step I. Agrifood system context

This step develops a concise profile of the national agrifood system and screens its main subsectors. It examines the contribution of crops, livestock, forestry, fisheries and aquaculture to the economy, employment, trade, food security and rural livelihoods, together with the natural resource base and the participation of women, youth and other groups.

The aim is not to select the final value chains at this stage. It is to establish a transparent longlist of candidate value chains for more detailed comparison in Step IV. Users should define the geographic scope, reference period and meaning of key terms at the outset, use trends rather than isolated figures where possible, and disaggregate data by location, sex, age and producer type when these differences could affect technology access or impact.

Why this step matters: Investment decisions taken without a clear picture of the agrifood system tend to default to the subsectors that are most visible politically or most familiar to the institutions involved, rather than those where climate technology would do most good. This step replaces that

default with evidence. It is also the only point in the process at which the full national picture is considered before the field narrows, so anything omitted here is unlikely to be recovered later.

Decision supported: Which agrifood subsectors and value chains are carried forward for detailed analysis in Chapter 3, and on what stated grounds.

National agrifood system overview

Purpose: To establish an evidence-based understanding of the national agrifood system and identify the agrifood subsectors with the greatest potential for climate technology investment. This provides the foundation for selecting priority value chains for further analysis.

How to apply this step

- Define the scope of the exercise, including the subsectors, geographic level and reference period to be covered.
- Compile a small set of comparable economic, social, food security and natural-resource indicators from official sources.
- Use three- to ten-year trends where available and flag breaks in data series or differences in definitions.
- Prepare a longlist of candidate value chains and record why each is included or excluded from further assessment.
- Validate the national profile and longlist with sector specialists and representatives of producer and market actors.

Key analytical questions:

- What is the role of agrifood systems in the national economy, food security, and rural livelihoods?
- Which agrifood subsectors are of greatest economic and strategic importance?
- What are the major trends affecting the agrifood system (e.g. production, trade, employment, demographics, food security), including trends in regional and international markets?
- Which agrifood subsectors are most important for livelihoods, particularly among vulnerable and food-insecure populations, including youth, women, Indigenous Peoples, and small producers?

Suggested analytical methods:

- Assess the contribution of agrifood systems and subsectors (crops, livestock, fisheries and aquaculture, and forestry) to GDP, employment, and exports.
- Assess the role of agrifood systems in food security, nutrition, and rural livelihoods.
- Identify land use patterns, forest resources, irrigation, and farm structure.
- Examine socioeconomic characteristics, including poverty, rural populations, and the participation of women and youth in agrifood systems.
- Present data disaggregated by location (urban/rural) and demographic group (sex and age, including youth), where available.

Suggested data sources:

- National statistics

- FAOSTAT
- FRA country reports
- World Bank Group

Expected outputs

Output I-1. Socioeconomic context

Understanding the broader socioeconomic context helps explain the importance of agrifood systems within the national economy and society. It also indicates how climate technology investments can contribute to national development priorities.

Use this to decide: how agrifood systems relate to national development priorities, which socioeconomic trends and inequalities the investment should respond to, and how the case for climate technology action should be framed.

Core indicators: GDP per capita, share of rural population and poverty rate. The remaining indicators strengthen the analysis where the data already exist.

Indicator	Unit
GDP (trend)	current USD billion
GDP per capita (trend)	current USD
Annual GDP growth rate (trend)	%
Share of rural population (trend)	%
Youth share in population	% of population
Poverty rate (trend)	% of population
Unemployment rate (trend)	% of total labour force

Output I-2. Economic importance of agrifood subsectors

Identifies which agrifood subsectors contribute most to the economy, providing an initial indication of where climate technology investments can have the greatest economic impact.

Use this to decide: which subsectors enter the screening exercise, on the basis of measured economic weight rather than assumed importance.

Core indicators: the role of agriculture in GDP, in employment and in exports. Commodity level export detail is useful but not required at this stage.

Indicator	Unit
Role of agriculture (total, crops, livestock, fisheries and aquaculture, forestry) in GDP (current, trend)	% of GDP
Role of agriculture in employment (current, trend)	%
Agricultural export value (current, trend)	USD; % of exports
Main exported agricultural commodities	USD
Main imported agricultural commodities	USD; % of domestic consumption

Output I-3. Natural resource base and production systems

Climate technologies must be compatible with the country's natural resource base and production systems. Information on land use, irrigation, forests and farm structure helps identify opportunities and constraints for technology deployment.

Use this to decide: which technology types are physically viable in the country, and which are ruled out by the resource base, irrigation coverage or farm structure before they reach the shortlist.

Core indicators: land use and irrigated cropland. Forest stock and farm size distribution should be added where forestry or smallholder production is central to the investment.

Indicator	Unit
Land use (cropland, meadows and pastures, forest land) (current, trend)	ha
Irrigated cropland	ha
Forest area (trend)	ha
Total forest growing stock (trend)	m^3
Farm size distribution (small, medium, large)	% of farms

Output I-4. Food security and nutrition context

Climate technology investments should also strengthen food security and nutrition. These indicators identify existing food security challenges and vulnerable populations, helping ensure that technology investments contribute to resilient and inclusive agrifood systems.

Use this to decide: which food security and nutrition outcomes the investment is expected to improve, and which populations it must reach in order to do so.

Core indicators: prevalence of undernourishment and prevalence of moderate or severe food insecurity. Child wasting data strengthen the nutrition case where available.

Indicator	Unit
Prevalence of undernourishment (trend)	% of population
Prevalence of moderate or severe food insecurity (trend)	% of population
Percentage of children under 5 years affected by wasting (trend)	% of children under 5

Agrifood subsector screening

Purpose: To identify the most relevant agrifood value chains by screening agrifood subsectors. This step narrows the range of potential value chains and provides a longlist of candidates for more detailed assessment and prioritization in the subsequent chapter.

Key analytical questions:

- Which value chains contribute most to the economy?
- Which value chains have the greatest export relevance?
- Which value chains are most important for food security?
- Which value chains are most critical to the livelihoods of vulnerable and food-insecure populations?

Suggested analytical methods:

- Analyse the contribution of major agrifood products and value chains to agricultural production.
- Assess the economic importance of value chains based on production volumes, value added, and export performance.

- Evaluate the contribution of value chains to national food security, including the production and consumption of staple foods.
- Review recent trends in production, trade, and consumption to identify structural changes.
Suggested data sources:
- National statistics
- FAOSTAT
- Fishery and Aquaculture Statistics – Yearbook
- FishStat

Expected outputs

Output I-5. Agrifood subsector screening

Provides an objective basis for identifying value chains with the greatest economic, strategic and food security relevance. It also highlights trends in production and trade that may indicate emerging opportunities or declining competitiveness, helping to inform the selection of priority value chains.

