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Practical Guideline

Tool for Process-Based Assessment of Scaling Pathway Outcomes

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To learn more about the CGIAR Scaling for Impact (S4I) Program, please contact: scaling@cgiar.org

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About CGIAR Scaling for Impact (S4I) Program

Scaling for Impact (S4I) is a CGIAR program (2025–2030) that tests, refines, and scales innovations in food, land, and water systems. It works to align those innovations with stakeholders' needs to achieve transformative impact.

Website: <https://www.cgiar.org/cgiar-research-portfolio-2025-2030/scaling-for-impact/>

About CGIAR

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Back cover photo: Woman farmer, Northern Region, Ghana. (photo: Barbara van Rijn)

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Tool for Process-Based Assessment of Scaling Pathway Outcomes

About the tool

Purpose of this tool

The Process-Based Assessment of Scaling Pathway Outcomes (PATHs) provides guidelines to assess a scaling process as it unfolds. It examines what is being scaled, how scaling is taking place, what outcomes are emerging, what factors influence progress, and how the approach is adapted over time. The tool helps users map the scaling process, link activities to outcomes, define indicators, track adaptations, and assess why change is happening. The result is a clearer, evidence-based understanding of what is working, what is not, why, and what should be adjusted to strengthen current and future scaling.

Who is this guideline for

- Development project implementation teams responsible for scaling agricultural, water, or food systems innovations
- Researchers and M&E specialists designing or carrying out process-based scaling assessments
- Financial institutions, impact investors, and blended-finance actors supporting scaling initiatives
- Government agencies, departments, and ministries overseeing or co-financing scaling programs
- Private sector actors participating in or facilitating scaling partnerships

What will this guideline help you do

- Map and characterize the scaling pathway(s) deployed in their initiative using the eight core PATHs elements
- Construct a dynamic Theory of Change that reflects how scaling unfolded, not just how it was planned
- Link outcomes to specific stakeholder groups and define measurable SMART indicators
- Select appropriate quantitative, qualitative, or mixed methods to assess causal linkages
- Build a continuous learning system that documents agility events, turning points, and iterative adaptations
- Strengthen adaptive management and make evidence-based strategic decisions throughout the scaling lifecycle

When to use this tool

- When designing the scaling pathways and initiatives
- Establish a Monitoring & Evaluation (M&E) framework from the outset, at the start of a scaling initiative.
- During implementation, to support adaptive management and adjust the scaling process as it evolves.
- At key decision points, such as go/no-go decisions, scaling reviews, or funding renewal.
- During mid-term and endline evaluations, assess how the scaling process unfolded and what was learned.
- After scaling completion, generate evidence on what worked, for whom, under which conditions, and why.

Time needed

- A basic application can be completed by a small team in 2 to 4 weeks using existing documentation and a limited number of interviews.
- A more comprehensive assessment may take 1 to 3 months, especially when covering multiple scaling pathways and including primary data collection, stakeholder workshops, and mixed-methods analysis.
- For ongoing monitoring, the tool can be integrated into regular reporting cycles, typically requiring 2 to 5 additional days per cycle for updating the assessment and reflecting on findings.

Resources needed

- A small team familiar with the scaling process, with Monitoring & Evaluation (M&E) support if needed.
- Existing plans, monitoring data, reports, and other relevant documentation.
- Time and budget for any additional data collection, stakeholder consultations, and review sessions.
- A simple system for recording indicators, adaptations, findings, and decisions.

Summary of steps for process-based outcome assessment

See step-by-step guidance in this tool on how to implement each of the following steps:

1. **Define the Purpose and Scope of the Assessment** to ensure the assessment is focused, relevant, and feasible
2. **Map the Intended and Actual Scaling Process** to reconstruct how scaling unfolded in practice, documenting each element with evidence.

3. **Translate the Framework into a Dynamic Theory of Change** to show how the scaling activities are expected to lead to outputs, outcomes, and ultimately impact.
4. **Link Outcomes to Stakeholders and Design the Measurement Approach** to define what changes you expect for different stakeholders and how you will measure whether these changes occur.
5. **Collect and Assess Evidence:** Implement the monitoring plan, assess progress, and understand what contributed to the observed outcome.
6. **Review Findings, Learn, and Adapt** the pathways based on the assessment findings to decide what should continue, change, or stop in the scaling process.

Table 1 below summarizes the challenges to expect when using the tool and how to mitigate them.

Table 1. Challenges to expect when using the tool

Challenge	Description	Mitigation approach
Resource intensity	Process-based assessment requires sustained investment in documentation, facilitation, and analysis. Limited budgets, personnel, and technical capacity constrain comprehensive M&E.	Embed the framework into existing M&E cycles. Use the Scaling Adaptation Log template (T2) as a running document, not a one-off task. Prioritize two or three key causal questions rather than assessing everything.
Retrospective reconstruction	When this tool is applied after implementation of scaling, key process data, especially agility events, may have been poorly documented or forgotten.	Conduct structured recall workshops with the implementation team. Use project correspondence and meeting minutes as memory aids. Flag confidence levels in the assessment.
Attribution in multi-actor environments	Multiple actors and external factors make it difficult to isolate the pathway's contribution to observed outcomes. Measuring generalizability and attributing outcomes in complex settings remains challenging.	Use contribution analysis rather than strict attribution. Triangulate across multiple data sources. Be explicit about alternative explanations.
Resistance to adaptive reflection	Institutional cultures that penalize failure or do not value iterative learning may resist agility documentation.	Frame agility events as evidence of good adaptive management, not failure. Ensure learning sessions are psychologically safe.
Equity blind spots	Standard M&E may not disaggregate data by gender, age, or wealth, making equity assessments difficult.	Build disaggregation requirements into indicator design from the outset. Review who is and who is not represented in multi-stakeholder dialogues or other engagement platforms.
Complexity of multiple pathways	Managing documentation for multiple simultaneous pathways can become unwieldy.	Use the pathway as the primary unit of analysis. Document each pathway separately, then map interactions. Keep the number of active pathways to a manageable number, typically two to four.

