



# Theories of change for tracking climate change adaptation

A quick reference guide

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**AICCRA**  
Accelerating Impacts of CGIAR  
Climate Research for Africa

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# 1. More than indicators

Recent assessments of global progress toward climate goals highlight the necessity and urgency for accelerated climate action across sectors, geographies, and political scales (IPCC, 2022; GCA, 2022). However, the gap between adaptation investment flows and needs remains high, especially in the agri-food sector (Campbell, 2022; UNEP, 2021; Laborde et al., 2020). As calls for increased investment in climate change adaptation increase, actors comprehensive understanding of adaptation goals, targets, and the most effective pathways to achieve them.

Adaptation to climate change is a process that builds the ability to adjust one or many aspects of a human system, as a way to persist and thrive through current and future climate impacts (adapted from IPCC, 2022). In contrast to climate change mitigation, where clear pathways to decrease global warming exist, climate change adaptation is determined by many distinct factors and can yield distinct outcomes and goals across time and space. These include changes in vulnerability to climate shocks, in resilience to short- and long-term climate variability, and in human health and well-being, among others.

Monitoring and Evaluation (M&E) of adaptation helps to build the evidence base for how different interventions can reach different goals of adaptation across time. M&E activities also deliver information on the effectiveness of investing in adaptation, which is critical for building the business case for increased public and private adaptation finance. While adaptation M&E places a heavy focus on identifying indicators for tracking and assessing adaptation, additional elements are needed to ensure adequate M&E process.

Theories of change (ToC) lie at the heart of any robust M&E plan. They lay out desired and describe context-specific pathways to achieve these. ToCs articulate assumptions on how resources and actions lead to desired results and impacts, thus representing an important tool to detect possible maladaptation or equity concerns early in the intervention design process. ToC originate in the evaluation and programme theory in the 1960s and have been used consistently to outline assumptions about why and how projects work. More recent applications to the climate change field have allowed to address aspects of impact and outcome attribution to specific interventions.

This document provides a quick reference guide on using theories of change in monitoring and evaluating adaptation to climate change. The reflections are based on learnings from applying climate adaptation M&E tools in different investment contexts (subnational, national). The notes provide definitions and explanations of key elements to consider in theory of change design and review and provide annotated collections of useful resources for deep dives. We illustrate the practical application of ToCs through case studies from Zambia and Ethiopia. The document is relevant for actors engaged in any adaptation cycle, from planning and implementation, to monitoring, evaluation, and reporting.



## 2. Theories of change explained

A **theory of change** represents a systematic approach to define goals and objectives, and to map implementation strategies and resources required to achieve desired impacts. Relationships between these theory of change elements are also known as impact pathways.

M&E activities help to measure if and how the different elements element of the theory of change occurred. **Monitoring** looks at whether inputs, activities and outputs were achieved throughout project or program implementation. **Evaluation** collects evidence about whether and how outputs led to intended outcomes and impacts. There is a temporal element to M&E – monitoring is needed while programs are underway to ensure that investments are being used as planned. Evaluation can happen before (ex-ante) or after (ex-post) a project or program, to determine expected or observed changes from activity implementation.

A theory of change moves beyond listing activities or outputs. It starts with robust goal-setting

that is then detailed through a consultative process to determine how a project, organization, or country is going to achieve those goals. Developing a theory of change that includes multiple goals and associated pathways creates a framework within which to identify challenges, needs, and resource gaps, and the key investments necessary to achieve impacts that address these needs.

The **adaptation cycle** provides a helpful starting point for understanding the different elements of a theory of change, how they relate to the wider M&E process, and the resources needed to support inclusive and transparent planning and implementation processes (UNFCCC, 2022). In Figure 1, the first two steps in the adaptation cycle (blue circles) refer to the design of a theory of change, while the last two steps (green circles) refer to the periodic review (or testing) of the theory of change, to ensure robustness and relevance.