Use this to decide: the longlist of candidate value chains taken forward to Step IV and the evidence used to include or set aside each candidate. Record the reasoning, not only the result, so that the longlist can be reviewed when priorities or evidence change.

At minimum, compare production or economic importance, food security relevance and climate relevance. Export value, harvested area, livestock numbers, employment, value addition and consumption patterns should be added where they materially affect the ranking.

Indicator	Unit
Production quantity by value chain (current, trend)	tonnes
Area harvested by agricultural product (current, trend)	ha
Livestock numbers by value chain (current, trend)	number of animals
Industrial roundwood production (current, trend)	m^3
Wood fuel production (current, trend)	m^3
Export value by value chain (current, trend)	USD
Main food staples	kcal/capita/day

Output I-6. Candidate value chain longlist

This list records the initial basis for carrying candidate value chains into Step IV. Use qualitative ratings at this stage.

Candidate value chain	Justification

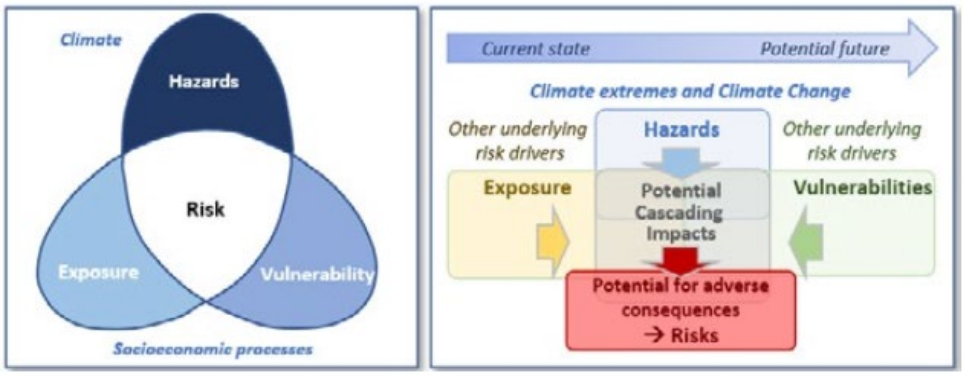
Step II. Climate impacts, risks and vulnerability

This step identifies and characterizes the climate-related hazards, exposures and vulnerabilities affecting the agrifood system and the candidate value chains. It considers acute events, such as

floods, storms and heatwaves, as well as chronic changes, such as rising temperatures, shifting rainfall patterns, salinity and sea-level rise. It also recognizes that climate-related pests, diseases, water stress, infrastructure disruption and market effects may transmit risk across value chain stages.

The assessment should distinguish current risks from plausible future risks and show where, when and for whom impacts are most significant. Climate policy documents can identify national priorities, but hazard characterization should draw primarily on climate risk assessments, national meteorological and hydrological services, observed loss data and credible projections. The result should be sufficiently specific to define the problem a technology is expected to solve and the adaptation or mitigation benefit that will later be claimed.

Figure 3. Climate risk concept (adapted from IPCC, 2014, Working Group II, Figure SPM.1)



Why this step matters: A technology can only be judged against the problem it is meant to solve. Without a structured account of which hazards affect which parts of which value chains, technology selection in Step VII becomes a matter of preference or supplier offer, and the adaptation benefits cannot later be demonstrated to funders who will ask exactly this question.

Decision supported: Which climate risks, in which locations and at which value chain stages, are significant enough to warrant intervention, and which population groups those interventions must reach.

Purpose: To identify the major climate hazards and risks affecting agrifood systems and understand how they impact different value chain stages, geographic areas, and stakeholder groups.

How to apply this step

- Define the baseline period and future time horizons used in the assessment.
- Identify hazards and stressors and describe their frequency, intensity, duration and geographic extent.
- Map exposure across production, storage, processing, transport, marketing and consumption.
- Assess vulnerability and adaptive capacity for different actor groups, including differentiated impacts by sex, age, livelihood and location.
- Rate the significance of each risk using a consistent combination of likelihood, consequence and confidence, and record the evidence behind the rating.

Key analytical questions:

- Which climate hazards affect agrifood systems?
- Which geographic regions are hotspots of climate risks?
- Which climate hazards have historically caused the largest economic losses?
- Which stages of the value chain are most affected?
- Which populations are most vulnerable?
- Which climate risks may create new opportunities?

Suggested analytical methods:

- Identify and characterize the main climate hazards affecting agrifood systems, including drought, floods, rainfall variability, heat stress, storms, salinity, pests and diseases, and slow-onset climate changes.
- Assess both acute climate hazards (e.g. floods, storms, heatwaves) and chronic climate stressors (e.g. rising temperatures, changing precipitation patterns, sea-level rise).
- Analyse climate risks across the entire agrifood value chain (production, aggregation and storage, processing, marketing and distribution, and consumption).
- Identify geographic climate risk hotspots by combining information on climate hazards, exposure, and vulnerability.
- Assess the differential impacts of climate risks on vulnerable populations, including smallholders, women, pastoralists, fishers, Indigenous Peoples, and other at-risk groups.
- Identify potential climate-related opportunities, such as shifts in crop suitability, new production systems, or emerging markets enabled by changing climatic conditions.

Suggested data sources:

- NDCs; NAPs; TNAs; long-term low-emission development strategies (LT-LEDS); National Communications, Biennial Transparency Reports (BTRs)
- National climate adaptation and mitigation strategies
- Climate risk assessments
- National meteorological and hydrological services
- Agriculture, environment, and water ministries or agencies

Use NDCs, NAPs, LT-LEDS, National Communications and Biennial Transparency Reports to understand national priorities and reported impacts. Use climate assessments, loss databases, meteorological and hydrological records, spatial analysis and locally validated knowledge to characterize the hazards and risks themselves.

Expected outputs

Output II-1. Climate risk and vulnerability matrix

Organizes climate risks across agrifood value chains by linking climate hazards to their impacts, affected locations, and stakeholder groups. This helps identify where climate risks are greatest, which actors are most vulnerable, and where climate technologies can have the greatest impact.

Use this to decide: which combinations of hazard, value chain stage and location are severe enough to warrant intervention, and therefore what the technologies selected in Step VII must actually address.

