MAINSTREAMING SCALING INITIATIVE CASE STUDIES

Getting to Scale: Practical Lessons from Feed the Future (2011–2024)

Mark Huisenga, Katie Hauser, and Lesley Perlman

September 2025

SCALING
COMMUNITY OF PRACTICE

MAINSTREAMING SCALING

A Case Study

Getting to Scale: Practical Lessons from Feed the Future (2011–2024)

From frameworks to markets, lessons for scaling agricultural innovations

by

Mark Huisenga, Katie Hauser, and Lesley Perlman

Formerly of the USAID Bureau for Resilience, the Environment and Food Security

September 2025

A Case Study for the Initiative on

Mainstreaming Scaling in Funder Organizations

For the Scaling Community of Practice

www.scalingcommunityofpractice.com

Table of Contents

Preface

The Scaling Community of Practice (SCoP) launched an action research initiative on mainstreaming scaling in funder organizations in January 2023. This initiative has three purposes: to inform the SCoP members and the wider development community of the current state of support for and operationalization of scaling in a broad range of development funding agencies; to draw lessons for future efforts to mainstream the scaling agenda in the development funding community; and to promote more effective funder support for scaling by stakeholders in developing countries. (For further details about the Mainstreaming Initiative, see the Concept Note on the SCOP website). The Mainstreaming Initiative is jointly supported by Agence Française de Développement (AFD) and the SCoP. The study team consists of the co-leaders, Larry Cooley (Co-Chair of the SCoP), Richard Kohl (Lead Consultant) and Johannes Linn (Co-Chair of the SCoP), and of Charlotte Coogan (Program Manager of the SCoP) and Ezgi Yilmaz (Junior Consultant). MSI staff provide administrative and communications support, in particular Leah Sly and Gaby Montalvo.

The principal component of this research is a set of case studies of the efforts to mainstream scaling by selected funder organizations. These studies explore the extent and manner in which scaling has been mainstreamed, and the major drivers and obstacles. The case studies also aim to derive lessons to be learned from each donor's experience, and, where they exist, their plans and/or recommendations for further strengthening the scaling focus.

This document brings together two companion case studies of USAID's Feed the Future Initiative:

- *Feed the Future Scales Up: Lessons Learned from the Feed the Future Initiative 2011–2020*
- *Addendum to Feed the Future Scales Up: Lessons Learned from the Feed the Future Initiative 2020–2024*

Originally prepared as stand-alone analyses, the two studies capture lessons from distinct phases of the Feed the Future journey. The first report reflects a decade of work describing the conceptual and systems-level foundations of scaling[1]—developing frameworks, testing pathways, and building an evidence base for how innovations could move beyond pilot stages into wider systems. The second, covering the subsequent four years, covers lessons on commercially viable pathways, business models, and investor-ready approaches for transitioning research outputs into market adoption.

Merging the two documents into a single volume provides a **comprehensive record of learning across 2011–2024**. It preserves the chronological flow while also offering an integrated perspective on how scaling practices have evolved.

This Study serves as both a historical reference and a forward-looking guide for donors and scaling practitioners.[2] It demonstrates that while approaches may vary—from frameworks and enabling environments to commercialization and partnerships—the underlying objective remains constant: ensuring that agricultural research and development (R&D) innovations reach the markets and users at a level to transform food systems, improve resilience, and advance global food security goals.

[1] In the context of the Feed the Future Initiative, "scaling" has been defined as the process of sustainably increasing the adoption and diffusion of a proven technology, practice, or set of practices so that their demonstrated positive impacts are maintained or enhanced as they reach widespread use among farmers, households, enterprises, and systems.

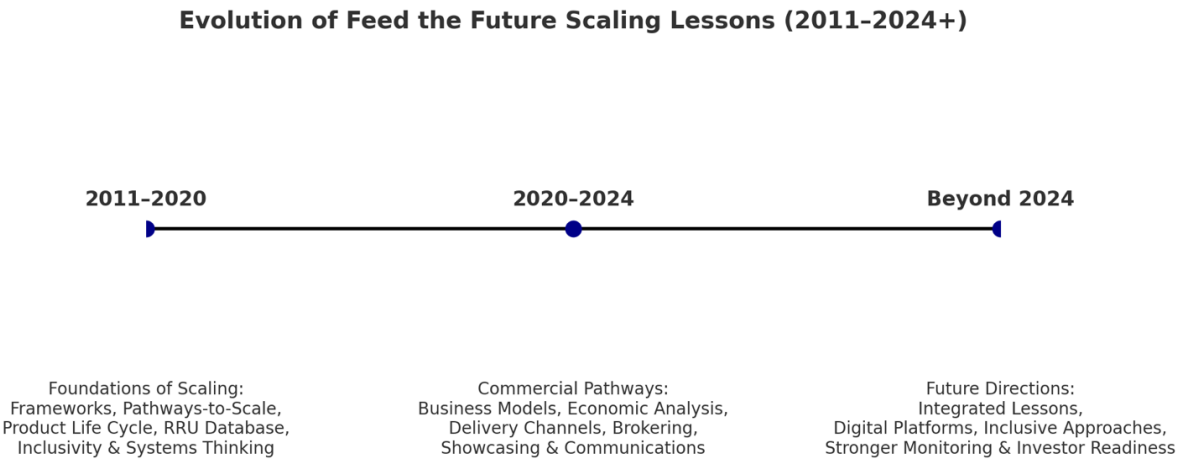
[2] Within the Feed the Future Initiative, *scaling practitioners* were the people and organizations directly responsible for turning promising innovations into widespread, sustainable adoption. They operated across the research-to-market continuum, bridging innovation design, development, delivery, and diffusion.