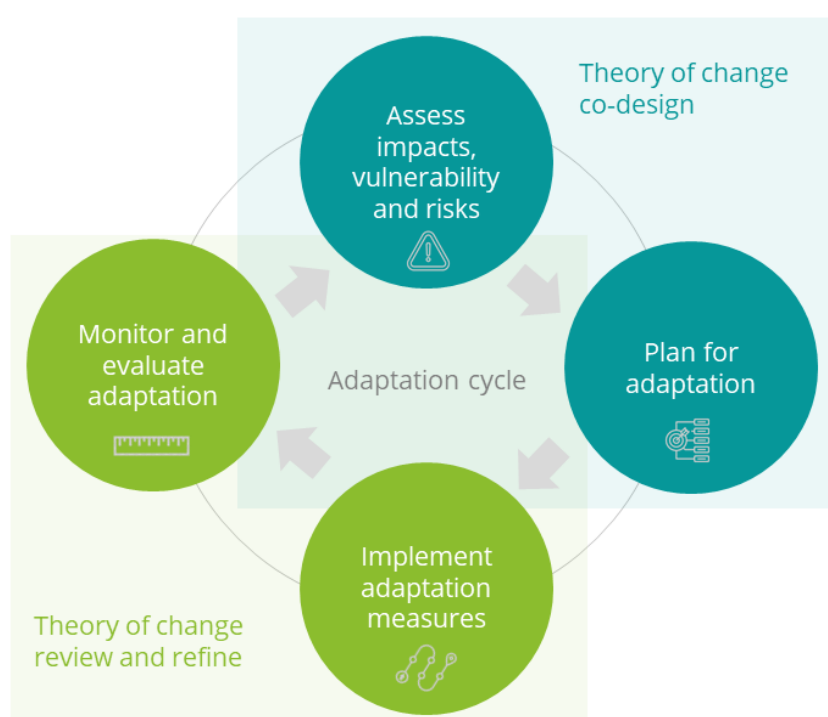


Figure 1. The adaptation cycle. Adapted from UNFCCC (2022)

Assessing current climate **vulnerability and risks** associated with it is a first step toward identifying adaptation needs. A theory of change helps to generate a **plan** for adaptation that defines impact pathways, from identified challenges (or the status quo) to desired impacts (goals, objectives). Once an adaptation theory of change is in place, the adaptation cycle moves to **implementation**. Testing the theory of change through continuous M&E helps to ensure delivery of expected results, outcomes, and goals, and facilitates learning and adaptive management of interventions.

**Stakeholder active engagement** in ToC design and testing is a key prerequisite for effective use of ToC in planning, monitoring and evaluation. Stakeholders may range from individuals and groups working on programming, budgeting and finance, to technical work and beneficiaries. The purpose of engaging stakeholders early on in the process is to agree on harmonized, **consistent definitions** for adaptation and related concepts; to build shared understandings of existing and potential challenges to address; to set **a common vision** for adaptation and **possible pathways** to address them as way to reach desired goals and mitigate challenges.

**Data and information** are also critical in the design and testing stages. Baseline data is important for long-term goal and target setting; future projections and evidence of interventions and pathways that can lead to intended impacts are necessary to demonstrate results and impacts. **Dedicated timelines and budgets** are important to make ToC operational. Traditional M&E budgets of up to 5% of total investment budget might not be enough if ToC will draw on extensive stakeholder consultation and engagement processes; this is especially true for large program or policy operating at national scale, where consensus and buy-in is required from very diverse stakeholder groups. Engaging stakeholders and agencies can also be time intensive. Putting in the time on the front end, however, can lead to a more robust and detailed theory of change and increase the success of M&E in the long run.



## Why theories of change for adaptation?

**Incorporate flexibility.** Climate change adaptation is set within a high degree of uncertainty about how climate change will unfold. Changes in climate are highly unpredictable and adaptation depends on and impacts many different parts of the social and political system. Being based on narratives about possible and desired futures and detecting a range of suitable pathways to these futures, ToC offer flexibility in planning. Planners are able to test ToC through continuous M&E and to periodically refine ToC, thus allowing them to incorporate new information and context as they emerge (OECD, 2014).

**Integrate multiple goals and perspectives.** A ToC makes assumptions explicit about causal relationships across elements of the change process. Thus, it is a useful tool for taking an integrated rather than sector-specific approach to setting adaptation goals and working backward through the process to define which sectors and pathways among them can effect change (Vaughn and Frankenberger, 2018). This lens is necessary because adaptation interventions influence multiple climate and development outcomes across sectors and multiple actors from

different sectors are needed to implement these. Also, some adaptations generate mitigation co-benefits and those can be maximized by understanding how the co-benefits are generated. By mapping causal chains and assumptions to these relationships, ToCs represent the go-to

**Plan consistently.** Developing ToC as the first step to a robust M&E plan for adaptation is necessary to enable learning on the long time-horizons associated with adaptation impacts. For example, having consistent indicators of outcomes and impacts over time will allow for more detailed and consistent reporting on additive or aggregate impacts. It can also help identify emergent challenges or ways in which individual adaptation projects and programs might be cancelling out or otherwise at odds with one another's intended impacts.