Value chain stage	Climate hazard	Agrifood impact	Geographic coverage	Actors impacted & Social impacts

Step III. Policy, institutional and innovation landscape

This step assesses the enabling environment for climate technology development, adoption and scaling. It reviews climate, agriculture, food security, rural development, science, technology, innovation and investment policies to determine whether they support the candidate value chains and intervention types. It also identifies regulatory requirements, incentives, standards, public services and budget or planning processes that could enable or constrain implementation.

The institutional analysis goes beyond listing organizations. It examines mandates, influence, capacity, coordination, accountability and the ability to reach intended users. It also reviews the agricultural innovation system: research, extension and advisory services, universities, private firms, producer organizations, finance providers, civil society and development partners, including the channels through which Indigenous, endogenous and local knowledge can inform technology design and uptake.

Why this step matters: Technologies fail at the point of adoption far more often than at the point of design. Overlapping institutional mandates, extension systems without reach, and financial institutions that cannot price agricultural risk will stop a well chosen technology as effectively as a technical flaw. Policy support and institutional incentives can facilitate adoption, but long-term sustainability and scalability depend on whether the technology is economically viable for its intended users. Assessing the enabling environment before technologies are selected allows these constraints to be designed around rather than discovered during implementation.

Decision supported: Whether the enabling conditions exist to deploy climate technologies at scale, which constraints must be addressed alongside the technology itself, and which institutions should lead.

Purpose: To assess whether the policy, institutional and innovation environment supports the development, adoption and scaling of climate technologies in agrifood systems, helping to identify institutional gaps, coordination needs and opportunities to strengthen the enabling environment.

How to apply this step

- Identify the policies, laws, plans, incentives and standards that directly affect the candidate value chains and technology types.
- Map the institutions responsible for policy, research, extension, regulation, finance, implementation and monitoring.
- Assess each institution’s mandate, influence, capacity, reach and coordination relationships rather than recording its role alone.

- Identify enabling-environment gaps that must be addressed as part of the technology intervention.
- Validate institutional findings with both duty-bearers and intended users, including producer organizations and underserved groups.

Key analytical questions:

- Which national policies, strategies, and plans address climate change and agrifood systems?
- Which policies explicitly promote climate technologies or resilience-building?
- Which priority value chains or subsectors are targeted by national policies?
- Which institutions are responsible for climate change, agriculture, technology, innovation, and rural development?
- Are institutional mandates clearly defined and coordinated?
- Which institutions lead climate technology implementation?
- Are extension systems capable of supporting climate technology dissemination?
- What role do farmers' organizations and cooperatives play in technology adoption?
- Are farmers' organizations, women, youth, Indigenous Peoples, and other affected groups meaningfully involved and represented throughout the technology adoption process, from assessment to implementation?
- What role do financial institutions play in supporting climate investments?
- Which institutions are trusted by farmers and local communities?
- What national systems support agricultural innovation and climate technology development?
- Which research institutions are working on climate agrifood technologies?

Suggested analytical methods:

- Review national climate, agricultural, innovation, and value chain policies and strategies to identify priorities, policy instruments, and provisions supporting climate technologies.
- Assess policy coherence and alignment across climate change, agriculture, food security, rural development, and science, technology, and innovation agendas.
- Map key institutions responsible for climate change, agriculture, research, technology development, finance, extension, and rural development, including their mandates, roles, and coordination mechanisms.
- Assess the national agricultural innovation system, including research institutions, extension services, universities, private sector actors, farmers' organizations, civil society, and development partners.

Suggested data sources:

- NDCs, NAPs, LT-LEDS, TNAs
- National development plans and climate change strategies
- National agricultural, food security, and rural development strategies
- National science, technology, and innovation strategies and policies
- Commodity- and value chain-specific policies and strategies

Expected outputs

Output III-1. Policy landscape

Identifies the national policies, strategies, and plans that support climate technology development and deployment in agrifood systems. It helps assess whether climate technology priorities are aligned across the policy landscape, while identifying policy gaps, inconsistencies, and opportunities to strengthen the enabling environment.

Use this to decide: whether existing policy supports the intended investment, and which policy gaps must be addressed in parallel for adoption to be possible.

Policy	Measures / Climate technologies promoted

Output III-2. Institutional mapping

Identifies the institutions responsible for developing, financing, regulating, promoting, and implementing climate technologies in agrifood systems. Understanding institutional roles helps clarify responsibilities, identify coordination gaps and capacity constraints, and determine which organizations should be involved in technology development, dissemination, financing, and implementation.

Use this to decide: which institutions should lead, which need capacity support, and where coordination gaps present a delivery risk that has to be managed rather than assumed away.

Institution	Mandate / role

Output III-3. Enabling-environment gaps

Converts policy and institutional gaps into measures that can be costed and carried into the technology package and financing pipeline.

Barrier or gap	Effect on technology uptake	Required action

Decision checkpoint before Chapter 3

Before moving on, confirm that you can answer each of the following. Where an answer is unclear, the prioritization in Chapter 3 will rest on an assumption rather than on evidence, which is acceptable only if the assumption is recorded and can be revisited.

- Can you name the priority subsectors and value chains, and state the criteria on which they were selected?
- For each, can you describe the main climate hazards and the value chain stages they affect?

- Can you identify who is most affected, including women, youth, Indigenous Peoples, and smallholder producers?
- Can you name the lead institutions, and the main policy or capacity constraints they face?
- Where the evidence was thin, have you recorded the assumption made and who validated it?

3. Identifying and prioritizing climate technology solutions

This chapter translates the contextual analysis into priority intervention areas for climate technology investments in agrifood systems. Building on the evidence generated in Chapter 2, it identifies and prioritizes value chains, analyses climate-related bottlenecks and opportunities, assesses market conditions and stakeholder capacities, and selects climate technology options with the greatest potential for scaling and investment. These analyses provide the basis for the investment planning and financing pathways developed in Chapter 4.

What this chapter decides

Chapter 3 is where the field narrows to specific interventions. It takes the evidence base from Chapter 2 and works through four questions in turn: which value chains to prioritize, how those chains actually function and where they are vulnerable, who must act for change to happen, and which technologies address the problems identified. It ends with a prioritized set of technology options supported by a documented rationale, rather than a list of promising ideas.

What you will have at the end

- A documented selection of priority value chains, with geographic scope and written justification (Step IV).
- A map of each chain from production to consumption, showing climate vulnerabilities, bottlenecks and candidate intervention points (Step V).
- An assessment of stakeholder roles, capacities and access barriers, including groups at risk of exclusion (Step VI).
- A prioritized set of climate technology options with expected benefits, trade-offs and required safeguards (Step VII).

This is the analytical core of the toolkit. Chapter 4 converts these outputs into costed investments, so a decision taken here without a recorded rationale will not survive scrutiny by a financing partner.