The PATHs Framework

The framework integrates eight analytical elements that enable continuous learning and assessment as indicated in Table 2 and the context and influencing factors of the framework indicated in Figure 1.

Table 2. The 8 analytical elements of the PATHs Framework

Element	What it captures	Key question
Adaptive Scaling Pathway	The coherent sequence linking system goals, actors, innovations, mechanisms, context, and responsiveness into a trajectory of change	What pathway(s) were deployed, and how did they evolve?
Functions	The core purpose of the pathway: Niche (experimentation), Reach (uptake), Accelerate (enabling conditions), or Transform (governance change) (Minh and Schmitter, 2025)	What was the pathway trying to achieve?
Activity delivery	Planned and actual interventions delivered along the pathway, including who did what, when, and how	Were activities implemented as planned, and what dynamics shaped delivery?
Outputs	Immediate, observable products of activities, e.g., feasibility studies, trained actors, partnership agreements, policy dialogues	What tangible products and deliverables were generated?
Influencing Factors	External drivers and internal conditions shaping suitability, scope, and effectiveness, i.e., policy environment, market structure, organizational capacity, social norms, and acceptance	What contextual conditions enabled or constrained the pathway?
Agility	The pathway's capacity to adapt activities, redesign trajectories, or introduce new approaches in response to emerging challenges and opportunities (Walter and Raetzke, 2021)	How and why was the pathway adjusted? What decisions were made at turning points?
Outcomes	Short-to-medium-term changes attributable to the pathway, including intended and unintended effects, for different actor groups (Koorts et al., 2021)	Who changed what, when, and to what degree?
System Change	Broader structural shifts in governance, norms, practices, or institutions: incremental (performance gains), reformative (reconfigured practices), or transformative (shifts in structures, norms, and rules)	Has the scaling contributed to durable system-level change?

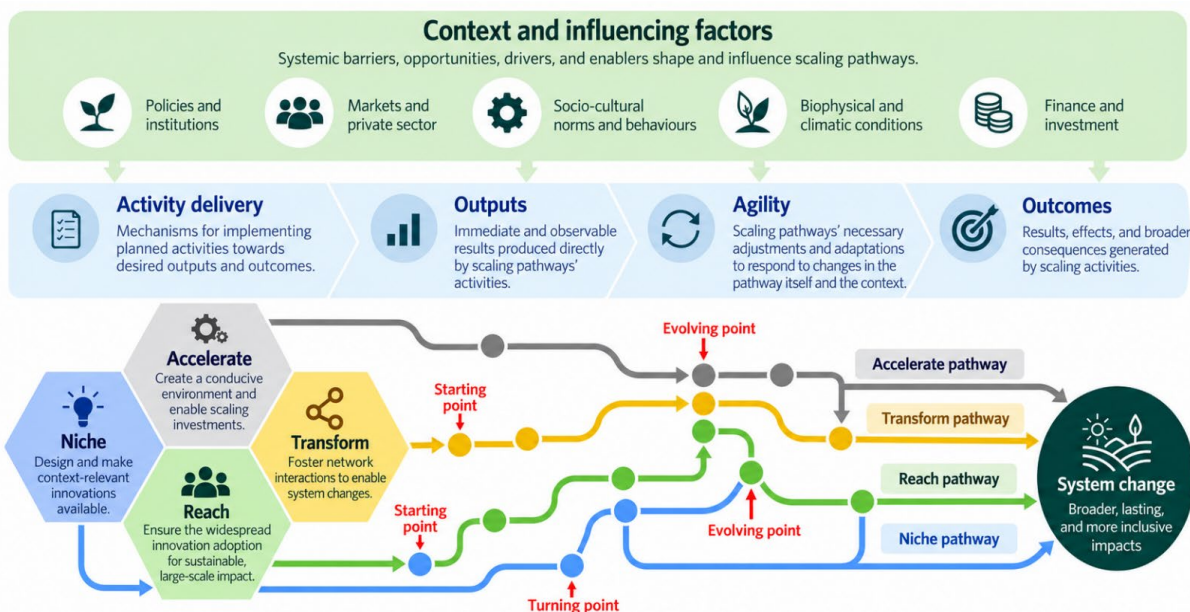


Figure 1. The context and influencing factors affecting the PATHs Framework

Box 1. Complementary resources for applying the PATHs framework

- [Scaling Scan](#) identifies scaling opportunities, constraints, enabling conditions, and trade-offs.
- [Scaling Readiness](#) assesses innovation readiness and use in context and helps prioritize bottlenecks to scale.
- [IFAD's Operational Framework for Scaling Up Results](#) offers guidance on partnerships, financing, institutional support, and sustaining scaling.
- [Better Evaluation: Contribution Analysis](#) and [Process Tracing](#) provides methods to test causal claims, examine sequences of decisions, and consider alternative explanations.
- [USAID's Collaborating, Learning and Adapting \(CLA\) Toolkit](#) provides practical resources for collaboration, reflection, evidence use, and adaptation.
- [ODI's adaptive management resources](#) offer guidance for iterative programming and organizational learning in complex settings.

PATHs can be used alongside established tools for scaling diagnosis, causal assessment, and adaptive management (Box 1). The following definitions explain the key concepts underpinning the PATHs framework, including adaptive scaling, scaling pathways, the four scaling functions, and how they relate to one another in guiding scaling processes.