### Box 1. Resources for deep dives

**Vogel (2012)** discuss the including origins and functions of theories of change. The document also includes details about theory of change elements, steps, types of evidence needed and applications in the context of international development programming.

**De Bours et al (2014)** provide additional guidance and motivations for using theories of change in climate change adaptation programming. They explain key differences with logic framework approaches and provide solutions on how to address some of the challenges linked with designing and operationalizing ToCs.

**Module 3 of the M&E training package** developed by the NAP-Ag Programme focuses on developing Theories of Change for adaptation in the agriculture sector, aimed at building capacity on design of M&E for national plans and strategies. The material is tailored for use in a 2–3-day training workshop.

# 3. Elements for co-design

As highlighted in previous sections, elements that provide the foundation for the design of adaptation theories of change include hazards, risks and vulnerabilities; goals and objectives; pathways to impacts, and assumption. These are discussed in more detail below.



## HAZARDS, RISKS, VULNERABILITIES

Adaptation ToCs start with a comprehensive description of the climate context. This includes assessment of specific climate hazards, risks and vulnerabilities affecting individuals, communities, regions, or sectors.

Ideally, climate risks and vulnerabilities should be characterized in terms of **extent, intensity, and impacts** on specific types of people or communities using data and evidence from the same or similar contexts. These data should be **disaggregated**, whenever possible, by sex, age, and other social characteristics that can affect both vulnerabilities and the ability to adapt.

Taking a **data-driven approach** to defining challenges can provide a starting point for identifying **adequate metrics** and indicators of success, and it can also help to prioritize where to target resources (see next elements below).



## GOALS AND OBJECTIVES

Further, adaptation ToCs map out a long-term adaptation vision (goal) and desired changes occurring on the short and medium term (outcomes, objectives).

Goals and objectives should reflect an **improvement** from the current situation and that directly address identified risks and vulnerabilities. For example, increased resiliency to drought or decreased climate-related mortality

represent examples of impact frameworks around which ToC elements can be organized.

Using **participatory process** to engage a wide range of stakeholders can set the foundation for a ToC process that builds a common vision for adaptation and ensures buy-in across sectors, organizations, and level of action.

Adaptation goals should **echo broader national targets, commitments, and plans**, to ensure alignment with high-level priorities and reporting processes. Whenever possible, adaptation goals should consider climate change mitigation and development **co-benefits**. This cross-walking of goals early in the ToC design can then support the development of an M&E plan and results framework that draws on existing indicators and metrics.



## PATHWAYS TO IMPACT

Defining the pathways to impact represents a starting point for **prioritizing resources and actions** most likely to lead to desired objectives and goals. Moreover, it helps to articulate and interrogate causal assumptions on how resources translate into actions, outputs, and outcomes.

**Working backward** from strategic priorities to define impact pathways is the core theory of change process. It takes time, human capacity, and access to information (see text box above).

The process should be as **participatory** as possible while still allowing for a process that leads toward prioritization and decision-making.

As much as possible, impact pathways should reflect **existing evidence and knowledge** base about specific contexts and sectors. Whenever possible, the ToC should draw on analyses and evidence that focus on the possible trade-offs and synergies between certain outputs and outcomes.





## ASSUMPTIONS

Articulating key assumptions, enabling conditions, and other contextual details that underlie a theory of change represents a key step in moving from design into the operationalization of the adaptation theory. These key assumptions could be related to changes in the future that will coincide with program or policy implementation and thus could help or hinder the impact pathways. Enabling conditions are similarly a description of characteristics of the overall system within which investments are being made that are necessary to support or facilitate movement along the impact pathways.

Stakeholder engagement and ground-truthing is a time-intensive but important and effective way to define and describe the key assumptions built into the theory of change. Beginning to build out a monitoring and evaluation plan or undertaking a structured process (like a SWOT (strengths, weaknesses, opportunities, threats)) analysis of possible risks that could undermine impact can also help identify contextual factors that could affect the efficacy of impact pathways (Abanda et al., 2022).