Step IV. Value chain prioritization

This step compares the candidate value chains identified in Step I and selects a manageable number for in-depth analysis. It combines economic, social, environmental, climate, institutional and market justification so that value chains are not chosen solely because they are large, visible or familiar. The final selection should state both why each value chain was chosen and why plausible alternatives were not.

Why this step matters: Chapter 2 identified a longlist of candidate value chains. This step reduces that list to the small number of value chains that will absorb the analytical effort in Steps V to VII, and everything that follows rests on it. A poor choice here is costly, because what results is not a wrong answer but a well-evidenced answer to the wrong question.

Decision supported: Which value chains are selected for in-depth analysis, over what geographic scope, and on what documented justification.

Purpose: To identify priority agrifood value chains with the greatest potential for climate technology interventions and investment.

How to apply this step

- Confirm the candidate longlist from Step I and remove options that fall outside the agreed scope.
- Validate the selection with a balanced stakeholder group and document the final decision and dissenting views.

Key analytical questions:

- Which value chains are most important for the economy and rural livelihoods?
- Which value chains have strong growth potential or strategic importance?
- Which value chains have the strongest domestic, regional, or international market opportunities, or are strategically important because of import dependence?
- Which value chains offer the greatest potential for value addition and increased competitiveness?
- Which value chains are priorities within national climate and agricultural strategies?
- Which value chains are critical for vulnerable populations?
- Which value chains are most vulnerable to climate change?
- What are the environmental impacts and resource implications of the value chain?
- Which value chains have the greatest potential for climate technology uptake and scaling?

Suggested analytical methods:

- Compile a list of potential value chains using national statistics, policy documents, and market information.
- Assess value chains based on economic importance, contribution to food security and rural livelihoods, climate vulnerability, market opportunities, and potential for climate technology uptake and scaling and summarize the findings in a standardized value chain summary sheet for each candidate value chain.
- Use the summary sheets as the basis for participatory stakeholder consultations to validate the analysis, incorporate local knowledge, and prioritize value chains, ensuring that national priorities and practical implementation considerations are reflected.

Suggested data sources:

- National agricultural and trade statistics
- National climate and agricultural policy documents
- Market studies and commodity reports
- FAOSTAT
- Expert knowledge and stakeholder consultation

Expected outputs

Output IV-1. Stakeholder participation in value chain selection

Describes the key stakeholders involved in selecting priority value chains and clarifies their roles in production, value addition, policy, research, finance, and market development. Engaging a diverse range of stakeholders helps validate the analysis, incorporate local knowledge, build ownership of the results, and ensure that selected value chains reflect national priorities as well as practical implementation and investment considerations.

Use this to decide: who must be involved when value chains are selected, and whose absence would make the selection contestable later.

Stakeholder involved	Role

Output IV-2. Final selection of value chains for in-depth analysis

Documents the final selection of priority value chains and the rationale for their inclusion. Defining the geographic scope ensures that subsequent analyses are targeted to the areas where interventions are most relevant and effective.

Use this to decide: the definitive list of value chains and their geographic scope. Everything in Steps V to VIII applies to this list, so record the justification in enough detail that someone outside the process could follow it.

Use a simple priority classification: High – Value chain is a strong candidate for detailed analysis and climate technology investment due to its high relevance across the assessment criteria. Medium – Value chain shows good potential but is of moderate relevance or requires additional evidence or stakeholder validation before prioritization. Low – Value chain has lower current relevance for climate technology investment or does not sufficiently meet the selection criteria but may be reconsidered as conditions or priorities change.

Value chain	Geographic coverage (national, subnational)	Justification (economic, food security, climate, policy, social criteria)	Priority

Step V. Value chain, intervention-point and market analysis

This step maps each selected value chain from inputs and production to aggregation, storage, processing, marketing, distribution and consumption. It identifies actors, product and information flows, infrastructure, services, technologies, governance arrangements and the distribution of costs, value and risk. Climate impacts and existing responses are located at specific stages so that intervention points can be defined precisely.

The step also includes the market analysis. Users should examine demand trends, prices and margins, buyer requirements, quality and certification standards, market access, competition, value-addition opportunities and the willingness and ability of actors to pay for the technology or

associated service. This market lens helps distinguish interventions that generate a private financial return from public goods or resilience measures that will require grant, public or concessional support.

Why this step matters: A value chain rarely underperforms everywhere at once. Losses concentrate at particular stages, and so do the opportunities to reduce them. Mapping the chain locates the specific points at which a technology would change the outcome, which is what separates a targeted intervention from a general programme of support.

Decision supported: Which intervention points within each chain offer the greatest gains in resilience, efficiency and value, and therefore where technology options should be sought in Step VII.

Purpose: To map selected agrifood value chains, identify climate vulnerabilities and system bottlenecks, and determine priority intervention points for climate technology action.

How to apply this step

- Draw the physical value chain and quantify major volumes, losses, prices, margins and flows where data permit.
- Identify climate impacts, existing technologies, bottlenecks and service gaps at each stage.
- Assess demand, buyer requirements, competition, market access and opportunities for value addition.
- Identify who bears the cost of the problem, who would pay for a solution and who would capture the benefits.
- Prioritize intervention points by combining climate significance, technical need, market opportunity, inclusion and feasibility.

Key analytical questions:

- How do value chains function from production to consumption?
- Which actors, services, and institutions shape value chain performance?
- How is the value chain connected to regional and international markets and supply chains?
- Which stages are most vulnerable to climate risks?
- Where are the major inefficiencies, losses, and technology gaps?
- Which technologies are already in use?
- What are current levels of technology uptake and readiness and related barriers?
- Which indigenous, traditional, or local technologies contribute to resilience?
- Which groups face barriers to technology access and participation?
- Which stages offer the greatest opportunities for value addition and market development?
- Which intervention points offer the greatest resilience, mitigation and investment potential?
- Who can pay, who benefits and where is public or concessional support justified?
- Which business models could support adoption, operation and maintenance of the technology?
- How are prices, margins, demand and buyer requirements changing?

Suggested analytical methods:

- Map each selected value chain to identify stages, actors, product, information and financial flows, supporting services and market linkages.
- Identify climate impacts, bottlenecks, technology gaps, and intervention points across the value chain.
- Assess existing climate technologies, including indigenous and local technologies.
- Using technology databases and stakeholder consultations, identify intervention points and potential technology solutions.
- Use stakeholder interviews, questionnaires and field observations to obtain information necessary for the analysis.