Adaptive scaling is a flexible process in which farmers, partners, and other stakeholders work together to bring agricultural innovations to scale. It involves identifying what needs to change, who needs to be involved, and how to overcome challenges as they arise. Rather than following one fixed plan, scaling may take different pathways and adjust based on experience, feedback, and new opportunities. This can include adapting innovations to local needs, building partnerships, mobilizing investment, strengthening stakeholder capacity, and improving conditions for wider adoption and lasting system change (Woltering et al., 2019, 2024; Minh and Schmitter, 2025).

An **adaptive scaling pathway** connects what/who (targeted changes and beneficiaries), which (the innovation), how (mechanisms, partnerships, strategies), where/when (context and timing), and why (responsiveness and agility) into a coherent trajectory. An adaptive scaling pathway can include one or more of the four scaling functions (Minh and Schmitter, 2025):

- **Niche** develops, tests, adapts, and refines innovations and innovation bundles and builds early networks, incentives, and learning loops. Typical activities include context analyses, co-design processes, pilot testing, and business model development.
- **Reach** localizes innovations for broad uptake, tailors business models, strengthens adoption feedback, and expands into new geographies or user segments. Focuses on reducing information asymmetries and stimulating demand.

- **Accelerate** shapes enabling conditions, such as finance, policy, capacity, data, and infrastructure. Brokerage actors' networks mitigate risks and crowd in investment, reducing systemic barriers to scale.
- **Transform** integrates networks and processes to shift governance, norms, and practices. Builds long-term, self-organizing collaborations and adaptive capacity. Targets durable institutional and cultural change.

Box 2: Distinction between adaptive scaling pathways and scaling functions

Adaptive scaling pathways describe *how* scaling takes place: the activities, actors, partnerships, and strategies through which an innovation is developed, expanded, and embedded in a system.

Scaling functions describe *what* the pathway aims to achieve: Niche (developing and testing innovations), Reach (expanding uptake), Accelerate (strengthening enabling conditions), and Transform (supporting lasting institutional and system change).

Three different types of **systems change** can be identified:

- Incremental change: Performance gains within existing systems, i.e., improved productivity, increased adoption rates, or efficiency gains. The rules of the game remain the same.
- Reformative change: Reconfigured practices, roles, or relationships, i.e., new business models, revised policies, shifted actor coalitions. The way the game is played changes.
- Transformative change: Shifts in structures, norms, and rules, i.e., new governance arrangements, changed cultural norms, or shifts in how systems are managed. The game itself changes (Woltering et al., 2024).

PATHs can be applied to **a single dominant pathway or to multiple interconnected pathways**. A single pathway follows one coherent trajectory; a complex pathway combines multiple trajectories to achieve desired scaling outcomes (Agyekumhene et al., 2026)

- Single pathway: Framework elements are applied sequentially. Each activity links to outputs, influencing factors, agility events, and outcomes along one coherent trajectory.
- Multiple pathways: Each pathway is characterized separately while tracking cross-pathway interactions. Turning points, evolving points, and cross-pathway synergies or tensions are documented explicitly.

Step-by-Step Guidance

STEP 1. Define the Purpose and Scope of the Assessment

Purpose: Ensure the assessment is focused, relevant, and feasible.

What to do

1. **Clarify why the assessment is needed.** Identify the questions you want to answer. For example:
 - Is the scaling approach working as expected?
 - What is helping or hindering scaling?
 - What changes are emerging for different actors?
 - What needs to be adapted?
 - What can be learned for future scaling?
2. **Define what you want to assess.** Decide whether you want to assess the complete scaling process or one or more clusters of activities. For example, activities related to making innovation accessible to potential users, or bundling the innovation with a financial product.
3. **Identify who should be involved in the assessment process.** Include people who know the innovation and scaling process well. It is helpful to include representatives of the user group and other key actors.
4. **Review what information already exists to get a good idea of the scaling process,** including contracts, project proposal, logical framework, existing Theory of Change, activity reports, learning notes, M&E data, minutes of meetings or stakeholder engagements, or other relevant documents.

5. **Check what is feasible to assess.** Consider the time, people, information, and resources available. Keep the assessment proportionate to the size and complexity of the scaling initiative.

Note: If the assessment requires indicator design, extensive data collection, or complex analysis, consider involving an M&E specialist.

STEP 2. Map the Intended and Actual Scaling Process

Purpose: Reconstruct how scaling unfolded in practice, documenting each element with evidence.

What to do

1. **Complete the [scaling process assessment template](#) (T1)** in Steps 2.2 to 2.8 below.
 - Complete one row per major cluster of activities as identified in step 1.2.
 - Continue adding information as activities take place, as real-time documentation is more accurate and easier than reconstructing the process retrospectively.
2. **Compare planned and actual activities and outputs.** For each cluster of activities:
 - List the planned key activities and the activities that were implemented.
 - Record the planned output for each planned key activity and the actual output of each implemented key activity. Outputs are the immediate, observable products generated. Be specific, for example, “three co-design workshops conducted with 45 farmers and six private suppliers in the XX Region,” rather than “stakeholders involved.”
 - Compare the planned and actual activities and outputs to assess whether implementation took place as intended and at the expected quality and scale. This helps determine whether weak results stem from the activities themselves or from how they were implemented.
3. **Identify influencing factors.** For each major activity, identify the external factors (policy, market, climate, socio-cultural dynamics) and internal conditions (budget, staff capacity, organizational mandates) that enabled or constrained delivery. Distinguish between conditions that were anticipated and those that emerged unexpectedly.
4. **Document important adaptations.** Record significant changes made during the implementation of the activities, such as modifying, pausing, or stopping an activity; changing partners; or introducing a new approach. For each adaptation, note what changed, why the change was made (what was the trigger), who made the decision, and how it affected subsequent activities or outcomes. These adaptations show how the scaling process responds to new challenges, opportunities, and learning.
5. **Describe outcomes.** Describe the changes observed for each actor group, because of, or influenced by, the activities and outputs. Distinguish between direct changes for the actors involved and broader changes in the system. Include both intended and unintended consequences.