## Box 2. Resources for deep dives

There are many tools to support the identification of theories of change elements. Below we highlight some examples that are relevant in the context of adaptation. The list is not definitive but is aimed to provide initial guidance on materials that can inform ToC design for investment and policy.

### UNFCCC guidelines for risks and vulnerability assessments

The Consultative Group of Experts (CGE) of the United Nations Framework Convention on Climate Change (UNFCCC) has developed extensive training materials to support many types of risk and vulnerability assessments. Chapter 2 of the recently updated **Training Materials on Vulnerability and Adaptation Assessment** provides an overview of common vulnerability assessment frameworks and methodologies. These training materials have been developed to support Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs), which include requirements for a detailed assessment of the current context and most extreme challenges.

Examples of vulnerability assessments and frameworks applications in national policy can be found at the **NDC Registry** and **NAP Central**. These repositories collect submissions of country's Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs).

### Repository of adaptation data from African NDCs and NAPs

The Alliance of Bioversity and CIAT, in collaboration with partners, mapped adaptation goals, objectives, targets, actions, and indicators used by African countries to report on adaptation. The **Adaptation Reference System** collects information from 53 Nationally Determined Contributions (NDCs) and 8 National Adaptation Plans (NAPs) and can be used as guide to framing adaptation theories of change aligned with national priorities (Nowak et al., 2022). An update of the dataset will be published in 2023.

### Impact pathways and prioritization

For example, the **Food Systems Dashboard** and the **Innovative Food Systems Solution portal** provide resources and tools to compare potential impact pathways of different investments and activities to support food system adaptation goals.

The **Evidence for Resilient Agriculture (ERA) database** provides a synthesis of existing scientific evidence on the relationships between activities meant to build resilient or climate-smart agriculture systems and the outputs and outcomes of those activities. The evidence in ERA and other databases like the Food Systems Dashboard provide an important validation of impact pathways explored in the theory of change process.

## 4. Review, refine, repeat

An adaptation theory of change reflects an understanding of why and how to invest in adaptation to achieve long-term goals. However, because processes are dynamic and systems are non-linear, theories of change need to be reviewed (or tested) and refined over time.

Ongoing stakeholder engagement should also be used to test and confirm the assumptions built into impact pathways. However, once a theory of change is designed and begins to be used to guide policy, programming, or other decisions making, further review can come from an even wider set of actors, and testing will happen as the theory of change is applied in the real world. Refining the steps, the impact pathways, and the assumptions underlying a theory of change should be an ongoing process that involves both input from many types of actors and accumulated evidence of success and impact.

Reviewing a theory of change once it has been developed can happen through ongoing formal consultation and stakeholder engagement, as well as through informal or on-the-ground conversations about the utility and accuracy of the

impact pathways. Testing the assumptions and relationships built into the theory of change as well as the views and reflections of stakeholders should happen as much as possible through the monitoring and evaluation process. This is one reason for designing a robust set of indicators and metrics that situate a results framework within the broader theory of change, in order to provide the evidence needed to test assumptions, identify synergies and trade-offs, and further refine understanding of how best to support adaptation process in a specific context.



### INDICATORS, METRICS, RESULTS FRAMEWORKS

Adaptation indicators and metrics are key elements for the operationalization of the theory of change. They represent key tools to assess implementation of actions and processes, achievement of outputs, outcomes, and goals. While an indicator refers to the adaptation dimension to be measured, the metric establishes the actual measurable unit of change.

A common way to distinguish between adaptation indicators is by their monitoring and evaluation function. Indicators of input measure resources needed to implement adaptation (e.g., finance, human resources, etc.). Process indicators measure the extent of implementing adaptation policy processes and governance structures needed for adaptation (e.g., adaptation plans, coordination units, etc.). Output indicators measure immediate results from adaptation activities (e.g., beneficiaries of activities, areas covered by the activities, etc.). Outcome indicators measure effects of the outputs or the level of success of activities in addressing climate risks (e.g., food security, soil health, etc.).