Suggested data sources:

- Agricultural census data; commodity, market, price, trade and logistics statistics
- National value chain studies
- Key informant consultations and field observations
- Climate technology databases and technology assessments

Expected outputs

Output V-1. Value chain diagram with flows and quantitative data

The value chain diagram provides a visual overview of the flow of products, actors and market linkages from production to consumption, complemented by quantitative data such as production volumes, yields, prices, trade flows or post-harvest losses.

Use this to decide: where the chain's volumes, losses and market linkages concentrate, and therefore which stages merit detailed diagnostic attention.

Output V-2. Value chain diagnostic matrix

Assesses each stage of the value chain by identifying climate impacts, existing technologies, bottlenecks, and social considerations. It helps identify where climate technologies can have the greatest impact and provides the evidence needed to prioritize intervention points and technology options.

Use this to decide: which stages combine high climate impact with weak existing technology, since these are the strongest candidates for intervention.

Value chain stage	Key actors	Climate impacts	Existing technologies	Technology gaps / bottlenecks	Gender and social considerations

Output V-3. Inventory of technologies used

Provides an overview of climate technologies currently used across the value chain and assesses their level of adoption, barriers to uptake, and scaling potential. It helps identify opportunities to strengthen and expand the use of climate technologies.

Use this to decide: whether to scale a technology already present in the country or introduce a new one. Technologies with proven local uptake usually carry lower delivery risk, even where their technical performance is not the highest available.

Technology	Value chain stage	Current level	Main barriers / Enabling factors	Scaling potential

Output V-4. Market opportunity and viability matrix

This matrix tests whether the identified intervention has a plausible market, service-delivery or public-benefit pathway. It does not replace a feasibility study, but it identifies the market evidence and business-model questions that must be resolved.

Intervention point / technology need	Prices, margins and value-addition opportunity	Business or delivery model	Market barrier / evidence gap

Output V-5. Intervention point matrix

Links identified problems with potential climate technology solutions and their expected benefits. It helps prioritize intervention points and provides the basis for selecting climate technologies for investment and scaling.

Use this to decide: the prioritized intervention points that Step VII will match technologies to. This output is the direct bridge between diagnosis and solution, and it should be possible to trace every technology later selected back to an entry in this table.

Intervention point	Problem identified	Potential technology solution	Expected climate, economic and social benefits

Step VI. Stakeholder analysis and technology uptake

This step identifies the stakeholders who influence, deliver, finance, use or are affected by the proposed interventions. It assesses their mandates, interests, influence, incentives, relationships, capacities and access to resources. The analysis should include public institutions, research and extension services, producer organizations, technology suppliers,

service providers, financial institutions, buyers, workers, consumers and groups that may not be represented in formal decision-making.

Technology uptake is assessed separately from technical availability. Users should document current adoption levels and distinguish barriers related to cost and finance, information and skills, infrastructure and services, regulation and standards, risk and uncertainty, social norms, labour and time demands, land or asset ownership, digital access and trust. Gender, age, disability, Indigenous Peoples' rights and other equity considerations should be examined in relation to decision-making, access, workload, risks and the distribution of benefits.

Why this step matters: Technologies are adopted by people, through institutions, under existing relationships and constraints. This step establishes who has to act for an intervention to work, who has the capacity to do so, and who is likely to be left out. It is also the point at which exclusion becomes visible early enough to design against, rather than appearing later as an evaluation finding.

Decision supported: Who should lead, partner in and be reached by the intervention, and which access barriers must be addressed for benefits to be shared equitably.

Purpose: To identify key stakeholders and assess how their roles, capacities, and relationships influence the adoption, financing, and scaling of climate technologies.

How to apply this step

- Map stakeholders by role, interest, influence, capacity and relationship to the technology intervention.
- Estimate current adoption and identify who uses the technology, who does not and why.
- Distinguish barriers faced by different groups rather than assuming a single "farmer" or "user" category.
- Identify delivery partners, technology champions, financing channels and institutions requiring capacity support.
- Translate each significant uptake or inclusion barrier into a specific accompanying measure.

Key analytical questions:

- Which stakeholders are involved across the value chain and technology ecosystem?
- What are their roles, responsibilities, and interests?
- How effective are stakeholder coordination and institutional arrangements?
- What barriers and incentives influence stakeholders' ability to adopt, finance, and scale climate technologies?
- Do women, youth, Indigenous Peoples, and vulnerable groups have equitable access to technologies and decision-making?

Suggested analytical methods:

- Map stakeholders across the value chain according to their roles, interests, influence, and responsibilities in climate technology development, adoption, financing, and governance.
- Assess stakeholder capacities, incentives, relationships, and barriers to climate technology uptake through participatory workshops.

- Assess gender equality, social inclusion, and technology justice to identify barriers to equitable participation, access to technologies, finance, information, and decision-making.

  Suggested data sources:

- Government and ministry reports; extension service databases; farmers' organizations and cooperative records; NGO and civil society reports; private sector and agribusiness associations
- Household surveys and socio-economic studies
- Stakeholder consultations

Expected outputs

Output VI-1. Stakeholder mapping

Identifies the key stakeholders involved in the value chain and assesses their roles, influence, capacities, and relevance to climate technology adoption. It helps identify potential implementation partners, technology champions, and capacity gaps that may affect successful technology deployment.

Use this to decide: which organizations to work through, which need capacity support before they can deliver, and who could credibly champion adoption.

Stakeholder	Role	Interest / Influence	Capacity	Technology relevance

Output VI-2. Inclusion assessment

Identifies social groups that may face barriers to accessing climate technologies, helping ensure that technology interventions promote equitable participation and benefit sharing.

Use this to decide: which social groups are most likely to face barriers to accessing and adopting climate technologies, and which constraints should be considered when designing and implementing technology interventions.

Group	Role in the VC	Access to technology	Main constraints

Output VI-3. Technology uptake and barrier-response matrix

This matrix turns adoption barriers into accompanying measures that can be incorporated into the technology package and costed in Step VIII.

User or stakeholder group	Barrier and evidence	Required accompanying measure

Step VII. Selection and prioritization of climate technology options

This step identifies technology options that respond directly to the intervention points, climate risks, market conditions and stakeholder constraints established in Steps V and VI. Options may include equipment, practices, information and digital services, biological materials, infrastructure, standards, organizational arrangements or packages combining hardware, software and orgware. Existing local, Indigenous and endogenous technologies should be considered alongside introduced and emerging options.

Technology selection should compare realistic alternatives rather than justify a preferred option after the fact. Each option should be described in a short factsheet covering its function, target users, value chain stage, climate rationale, maturity, current adoption, costs, operation and maintenance requirements, enabling measures, expected benefits, risks, safeguards and scaling pathway. The analysis should consider life-cycle and system effects, including resource use, emissions, waste, labour, affordability and the possibility of maladaptation or exclusion.