STEP 3. Translate and Reflect the Framework into a Dynamic ToC

Purpose: Show how the scaling activities are expected to lead to outputs, outcomes, and ultimately impact.

What to do

1. **Complete the [Theory of Change \(ToC\) Template](#) (T2).** Use the information from Step 2 to complete the pathway from Activity → Output → Outcome → Impact:
 - **Activity:** What are you doing to support scaling?
 - **Output:** What is the immediate result of that activity?
 - **Outcome:** What change do you expect to see as a result?
 - **Impact:** What longer-term change should these outcomes contribute to?

Note: If the scaling process has not yet started, use the planned activities and expected outputs and outcomes. If implementation is already underway, update the ToC to reflect the activities that were implemented, the outputs produced, and the outcomes that are emerging.
2. **Capture changes and feedback during implementation.** Scaling does not always follow a straight line. Record when outcomes, new information, or changes in the context lead to adjustments in activities, assumptions, or the scaling approach. Mark important turning points and adaptations in the ToC and update the links where needed.

3. **Review the ToC with the people involved in the scaling process.** Check whether the activities, outputs, outcomes, and impact are realistic and whether anything important is missing.
4. **Update the ToC as the scaling process develops.** If activities change, expected outputs are not achieved, or different outcomes emerge, adjust the ToC accordingly. Record important adaptations in the [Scaling Adaptation Log](#). Document what changed, what prompted the change, and what it implies for ongoing activities.

What makes a good adaptive Theory of Change

A strong Theory of Change explicitly shows:

1. The sequence of activities and outputs along each pathway.
2. The assumptions under which activities lead to outcomes.
3. The influencing factors that could strengthen or weaken these assumptions.
4. The agility mechanisms through which the pathway can adapt when assumptions are challenged.

Rather than judging success against fixed endline targets, it generates actionable learning to inform ongoing adjustments. It should be readable as a narrative, not just a logic diagram.

STEP 4. Link Outcomes to Stakeholders and Design the Measurement Approach

Purpose: Define what changes you expect for different stakeholders and how you will measure whether these changes occur.

What to do

1. **Identify the stakeholder groups for whom change is expected.**
 - Identify the main actors that are expected to experience a change because of the scaling process, such as users, suppliers, service providers, financial institutions, government agencies, or other relevant actors.
 - Where inclusion is important, identify specific groups separately, such as women, youth, pastoralists, or other groups that may experience different opportunities, barriers, or outcomes.
2. **Describe the expected outcome for each stakeholder group.** Clearly describe what you expect to change for each group. Outcomes should describe a change resulting from the scaling process, for example in behavior, (organizational) practices, performance, access, collaboration, investment, market participation, or policy implementation. For example:
 - Farmers regularly use innovation and apply it correctly.
 - Suppliers increase sales of the innovation and provide reliable after-sales services.
 - Financial institutions increase lending to users or businesses involved in the innovation.
 - Government agencies apply or implement policies and programmes that support scaling.
 - Women or youth gain greater access to the innovation, finance, services, or decision-making opportunities.

Practical note: Considering different stakeholder groups helps ensure that the assessment looks **beyond end users' adoption** and captures changes among the other actors needed for scaling.

3. **Define at least one indicator for each main outcome.**
 - An indicator is a specific measure that helps you determine whether an expected change is taking place. For example, if the expected outcome is "more farmers use innovation", an indicator could be "Percentage of target farmers using innovation" or "Number of farmers using innovation".
 - Formulating indicators makes expected outcomes more concrete and allows you to track progress over time.
 - Where appropriate, make indicators SMART: Specific, Measurable, Achievable, Relevant, and Time-bound.
4. **Assess feasibility and data availability.** For each indicator, identify whether data already exists in project records, whether it can be collected through primary research, or whether proxy measures are needed.
5. **Check whether each indicator can realistically be measured.** For each indicator, determine:
 - What information is needed to measure it.
 - Whether this information already exists.
 - How it can be collected if it does not exist.
 - Whether collecting it is realistic given the available time, budget, and capacity.

- Where an indicator is too difficult or costly to measure, consider using another indicator that can provide a reasonable indication of the expected change.

6. **Complete the monitoring plan using** the [Monitoring Sheet](#) (T3). Agree who will collect, verify, and report the indicator and when this should be done. Below in Table 3 is an illustrative plan for solar irrigation.

Table 3. Illustrative plan for solar irrigation

Stakeholder	Expected outcome	Indicator and target	Measurement method	Responsible for collection
Smallholder farmers	Farmers adopt and use solar irrigation	40% of target farmers using solar irrigation by the end of the project	Farm survey at the end of the production season	Field staff
Private suppliers	Suppliers expand their provision of solar irrigation products and after-sales service.	4 suppliers offering solar irrigation products with after-sales service by the agreed review date.	Supplier interviews and administrative or sales records, annually or at agreed review points.	Implementation team
Financial institutions	Financial institutions increase financing available for solar irrigation adoption.	20 loans granted for solar irrigation adoption during the assessment period. 3,000 USD total value of loans granted.	Financial institution records and interviews, annually or at agreed review points.	External evaluator
Ministry of Agriculture	Government policies increasingly support and institutionalize solar irrigation.	Evidence of solar irrigation being incorporated into relevant policies, strategies, programs, or budgets by the agreed review date.	Policy and program documents reviewed annually or at major policy review points.	Implementation team
Women and youth	Women and young people increase their uptake of and access to solar irrigation.	20% of new solar irrigation adopters who are women or under 35, compared with the baseline or agreed target.	Disaggregated monitoring data or farmer survey, annually or at the end of each production season.	Field staff

Contribution versus attribution

In complex scaling processes, it is often difficult to prove that a specific activity directly caused an observed change. Instead, assess whether the scaling activities contributed to the change and consider what other factors may also have influenced it. Use information from different sources to check whether the findings are consistent and credible.