Whenever possible, indicators and metrics for adaptation should draw from existing results frameworks or related sets of indicators, to avoid data burden. If no results framework



**Table 1. Snapshot of a results framework for climate-smart livestock investment in Ethiopia**

TOC function	Indicator	Metric	Climate-smart agriculture pillar	Link to existing M&E system
Output	Improved value addition in livestock value chain	Increase in number of value chain actors trained	Adaptation	Ethiopia Green Climate Fund (GCF) proposal includes enabling environment indicators like increases in knowledge and capacity.
Outcome	Increased livestock efficiency	Improved dairy output (liters/cow/day)	Productivity; Adaptation	Ethiopia NDC commits to improved productivity in the livestock sector and reduction in post-harvest losses.
Impact	Reduced GHG emissions	Amount of CH <sub>4</sub> emissions from livestock reduced (tons)  Amount of N <sub>2</sub> O emissions from livestock reduced (tons)  Amount of CO <sub>2</sub> emissions from livestock reduced (tons)	Mitigation	Ethiopia NDC sets goal to reduce GHG emissions by at least 68.8% by 2030 and to reduce per-unit livestock emissions.  Ethiopia GCF results framework sets goal of reduced GHG emissions.



exists for an appropriate context or scale, a results framework should be built that includes indicators and metrics from each individual element in the theory of change, as well as from each pathway linking these elements.

A results framework provides an operational plan for monitoring and testing the adaptation theory of change. A results framework defines indicators (measurable categories of achievement) and metrics (quantified or measured indicators, usually calculated to show change) for each step in the theory of change. Whenever possible a results framework should also link indicators and metrics to existing M&E systems as well as to other development priorities in order to align overall impact reporting across investments and plans.

Table 1 below provides an example of a results framework for investments in climate-smart livestock production in Ethiopia. Each indicator and metric is associated with a step in the ToC and with one or more pillars of climate-smart agriculture. Each indicator and metric is also linked to an M&E framework for an existing national plan.



### Box 3. Resources for deep dives

Monitoring and evaluation plans, which include definition of indicators and metrics as well as the analytical processes used to test the assumptions and efficacy, can take many forms and approaches. Below we offer examples of resources that can guide additional deep dives into these topics.

**The Good Practice Study** prepared by the Climate-Eval Community of Practice on evaluation of climate change and development offers detailed explanation of indicators, metrics, and measures in the context of M&E of climate change adaptation (Climate-Eval, 2015). In addition, it provides detailed classifications of adaptation indicators, with examples.

The **Adaptation M&E Toolbox**, developed by GIZ, provides guidebooks and templates for selecting and collecting adaptation indicators as part of an M&E process for adaptation at the project or national plan level. The tools offer detailed guidance on the next steps after a theory of change is complete. This includes identifying indicators, creating a plan for data collection and analysis that supports both monitoring implementation and evaluating impact, and linking outcomes across projects up to the national level (GIZ, n.d.).

Some NDCs and NAPs have already started identifying adaptation indicators and metrics. They can represent useful frameworks for guiding investment-specific results frameworks. The **Adaptation Reference System** collects information from 53 Nationally Determined Contributions (NDCs) and 8 National Adaptation Plans (NAPs) and can be used as guide to framing adaptation theories of change aligned with national priorities (Nowak et al, 2022). An update of the dataset will be published in 2023.

**UKCIP** (formerly the United Kingdom Climate Information Programme) provides tools and examples of how to move from the theory of change process to a monitoring, evaluation, and review plan that is iterative and reflects the adaptation process. (UKCIP, nd)

**Dinshaw et al (2014)** discuss aspects of attribution and long-term horizons in M&E of adaptation. In addition, they present different techniques for setting adaptation targets and establishing baselines in complex contexts.

## 5. Adaptation theory in practice

### Measuring climate-smart agriculture benefits of agri-businesses in Zambia

The Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) program focuses on making climate information services, including technology, advisory services, and data, more accessible to smallholder farmers to support improved decision-making and resilience. In Zambia, the AICCRA Zambia Accelerator Program is working with agri-business partners to scale a set of climate-smart innovation bundles that produce and/or commercialize climate-smart inputs (e.g., animal feed, organic fertilizers, solar irrigation pumps), finance products, or agriculture and climate advisory services.

To support impact measurement, AICCRA strengthened capacities of innovation bundle teams to co-design theories of change and

impact pathways for each of their investments. These help to articulate a vision for impact and offer a holistic perspective of the change process. ToCs have built-in flexibility; teams can periodically adjust the impact narrative (e.g., pivot to new impact or outcome areas, adding new core activities, etc.), and so respond to changing, unforeseen future circumstances.