Why this step matters: This is the point the preceding analysis has been building towards. Because the problems, locations, actors and constraints have already been established, technology selection can be argued from evidence rather than asserted. It also guards against the most common failure in technology planning, which is choosing a technology first and assembling the justification afterwards.

Decision supported: Which climate technologies are taken forward for investment, in which value chains and at which stages, and what safeguards or accompanying measures they require.

Purpose: To identify, assess and prioritize climate technology options that address the key climate risks and bottlenecks in selected agrifood value chains. The results provide a basis for selecting priority technologies for investment, implementation and further development into climate technology packages.

How to apply this step

- Generate a broad set of options for each prioritized intervention point using local knowledge, technical sources and stakeholder consultation.
- Eliminate options that do not meet minimum thresholds for climate relevance, technical suitability and legal compliance, or that present unacceptable environmental or social risks.
- Assess the package of equipment, services, skills, finance and institutional measures needed for adoption and sustained operation.
- Validate the preferred options with intended users, technical specialists, implementing institutions and potential financing partners.

Key analytical questions

- Which technologies can address identified climate risks and value chain bottlenecks?
- Which technologies provide strong adaptation, mitigation, resilience, and economic benefits?
- Are technologies technically feasible, scalable, and financially viable?
- Are technologies accessible and appropriate for different user groups and local contexts?

- Which technologies offer the greatest potential for investment and scaling?
- Could climate technology deployment create unintended environmental, social, or economic impacts?
- Which measures or safeguards are needed to minimize risks and ensure equitable outcomes?

Suggested analytical methods:

- Screen and assess climate technology options using technology factsheets and evidence from the preceding analyses.
- Evaluate technologies against technical, economic, environmental, social, and institutional considerations, including climate benefits, scalability, and suitability for local contexts.
- Validate and prioritize technology options through stakeholder consultations, considering stakeholder needs, implementation capacity, and investment potential.
- Assess potential synergies, trade-offs and unintended consequences of climate technology deployment through stakeholder consultations, identifying appropriate safeguards and mitigation measures.

Suggested data sources:

- Information and evidence generated in the previous steps
- Climate technology databases and technology factsheets
- Stakeholder consultations

Minimum technology factsheet information: intervention point addressed; description and operating requirements; target users and scale; climate rationale; technical maturity and local experience; capital and operating costs; expected economic, social and environmental benefits; enabling conditions; operation, maintenance and skills requirements; risks, trade-offs and safeguards; and potential pathway for scaling.

Expected outputs

Output VII-1. Climate technology inventory

Provides a comprehensive overview of technologies applicable to the selected value chain. It provides a clear and evidence-based justification for technology selection and serves as the foundation for investment planning, policy support and technology deployment.

Use this to decide: the technologies that proceed to investment planning in Chapter 4, and the documented reason each was preferred over the alternatives considered.

Use a simple priority classification: High – the technology demonstrates strong climate, economic and social benefits, is suitable for the local context, and has high potential for adoption and scaling; it should be prioritized for investment planning. Medium – the technology shows good potential but requires further evidence, enabling conditions, or stakeholder validation before being prioritized. Low – the technology is currently less suitable because of limited benefits, feasibility, scalability, or alignment with national priorities; it should not be prioritized at this stage. Record the evidence and rationale for every rating.

VC stage	Technology option	Technology readiness	Current adoption level	Climate benefit	Economic benefit	Inclusiveness	Scaling potential	Priority

Output VII-2. Assessment of synergies, trade-offs and safeguards

Identifies potential impacts associated with the implementation of climate technologies. It supports the selection, design, and implementation of climate technologies in ways that maximize co-benefits while minimizing unintended negative impacts through appropriate safeguards and mitigation measures.

Use this to decide: which safeguards, accompanying measures or design changes are required before a technology is deployed, and which trade-offs must be disclosed to decision-makers rather than left implicit.

Technology	Potential synergies	Potential trade-offs	Stakeholders affected	Safeguards / mitigation measures

Decision checkpoint before Chapter 4

Chapter 4 costs and finances what has been selected here, and financing partners will test each of the following. Confirm that you can answer them before proceeding.

- Can you list the priority value chains and justify each selection in writing?
- For each chain, can you name the specific intervention points and the problems they address?
- Can you state which technologies were selected, and which were considered and set aside, with reasons?
- Have you identified the accompanying measures without which the technology will not be adopted?
- Have you recorded the trade-offs, the safeguards required, and the groups at risk of exclusion?

4. Building investment and financing pathways

This chapter translates the priority climate technology interventions identified in Chapter 3 into actionable investment and financing pathways. Building on the assessment of selected value chains, intervention points, and priority climate technologies, it estimates investment needs, assesses investment readiness, and identifies appropriate financing instruments and sources. Together, these analyses support the development of investment bundles and financing pipelines capable of mobilizing public and private investment for resilient and sustainable agrifood system transformation.

What this chapter decides

Chapter 4 answers the final decision in the pathway: what it will take to move from technology priorities to financed implementation. It estimates what the selected interventions cost, tests whether they are ready for investment, matches them to sources and instruments that realistically fit, and assembles the result into a pipeline that can be taken to funders.

What you will have at the end

- An estimate of investment needs across value chain stages for the selected interventions (Output VIII-1).
- An assessment of how investment ready each intervention bundle is, and what is missing (Output VIII-2).
- A mapping of financing sources and instruments to the interventions they realistically suit (Output VIII-3).
- A structured financing pipeline with budgets, responsibilities, timelines and priorities (Output VIII-4).

The pipeline is the toolkit's final planning product. It should provide a credible evidence base for concept notes, national investment plans and discussions with financing partners, while clearly identifying which entries require further project preparation before a funding proposal can be submitted.

Step VIII. Investment planning and financing pathways

This step translates the selected technology packages into preliminary investment plans. It defines the scale and sequencing of each intervention, estimates the full resources required, assesses readiness and risks, and matches the intervention to financing sources and instruments that fit its beneficiaries, cash-flow profile, public benefits and level of maturity. The unit of analysis should be an intervention bundle, not a piece of equipment in isolation.

The output is a pre-investment financing pipeline. Some entries may be ready for concept-note development, while others will require feasibility work, regulatory action, institutional strengthening, market testing, safeguards studies or a delivery partner before they can be presented to a funder. The purpose of the readiness assessment is to make these gaps explicit and sequence the work needed to close them.