STEP 5. Collect and Assess Evidence

Purpose: Implement the monitoring plan, assess progress, and understand what contributed to the outcome.

What to do

1. **Implement the monitoring plan** as developed in Step 4.6. Collect the information for each indicator according to the method, timing, and responsibilities agreed in Step 4. Record the results in the Monitoring Sheet (T4).
2. **Review progress against the indicators and targets.** Compare the results with the baseline and/or targets. Identify where progress is on track, where it is falling behind, and whether results differ between stakeholder groups.
3. **Identify the most important questions you want to answer** to understand why observed changes happened and how the scaling activities contributed to them. For example:
 - Which activities contributed most to the outcome?
 - What other factors helped or hindered the change?
 - Why did the outcome occur for some actors but not others?
 - How did adaptations made during implementation affect the results?
4. **Use different sources of information to answer these questions.** Draw on the monitoring information collected in Step 4 and, where needed, complement it with interviews, group discussions, observations, document reviews, or other relevant sources.
5. **Compare different explanations.** Consider whether the observed change can reasonably be linked to the scaling activities, while also identifying other factors that may have contributed. For example, an increase in solar irrigation adoption can be related to training and improved access to finance, but declining equipment prices or a new government subsidy may also have played a role.
6. **Collect information at useful moments during the scaling process.** Do not wait until the end. Review progress at important milestones so that findings can still be used to improve the scaling approach.
7. **Use specialist support where needed.** If you need to demonstrate more rigorously whether activities affected an outcome, consider involving an M&E or evaluation specialist to select an appropriate method.

STEP 6. Review Findings, Learn, and Adapt the Scaling Pathways

Purpose: Use the findings to decide what should continue, change, or stop in the scaling process.

What to do

1. **Bring the findings together.** Review the information collected through the monitoring plan and the analysis from Step 5. Compare what was expected with what happened.
2. **Identify the main lessons.** Discuss:
 - What is working well and why?
 - What is not working as expected and why?
 - What factors are helping or hindering scaling?
 - Are outcomes different for stakeholder groups?
 - Have adaptations made during implementation improved the scaling process?
3. **Look across scaling pathways where relevant.** If several pathways are being used, consider how they support or hinder each other and whether changes are needed to improve coordination between them.
4. **Decide what to do next.** Based on the findings, agree on what should:
 - Continue as planned or be stopped.
 - Be adapted or strengthened.
 - Receive more or fewer resources.For each decision, record **what will be done, who is responsible, and by when.**
5. **Update the scaling pathways/approach.** Revise the relevant plans, ToC, indicators, or assessment framework where the findings show that assumptions, activities, or expected outcomes have changed.
6. **Document and share the main lessons.** Record the key findings, decisions, and recommendations and share them with the people who need to act on or learn from them. At the end of the scaling process, capture lessons that can inform future scaling initiatives.

Turning assessment into action

The assessment should not end with a report. Each review should lead to clear decisions about what should continue or change, who will act, and by when.

Tools and Templates

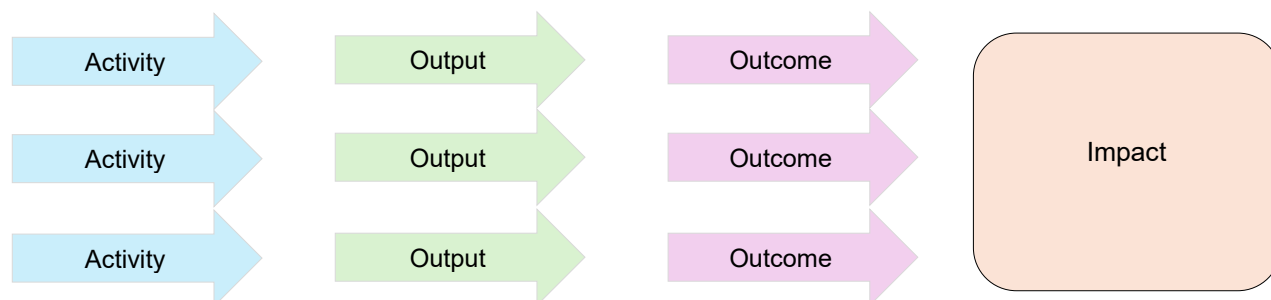
T1. Scaling Process Assessment Template

Use T1 in Step 2.1 for each scaling pathway. Complete one row per major activity cluster. Update each milestone.

Pathway & function	Planned activities & outputs	Implemented activities and actual outputs	Influencing factors	Adaptations made	Outcomes & system change

T2. Theory of Change Template

Use this template in Step 3.1 to document how scaling activities result in outputs, outcomes, and ultimately impact. It makes the expected chain of change clear and can be updated as the scaling process evolves.



Use this log in Step 3.4 to document significant adaptations to planned activities, scaling pathways, or strategies, including what triggered the change, who decided it, and how it affected expected outcomes.

Date	Pathway affected	What changed?	Trigger (why?)	Who decided?	Consequences for outcomes

T3. Monitoring Sheet

Use this sheet to define and assign responsibility for outcome indicators. Complete one row per outcome.

Stakeholder group	Expected outcome	Indicator & target	Measurement method & timing	Responsible

Practical Considerations

Integrating PATHs with Existing M&E Systems

Results framework / log frame	PATHs extends the log frame by adding process elements, i.e., activities, influencing factors, and agility, to explain why outcomes were or were not achieved. SMART indicators from Step 4 feed directly into the log frame.
Theory of Change	PATHs informs the adaptive ToC by providing structured evidence to build and update the more detailed, iterative ToC developed in Step 3.
M&E plan	PATHs strengthens M&E by linking the SMART indicator planning sheet (Template T3) directly to M&E plans. Regular PATH reviews can complement/replace periodic M&E reviews.
Learning agenda	PATHs supports learning by using agility-event documentation and contribution analysis from Step 6 to generate evidence on what works, why, and under which conditions.