Most importantly, ToCs set the foundation for defining fit-for-purpose metrics and methods to assess these. In 2023, innovation bundle partners will work closely with the AICCRA Zambia team to select relevant metrics that meet their impact priorities and needs. Monitoring plans will be designed and implemented and a baseline for impact evaluation will be established (Dahl, 2022)



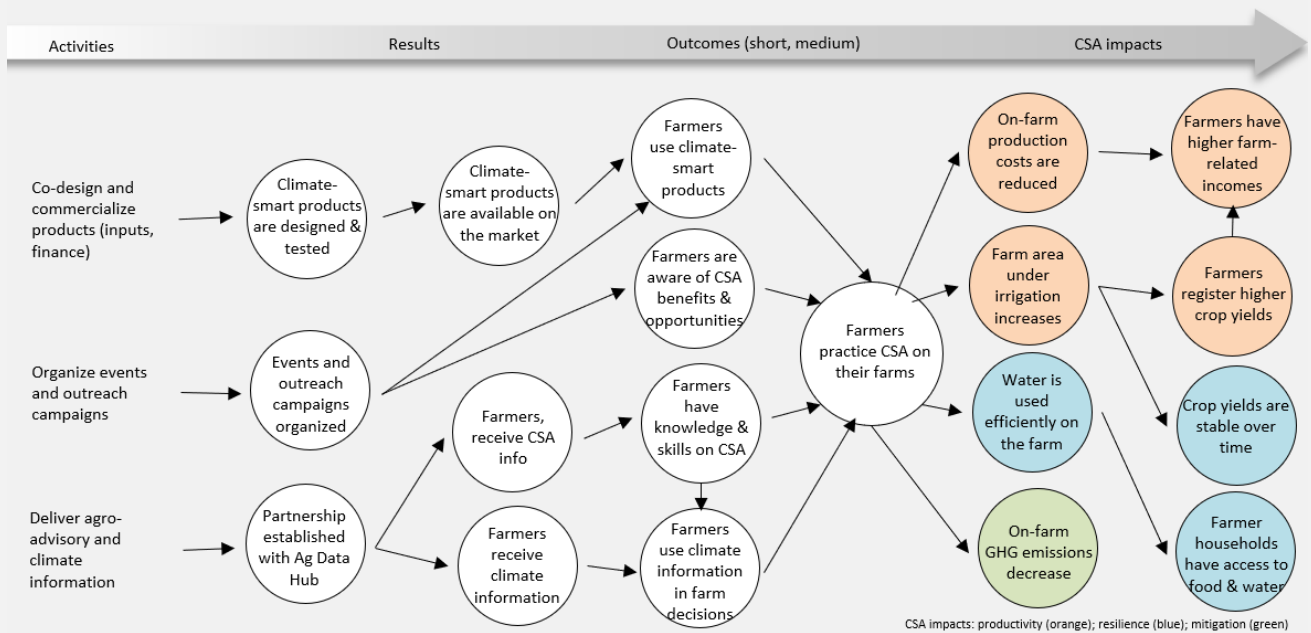


While innovation bundles have unique value proposition, they focus on similar results and outcomes, unleashing, to various extents impacts for Zambian smallholder farmers. Innovation bundles focus on three investment areas: product design and sales, communication and outreach; and information dissemination.

CSA, as well as improved access to information. All these outcomes will be critical for increasing on-farm uptake of CSA and for unlocking long-term benefits (e.g., agricultural yields, incomes, jobs, access to food and water, or reduced greenhouse gas emissions).

These will help to secure financial returns for the SMEs, but also improve access to productive and financial resources, enhanced awareness, knowledge and skills on

**Figure 2. High-level impact narrative of the Accelerator programme on CSA, drawn from each bundle-specific ToC.** Source: Dahl (2022)





# Monitoring and Evaluating Ethiopia's Climate Smart Agriculture Investment Plan



Over the past five years, the World Bank has invested in a set of Climate-Smart Agriculture Investment Plans (CSAIPs) for countries across sub-Saharan Africa and Asia. Each country's CSAIP is a set of investments that have been identified and prioritized through stakeholder consultation processes. Here, stakeholders identify key investments that could be conceptualized as a single project and then develop a theory of change for how each climate-smart agriculture practice would lead to impacts on the three pillars of CSA – productivity, mitigation, and resilience.

These theories of change for individual investments or projects can also be used to generate a higher-level theory of change that identifies the most commonly planned-for inputs, actions, and outputs across multiple projects.