Why this step matters: Technology priorities that are not costed and matched to a plausible source of funds tend to remain priorities. This step converts analysis into something a financing partner can act on: a defined intervention, a number attached to it, a named instrument, and an institution accountable for delivery. It is also where proposals that cannot be financed at the scale envisaged are identified, which is far more useful early than late.

Decision supported: Which interventions are taken forward for financing, in what sequence, through which sources and instruments, and what must be done first to make them investment ready.

Purpose: To translate climate technology priorities into investment and financing pathways for scaling climate technologies in agrifood systems.

How to apply this step

- Define the intervention bundle, target users, geographic scale, implementation period and responsible institutions.
- Estimate capital costs, operating and maintenance costs, replacement costs, technical assistance, capacity development, safeguards, monitoring, transaction costs and contingency.
- Assess technical, institutional, market, financial, implementation, climate-rationale and environmental and social readiness.
- Match the bundle to potential grants, public budgets, concessional or commercial debt, guarantees, equity, results-based finance or blended structures, as appropriate.
- Record the financing gap, readiness gap, next preparation action, responsible institution and realistic sequence for approaching financing partners.

Key analytical questions:

- What are the investment needs for priority climate technologies?
- Which financing sources and instruments are available?
- Which financing instruments are most suitable for different technologies and actors?
- What financing gaps exist?
- What barriers and risks affect investment?
- How can financing become more accessible to vulnerable groups?
- Which interventions are investment-ready and scalable?

Suggested analytical methods:

- Estimate investment needs for prioritized intervention bundles, including equipment and infrastructure, operating and maintenance costs, replacement, services, capacity development, safeguards, monitoring, transaction costs and contingency. State the price year, currency, unit costs, scale assumptions and source for each estimate.
- Assess investment readiness by analysing enabling conditions, including regulatory frameworks, institutional capacity, market viability, implementation capacity, and risk management.
- Map available financing sources and instruments, including public finance, climate funds, development finance, commercial finance, blended finance, and private investment.

- Match financing instruments to different technologies, value chain actors, and investment scales based on investment characteristics, risk profiles, and financing requirements.
- Identify financing gaps and opportunities to mobilize additional public and private investment, including measures to improve access to finance for women, youth, smallholders, and other underserved groups.

  Suggested data sources:

- National budgets and investment plans; climate finance facilities; development bank and donor programmes; financial institution reports; GCF, GEF, Adaptation Fund pipelines
- Technology cost databases
- Existing feasibility studies

Expected outputs

Output VIII-1. Investment needs

The investment needs assessment estimates the resources required to implement priority climate technologies across the value chain.

Use this to decide: whether the intended intervention is affordable at the scale envisaged, and where costs concentrate across the chain. If the total is implausible against the finance realistically available, return to Step VII and revise the scope before going further.

Value chain / intervention bundle	(Pre)Production	Aggregation & Storage	Processing	Marketing & Distribution	Consumption	Indicative investment
Value chain (VC) 1	• Equipment • Practices • Skills	• • •				
VC 2	• • •					
VC 3						

Output VIII-1A. Costing assumptions and evidence

Complete this companion table for each intervention bundle so that totals can be updated and reviewed.

Cost item	Unit and quantity	Unit cost / price year	Total	Source or basis	Uncertainty / contingency

Output VIII-2. Investment readiness

The investment readiness assessment evaluates whether priority technology interventions are sufficiently prepared for investment and implementation.

Use this to decide: which interventions can be presented to financing partners now and which require preparatory work first. Presenting an unready bundle usually does more damage to a pipeline than delaying it.

Use a simple readiness classification: High – sufficient evidence and arrangements exist to proceed to concept-note or funding-proposal preparation; Medium – the intervention is promising but specified gaps must be closed first; Low – a fundamental technical, institutional, market, financial or safeguard issue prevents progression at the proposed scale. Record the evidence and next action for every rating.

Intervention bundles	Technical readiness	Institutional readiness	Market readiness	Financial readiness	Investment risks

Output VIII-3. Financing source and instrument mapping

Mapping financing sources and instruments facilitates the identification of mechanisms that fit the intervention's purpose, maturity, beneficiaries, risk profile, scale and capacity to generate revenue or savings. The mapping should distinguish the source of funds from the financial instrument and should record eligibility requirements and preparation steps.

Use this to decide: which source–instrument combination fits each intervention, given its risk profile, scale and the actors involved. Concessional finance, commercial lending, blended structures and grant support are not interchangeable, and matching them badly is a common reason pipelines stall.

Funding sources	Financing instruments	Description

Output VIII-4. Climate technology financing pipeline

The climate technology financing pipeline translates priority interventions into a structured pre-investment portfolio. It records financing needs, potential sources and instruments, implementation responsibilities, timeframes, priorities and remaining readiness gaps, providing a roadmap for project preparation, resource mobilization and coordination.

Use this to decide: the sequence in which interventions proceed to preparation and financing, who leads each one, which financing partner is approached and what must be completed first. Each pipeline entry should be accompanied by a short readiness note and next action so that users who were not part of the analysis can understand its status.

Use a simple priority classification: High – the intervention is strategically important, has strong investment potential, and is sufficiently mature to be advanced as a near-term financing priority. Medium – the intervention has good potential but requires additional preparation, evidence, or enabling conditions before financing should be pursued. Low – the intervention is a longer-term opportunity because significant technical, institutional, financial, or market constraints remain. Record the evidence and rationale for every rating.

Intervention bundles	Financing sources	Financing instruments	Estimated budget	Investment gap	Implementation timeframe	Lead institution	Priority

Decision checkpoint before submission

A pipeline is only as strong as the analysis behind it. Before taking it forward, confirm:

- Can each cost estimate be traced to a stated basis and set of assumptions?
- Is each intervention matched to a source that realistically funds work of that type and scale?
- Is a named institution accountable for each entry, with its capacity assessed in Step VI?
- Have the safeguards and accompanying measures identified in Step VII been carried through into the pipeline entries?
- Are the limitations of the analysis documented, so that reviewers can see what is evidenced and what is judged?

5. Taking the results forward

This toolkit provides a structured methodology for identifying, prioritizing, and financing climate technology interventions in agrifood systems. By linking climate risks, agrifood value chains, technology options, and financing opportunities, it supports evidence-based decision-making and the development of coherent investment priorities.