Adapting PATHs to Different Contexts

PATHs was developed for agricultural innovation scaling but can be adapted across sectors and geographies. Its process-based approach is particularly suited to complex socio-technical systems, such as agriculture, water management, climate adaptation, and sustainability transitions, where scaling unfolds across diverse contexts and levels (Agyekumhene et al., 2026).

- Retain core structure: Keep 8 core elements and 6 operational steps to maintain the framework's integrity.
- Adapt indicators and examples: Tailor these to the sector, innovation, context, and stakeholder landscape.
- Adjust assessment depth: Use a simplified approach for smaller projects and a more comprehensive assessment for large, multi-actor programs.
- Adapt facilitation: Modify tools and templates to fit cultural and linguistic contexts while maintaining conceptual alignment with the framework.

Practical examples

Scaling Solar-powered Farmer-led Irrigation Development in Northern Ghana

This section illustrates how PATHs was applied to scaling solar-powered farmer-led irrigation development (S-FLID) in Northern Ghana. Drawing from ongoing work by IWMI and partners since 2020, this case demonstrates how the framework can be operationalized in a real-world multi-pathway context (Agyekumhene et al., 2026).

Context and the Innovation

S-FLID addresses persistent barriers to small-scale irrigation in Northern Ghana, including high fuel costs, weak market linkages, limited access to equipment and finance, and socio-institutional constraints. It bundles solar-powered irrigation pumps with water-source development, conveyance systems, and inclusive financing (Minh and Ofosu, 2022; Minh et al., 2022). Despite rising demand, the supply chain remains largely private-sector-led and import-dependent, with limited local services and affordable finance. Since 2020, IWMI, private suppliers (Pumptech, Tech 2 Resources, and Interplast), GIZ, and the Ministry of Food and Agriculture have co-developed the scaling pathways (Minh and Schmitter, 2025).

The Two Scaling Pathways

The initiative follows two interlinked pathways across the Niche, Reach, Accelerate, and Transform functions to co-develop S-FLID technologies, inclusive business models, financing mechanisms, and sustained stakeholder engagement (Agyekumhene et al., 2026).

- **Bundling and scaling inclusive S-FLID businesses (Niche+Reach):** Co-design and pilot context-specific business models, then expand adoption through awareness, stronger supply-demand linkages, and local sales and service networks.
- **De-risking investment and strengthening markets (Accelerate+Transform):** Reduce investment risks through blended finance, smart subsidies, and partnerships, while strengthening stakeholder dialogue, private-sector engagement, and enabling policies.

PATHs Framework Applied to S-FLID

Table 1 presents the full PATHs characterization for both scaling pathways in Northern Ghana. Activities are color-coded by function (Niche, Reach, Accelerate, and Transform). Outcomes are coded by timeframe (early, mid-term, longer-term). The system change column specifies the incremental, reformative, or transformative structural shifts expected from each pathway.

Dynamic Theory of Change — Key Features

The S-FLID ToC was structured around the two interlinked pathways, with path interdependencies, feedback loops, and turning points made explicit (Agyekumhene et al., 2026).

- **Path interdependencies mapped:** demand creation (Path 1) and de-risking (Path 2) are mutually reinforcing, not sequential.
- **Feedback loops documented:** uptake data from early farmers fed into supplier confidence and financial actor calculations, influencing Path 2 activities.
- **Three turning points recorded:** (i) pivot to women-focused engagement after low female participation; (ii) shift from commercial bank to impact investor after repeated refusals; (iii) expansion of MSD scope to climate adaptation finance after a policy window emerged.
- **Assumptions challenged:** the assumption that financial actors would engage once demand was demonstrated required revision—active relationship-building and risk-sharing instruments were needed earlier than anticipated. This reflects that outcomes are emergent properties of adaptive, interconnected pathways rather than linear results.

Measurement and Learning

The assessment design translated PATHs elements for each pathway into SMART indicators linked to specific actor groups and levels of change, with systematic attention to agility.

- **Quantitative:** Farmer surveys (participant and non-participant) to assess adoption indicators; administrative data from financial institutions and service providers for market indicators.
- **Qualitative:** Key informant interviews with suppliers, financial actors, and MoFA staff; focus group discussions with farmer groups; participatory observation at MSD sessions.
- **Interactive learning:** Co-reflection sessions at MSD platforms; regular internal learning reviews at project milestones.

Evidence from the first round of data collection (2022) revealed that farmers' willingness to adopt was higher than expected, but payment terms remained a critical barrier. This prompted an agility event in Path 2—flexible payment discussions with suppliers—and a ToC update emphasizing financial accessibility as a more central outcome pathway (Agyekumhene et al., 2026)