The AICCRA program has been supporting the development of systematic and comprehensive theories of changes and monitoring and evaluation plans for several countries' CSAIPs. Developing synthetic and high-level theories of change for climate change adaptation at the national level is especially important to track the overall impact of projects, programs, and investments being made by many different types of actors (Nowak et al., 2019).

The process to develop the Ethiopia theory of change included several rounds of stakeholder workshops (see Eshete et al., 2020) which led to initial drafts of individual theories of change for each CSAIP investment and then the development of an integrated theory of change and results framework at the investment portfolio level.

**Figure 3. Ethiopia climate-smart agriculture investment plan theory of change**

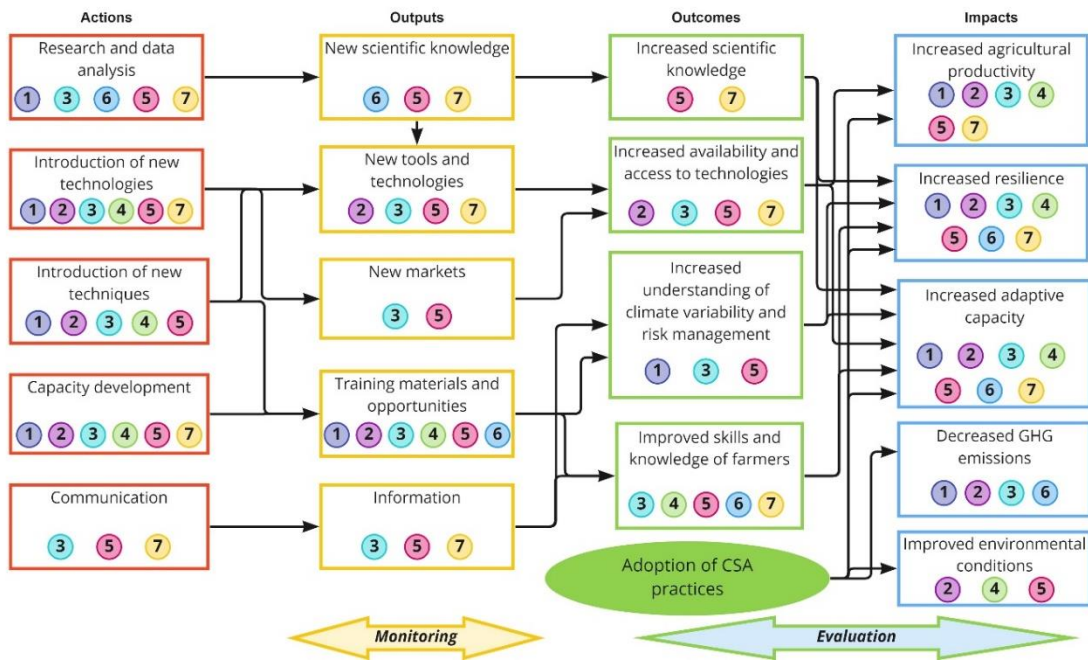


Figure 3 shows a theory of change for Ethiopia's CSAIP, with the actions, outputs, outcomes, and impacts of specific investments organized into more general categories. Understanding how multiple projects and development efforts fit into a broader adaptation agenda can enable systematic tracking of resource flows as well as learning across contexts about intended impact pathways and their actual efficacy.

For example, the figure highlights the relatively large number of projects putting resources into new technologies and capacity development for producers, and relatively few projects focused on communications.

Relatively small investments in communication about CSA techniques and technologies could lead to less social acceptance and thus adoption at a broad scale, which would in turn limit the impacts of the technology development. If such a pattern was seen across many countries or contexts, a new emphasis on communication might emerge as an important action to take in conjunction with CSA investments.



## 6. Final considerations

Climate change adaptation programs and policies often start with big-picture goals that can be achieved in many different ways depending on the current context and intersecting priorities for development and climate change mitigation.

Moving from high-level goals to concrete plans and pathways to achieve impact can be facilitated by undertaking a process to develop an adaptation theory of change. The theory of change must include a level of detail at each step in the impact pathway that matches the program or policy for which it is being developed.

Key stakeholders that represent actors at each step of the theory of change as well as those that can enable overall implementation processes should be engaged from the outset.

Finally, an adaptation theory of change must move from goals to plans to measurable indicators and metrics of success, in order to increase transparency, document progress, and incentivize investments in adaptation activities across sectors.



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