What you should now have

Applied in full, the toolkit should leave users with a traceable set of outputs from all eight analytical steps:

- Step I – a national agrifood profile and a documented longlist of candidate value chains;
- Step II – a climate impact, risk and vulnerability profile linked to locations, value chain stages and affected groups;
- Step III – a policy, institutional and innovation assessment and an enabling-environment measures;
- Step IV – justified selection of priority value chains and geographic scope;
- Step V – value chain maps, market analysis and prioritized intervention points;
- Step VI – stakeholder, technology-uptake and inclusion analyses with accompanying measures;
- Step VII – prioritized technology packages with evidence, expected benefits, trade-offs and safeguards; and
- Step VIII – costed intervention bundles and a pre-investment financing pipeline with readiness gaps and next actions.

Where an output cannot yet be supported, the gap should be recorded rather than concealed. A clearly stated gap is a useful result: it shows what must be investigated, validated or prepared before an intervention advances.

The methodology is intended to be applied sequentially and adapted to national and subnational contexts. As new information becomes available, technologies evolve, and policy priorities change, the analysis can be updated to refine technology priorities and investment pathways.

The outputs provide a foundation for mobilizing finance, strengthening collaboration and integrating climate technology priorities into national and subnational plans and programmes. They should be updated as evidence improves, technologies evolve, policy priorities change and preparation work closes the gaps identified in Step VIII.

Next steps

- Commission the technical, market, economic, environmental, social and gender studies required for the highest-priority pipeline entries;
- Develop concept notes and funding proposals, including a quantified climate rationale, implementation arrangements, safeguards and results framework;
- Integrate the results into national, subnational and sectoral planning and budgeting processes;

- Confirm implementing and financing partners, sequence preparatory actions and update the pipeline as interventions progress.

Annex A. Reference documentation and tools

The annexes provide practical resources to support application of the toolkit. They include templates, examples, reference materials and additional methodological guidance that complement the analytical steps presented in the main text.

Chapter 2. Establishing the evidence base

Step II. Climate impacts, risks and vulnerability

- Zebisch et al. (2023). Climate Risk Sourcebook.

Chapter 3. Identifying and prioritizing climate technology solutions

Step IV. Value chain prioritization

- Value chain summary sheet template (to be developed)
- Stakeholder consultation guidance and facilitation template (including objectives, suggested participants, discussion questions and a provisional agenda) (to be developed)
- Walker, C., DeMatteis, L. and Lienert, A., eds. 2021. Selecting value chains for sustainable food value chain development – Guidelines. Rome, FAO.

Step V. Value chain, intervention-point and market analysis

- Value chain diagram example (see Annex B, Output V-1)
- Stakeholder interview template (to be developed)
- Technology uptake questionnaire (to be developed)
- Technology database: FAO (2021); FAO (2025); Alvar-Beltrán (2021); WIPO (n.d.); WIPO (2022); CTCN; Clements et al. (2011); Uprety et al. (2012)
- FAO & UNIDO (2024); FAO (2016)

Step VI. Stakeholder analysis and technology uptake

- Wageningen University & Research (2024)

Step VII. Selection and prioritization of climate technology options

- Stakeholder consultation guidance and facilitation template (including objectives, suggested participants, discussion questions and a provisional agenda) (to be developed)
- Technology factsheet template (including type, value chain stage, climate impact addressed, description and target users) (to be developed)
- FAO (2021)

Chapter 4. Building investment and financing pathways

Step VIII. Investment planning and financing pathways

- Green Climate Fund. Investment framework and policies on financial instruments.
- Description of common financing instruments (to be developed)
- Indicative guide to instrument matching
  The examples below are indicative, not prescriptive. Instrument choice depends on national rules, fund eligibility, affordability, risk allocation and the economics of the specific intervention.

Intervention characteristic	Potential instrument or support	Typical rationale / caution
Public good, policy reform, early-stage capacity or non-revenue-generating adaptation	Grant or public budget	Appropriate where benefits are broad and cannot be captured as cash flow; avoid using scarce grant finance for commercially viable activities.
Revenue-generating activity with affordability constraints or a long payback period	Concessional loan or blended finance	Concessionally should address a demonstrated barrier and not displace finance available on reasonable commercial terms.
Viable borrower or project constrained by perceived or collateral risk	Guarantee or risk-sharing facility	Useful where risk allocation, rather than underlying economics, prevents lending; requires capable financial intermediaries.
Growth-stage enterprise with scalable commercial model	Equity or patient capital	Suitable where investors can share risk and returns; requires governance, exit and ownership considerations.
Proven cash flow and manageable risk	Commercial debt or leasing	Requires repayment capacity, affordability and appropriate tenor; may be unsuitable for the poorest users without complementary support.

Core methodological references

- FAO. 2024. Climate technologies for agrifood systems transformation: Placing food security, climate change and poverty reduction at the forefront. Rome. DOI: 10.4060/cd2877en.
- UNFCCC. Technology Needs Assessment guidance, including the TNA step-by-step guide and guidance for Technology Action Plans.
- Walker, C., DeMatteis, L. and Lienert, A., eds. 2021. Selecting value chains for sustainable food value chain development – Guidelines. Rome, FAO. DOI: 10.4060/cb7623en.
- FAO. 2022. Assessing agricultural innovation systems for action at country level: A preliminary framework. Rome.
- FAO. 2022. Climate resilience and disaster risk analysis for gender-sensitive value chains: A guidance note. Rome. DOI: 10.4060/cc0051en.
- IPCC. 2022. Climate Change 2022: Impacts, Adaptation and Vulnerability, including the AR6 glossary and risk framework.
- Green Climate Fund. Investment framework, investment criteria and guidance on financial instruments and project preparation.

- ADEME. 2019. Comment développer sa stratégie d'adaptation au changement climatique à l'échelle d'une filière agroalimentaire?
- UNEPCCC. 2024. TNA step-by-step Guide (second edition) - A guidebook for countries preparing Technology Needs Assessments and Action Plans

Illustrative case-study placements

Toolkit section	Case study content
Chapter 2, Step I (subsector screening)	Agricultural labour and mechanization: illustrate a rapid decline in the agricultural labour force and the resulting pressure to mechanize, while agriculture remains central to rural livelihoods.
Chapter 2, Step II (climate impacts, risks and vulnerability)	Compound climate vulnerability: illustrate the share of agricultural losses attributable to floods and droughts and the effect of high temperature anomalies on crop water demand.
Chapter 2, Step III (policy, institutional and innovation landscape)	Policy alignment: show how national policies and institutional arrangements support or constrain technology deployment.
Chapter 3, Step V (value chain, intervention-point and market analysis)	Value chain bottlenecks: illustrate how inadequate equipment, infrastructure or services constrain value chain performance and investment.
Chapter 3, Step VII (selection and prioritization of climate technology options)	Technology deployment: show how a selected option, such as solar-powered irrigation, is introduced, adopted and scaled.