PATH & ACTIVITY	OUTPUT	FACTOR	AGILITY	OUTCOMES	SYSTEM CHANGE
Path 1: Bundling and scaling inclusive solar-powered farmer-led irrigation (S-FLID) — Niche + Reach					
NICHE - Analyze context, value chains, and supply chains - Segment S-FLID demands by farmer types and geography - Co-design S-FLID bundles with farmers & suppliers - Develop tailored business models per segment - Pilot and verify S-FLID bundles at target sites	- Context-relevant innovation bundles identified - Demand segments identified - Tailored business models assessed - Market linkages established - Local sales and service networks established - Market opportunities assessed - Knowledge products produced	- Stakeholder interest & participation - Product and service suitability - Policies and interventions - Resource availability - Market structure - Religious and social norms - Access to finance	- Adjust bundle components on feedback - Expand partner collaborations - Adjust activities to context and opportunities - Change engagement and communication approaches - Adjust market-entry strategy based on local constraints	EARLY - Increased awareness among target users & partners MID-TERM - Increased adoption willingness of farmers & service providers - Increased S-FLID demand - Reduced information asymmetries among actors - Improved S-FLID access through local sales & service networks - Strengthened trust and interaction among stakeholders LONG-TERM - Increased & more structured demand for S-FLID	Incremental - S-FLID bundles adopted by early-mover farmers & suppliers within supply chains - Suppliers integrate solar irrigation into routine product offerings - Water productivity & income gains recorded - Farmer awareness & willingness to pay established a foundation for wider scale-up Reformative - Sales & service networks operated independently of project facilitation - Co-designed bundle specifications embedded in private sector catalogues - Demand–supply coordination no longer dependent on ad hoc project support - Market linkage models replicable across new geographies and user segments
Path 2: De-risking S-FLID investments and strengthening inclusive market development — Accelerate + Transform					
ACCELERATE - Identify investment & de-risking options - Co-create financing modalities; engage financial actors, banks, and impact investors - Design blended finance and guarantee mechanisms - Build cross-value-chain investment partnerships TRANSFORM - Establish & facilitate MSD - Strengthen private sector engagement in MSD - Support S-FLID policy reform and advocacy - Build stakeholders' adaptive scaling capacity	- De-risking mechanisms mapped - Co-designed financing models identified - Investment partnerships strengthened - Investor understanding enhanced - Multi-stakeholder dialogues (MSDs) established & facilitated - Stakeholder scaling capacity strengthened	- Maturity of financial ecosystem - Stakeholder risk tolerance - Financial regulatory conditions - Availability of data & guarantees - Trust levels & power relations - Private sector incentives - Human & institutional capacity	- Dynamic partnerships & financing adjustments - Changed risk management actions - Change MSD structure, participation and capacity-strengthening approaches	EARLY - Improved perceived & actual S-FLID investment viability among financial & impact investors MID-TERM - Increased interest and engagement of financial actors in financing S-FLID adoption - Sustained private sector participation in MSD and partnerships - Improved inclusive business practices among private sector & financial actors LONG-TERM - Enhanced capacity of stakeholders to assess, manage and engage in S-FLID scaling	Reformative - Banks & DFIs introduce agri-solar loan products adapted to smallholders - Private sector adjusts risk assessment and due diligence practices for S-FLID investments - Blended finance and guarantee structures replicated beyond the project - MSD used as a routine cross-sector coordination & problem-solving mechanism Transformative - S-FLID integrated into national irrigation policy and public investment programs - MSD institutionalized as a standing multi-actor body that outlasts project support - Inclusive financing norms adopted across the broader agri-solar sector - Adaptive scaling recognized as the approach guiding irrigation investment decisions
Context & Influencing Factors: • Supplier & dealer readiness; state schemes as entry points • FPO readiness & training capacity • CSR/ESG corporate interest in water-use efficiency • Bank & DFI appetite for blended agri-tech finance • Partner risk appetite & first-loss willingness					
Pathway: •Niche •Reach •Accelerate •Transform Outcome timeframe: •Early outcomes •Mid-term outcomes •Longer-term outcomes System change: Incremental Reformative Transformative					

Table 4. PATHs Framework applied to S-FLID in Ghana

Scaling VIA Sensors Bundled with Solar-powered Pumps in India

This section applies PATHs to scaling Virtual Irrigation Academy (VIA) soil-water sensors bundled with solar-powered irrigation pumps in India. Drawing on IWMI's commercialization research and a proposed scaling pathway, it illustrates how market development, pilot evidence, financing, and institutional partnerships can be integrated into an adaptive scaling process (Banerjee et al., under review). The example demonstrates the practical application of PATHs for understanding and strengthening complex, market-oriented scaling processes.

Context and the Innovation

India faces growing groundwater stress, inefficient irrigation, and limited access to affordable decision-support tools. VIA's Chameleon sensors provide color-coded soil-moisture information to guide irrigation, even with limited connectivity. Evidence from Odisha and Assam shows water savings of 8–52% across plot-seasons (median 12.3%) and average yield gains of 17%, yet adoption remains below 5% (Mahapatra et al., 2025). Most deployments rely on research or program funding rather than commercial channels. Bundling sensors with solar pumps could combine reliable irrigation with improved water management, but requires viable payment models, local sales and service networks, and credible evidence for partners.

The Two Scaling Pathways

The proposed initiative links two pathways across the functions to co-design sensor–solar packages, test delivery and support models, and mobilize financing and partnerships without long-term subsidy dependence.

- **Market intelligence, bundling and uptake (Niche + Reach):** Segment farmers by irrigation conditions and ability to pay; co-design and pilot sensor–solar packages; strengthen suppliers, dealers and farmer producer organizations (FPOs); and build local demonstration, installation and advisory capacity.
- **De-risking investment and strengthening markets (Accelerate + Transform):** Use credible pilot evidence to engage corporate sustainability partners, banks and development finance institutions; develop risk-sharing, loan, insurance and advisory arrangements; and strengthen enduring relationships between supply chains, water stewardship programs and public institutions.

PATHs Framework Applied to S-FLID

Table 2 presents the full PATHs characterization for both scaling pathways in India. Activities are color-coded by function. Outcomes are coded by timeframe. The system change column specifies the incremental, reformative, or transformative changes expected from each pathway.

Dynamic Theory of Change — Key Features

The India Theory of Change is organized around two mutually reinforcing pathways, with feedback loops and potential turning points made explicit. The following are proposed learning priorities rather than verified implementation events.

- **Path interdependencies mapped:** Testing market demand and local service delivery (Path 1) generates the evidence needed for investment and institutional engagement (Path 2), while financing and partnerships in turn affect uptake.
- **Feedback loops identified:** Farmer payment preferences, dealer performance, and measured water-use outcomes inform pricing, product configuration, partner selection, and funder confidence.
- **Potential turning points:** (i) Shift to pooled, corporate-funded, or seasonal payments where direct farmer affordability is low; (ii) diversify distribution to cooperatives or FPOs where dealers cannot provide support; and (iii) redesign guarantees where lenders view pilot results as insufficient.
- **Assumptions to test:** Proven agronomic value alone may not produce commercial demand; the payer, delivery costs, after-sales support, product performance across seasons, and credible impact evidence must be validated before expansion.

Measurement and Learning

The assessment should translate PATHs elements into measurable indicators for farmers, dealers, corporate partners, and financing institutions, while tracking adaptations and readiness for the next stage.

- **Quantitative:** Adoption, willingness to pay, deployments and repeat purchases; water-use and crop productivity measures; installation and support costs; financing commitments and repayment performance.
- **Qualitative:** Farmer interviews and focus groups; key informant interviews with suppliers, FPOs, corporate sustainability actors, banks and government agencies; reflection on inclusion and delivery barriers.
- **Interactive learning:** Pilot reviews with supply-chain and finance partners; seasonal verification of results; regular updates to pricing, finance arrangements and the Theory of Change.

Existing Indian research shows promising farm-level gains but limited adoption and unproven commercial willingness to pay. Early pilots should therefore prioritize multi-season technical validation, viable local service delivery, committed buyers or funders, repeat procurement, and clearly assigned financing responsibilities before geographic expansion.

PATH & ACTIVITY	OUTPUT	FACTOR	AGILITY	OUTCOMES	SYSTEM CHANGE
Path 1: Bundling and scaling VIA sensor–solar pump packages — Niche + Reach					
NICHE - Analyze farmer segments by land size, irrigation type, and willingness to pay - Assess VIA sensor and solar pump markets, dealers, and input chains - Identify AgTech startups, FPOs, CSR/ESG programs and supply partners - Co-design bundle features, pricing and service models with early adopters	- Farmer segments, affordability and technical-readiness profiles - Market opportunities and potential distribution partners mapped - CSR/ESG water stewardship partners identified - Bundle specifications and tested prices documented - Pilot protocols and evidence on demand and water use - Training modules, troubleshooting guides and support channels - Baseline production and water-use records	- Supplier and dealer willingness to bundle sensors - Farmer affordability, trust and technical readiness - FPO capacity and local service infrastructure - Training resources and demonstration sites - State schemes (PM-KUSUM and PMKSY) as entry points - Corporate interest in credible water-use reporting	- Refine farmer segments and bundle messaging on market feedback - Adjust components, pricing and payment plans after early adoption tests - Rework distribution partnerships where dealer readiness is weak - Adapt training and train-the-trainer design to staff capacity - Improve data protocols and consent practices based on partners' requirements	EARLY - Greater clarity on priority users, partners and viable delivery channels - Improved farmer and supplier awareness of sensor-enabled irrigation MID-TERM - More credible bundle pricing and farmer payment options - Higher confidence in installation, advisory services and sensor use - Stronger evidence of productivity and water-saving performance - Expansion of local demand and sensor uptake	Incremental - Early adopters and suppliers integrate sensors into solar-pump packages - Dealer and FPO networks routinely offer basic installation and support - Water-use monitoring increasingly informs irrigation decisions Reformative - Sensor information becomes part of commercial solar irrigation offerings
Path 2: De-risking investment and strengthening inclusive irrigation markets — Accelerate + Transform					
ACCELERATE - Use pilot evidence to engage CSR, banks, DFIs and impact investors - Map investment risks and mitigation needs - Co-design commercial guarantees and first-loss arrangements - Structure linked sensor, solar, insurance and advisory finance - Develop supplier, FPO and corporate co-funding partnerships TRANSFORM - Align partner roles, reporting and data governance - Build longer-term market and institutional collaboration - Engage state programs while prioritizing commercial viability	- Investor risk map and commercial business case - Partnership agreements and co-funding proposals - Candidate first-loss, guarantee and blended finance mechanisms - Bundled loan, insurance and advisory product designs - Water-use and productivity reporting arrangements - Institutional coordination and investment plans	- Credibility of agronomic and financial evidence - CSR willingness to co-invest beyond compliance - Bank and DFI risk appetite and first-loss capacity - Policy alignment, regulatory conditions and financing costs - Partner capacity to support field delivery and verify results - Farmer data consent and ownership arrangements	- Revise partner mix when funders or lenders disengage - Adjust guarantee coverage and products to lender requirements - Use FPO, cooperative or self-help group channels if formal lending stalls - Reconfigure payment timing and service obligations when affordability is weak - Use state programs tactically as transitional bridges - Improve evidence and reporting as verification standards evolve	EARLY - Stronger investor understanding of the sensor–solar business case MID-TERM - Multi-partner coalitions lower market entry and investment risks - Commercial or blended financing options become more credible - Greater affordability through scale and tailored payment mechanisms LONG-TERM - Increased sustained private investment and repeat procurement - Reduced dependence on project subsidy for sensor-enabled irrigation	Reformative - Banks, corporate partners and suppliers introduce linked irrigation service and finance models - CSR and public irrigation programs increasingly coordinate around measured water-use outcomes Transformative - Commercial finance ecosystem links solar equipment, sensors, insurance and advisory services - Water efficiency and risk reduction become routine criteria in irrigation investment
Context & Influencing Factors: • Supplier and dealer readiness; schemes as entry points • FPO capacity and training • CSR/ESG interest in water efficiency • Bank/DFI appetite for blended finance • Risk tolerance and first-loss willingness					
Pathway: •Niche •Reach •Accelerate •Transform Outcome timeframe: •Early outcomes •Mid-term outcomes •Longer-term outcomes System change: Incremental Reformative Transformative					

Table 5. PATHs Framework applied to scaling VIA sensors bundled with solar-powered pumps in India

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