This Study complements two prior case studies on the experience with scaling under Feed the Future published as part of the SCoP's Initiative on Mainstreaming Scaling in Funder Organizations:

- Mainstreaming Scaling Initiative Case Studies: Feed the Future
- Mainstreaming Scaling: A Case study of USAID-Funded Research Outputs from Feed the Future's Innovation Laboratories

Executive Summary

Over more than a decade, in addition to investment in agriculture R&D, Feed the Future (FTF) has also advanced the science and practice of scaling agricultural innovations, shifting from early lessons on pathways and enabling environments (2011–2020) to more recent emphasis on commercialization and business-led adoption (2020–2024). These experiences have demonstrated that scaling is neither automatic nor linear. It requires intentional and early design, context-appropriate pathways, effective partnerships, and increasingly, viable business models that link innovations to market demand.



Lessons from 2011–2020: Building the Foundations

During this period, USAID's Bureau for Food Security established a **pathways-to-scale framework** grounded in economic theory, developed a **Product Life Cycle (PLC) approach** for research investments, and compiled a **Research Rack-Up (RRU)** database of over 1,500 innovations. Lessons emphasized:

- **Start with scale in mind**: assess scalability early using user-centered criteria.
- **Select the right delivery pathway**: private, public, or public-private partnership, depending on the good's characteristics.
- **Engage the right partners**: aligning private sector, donors, and governments.
- **Design for inclusivity**: ensuring women, youth, and marginalized groups are not left behind.
- **Adapt locally**: using iterative, evidence-based approaches with local partners.
- **Track diffusion and impact**: going beyond direct program participant counts to measure real-world adoption.

This decade established the theoretical and operational foundations of innovation scaling while underscoring persistent challenges in diffusion tracking, market intermediation, and sustaining uptake beyond donor cycles.

Lessons from 2020–2024: Prioritizing Commercial Pathways

The subsequent period built directly on these foundations, sharpening focus on **commercial scaling** as the most viable pathway for many innovations. This period highlights that while public and public-private pathways remain important, widespread and sustainable uptake requires business models that are profitable, investable, and connected to effective delivery channels. Key findings include:

- **Business models drive scale**: exploring how an innovation can make money by describing the problem it solves; the target or market segment that will use the innovation; the revenue streams and cost structures; and the delivery channels, partnerships, resources and operations that will deliver the innovation.
- **Critical data and planning are needed to provide input into the business model**:
    - **Economic analysis is critical**: standardized cost-benefit data (production costs, ROI, market size) is essential for investor engagement and digital platform dissemination.
    - **Delivery channels matter**: agrodealers, cooperatives, fabricators, business service providers (BSPs), Business to Business (B2B) relationships, distributors, licensing arrangements, and digital platforms are critical conduits to reach farmers and markets. Each offers unique advantages and limitations.
- **Showcasing works—with preparation**: trade shows and virtual showcases can spark demand but require investor-ready materials with specific data.
- **Brokering and partnerships accelerate uptake**: tailored matchmaking between innovators, investors, and distributors bridges the gap between demonstration and adoption.
- **Communication strategies must be embedded early**: prospectuses, sell sheets, and investor-oriented and marketing materials should be part of the R&D process from the outset.

Looking Across 2011–2024: Toward Sustained Scaling

Taken together, the two phases show an evolution in understanding scaling:

- From **theoretical frameworks and systems orientation** (2011–2020) to **commercialization and investor readiness** (2020–2024).
- From focusing primarily on **innovation characteristics and enabling environments** to prioritizing **business models, economic viability, and delivery channels**.
- From donor-driven facilitation to **market-driven partnerships** that can sustain adoption beyond program cycles.

The way forward will require integrating both sets of lessons: continuing to plan for scale from the earliest stages of research, while embedding business model design, economic analysis, and communication strategies to ensure commercial pathways can succeed. Future efforts should also strengthen inclusive approaches, leverage digital platforms, and refine monitoring methods that capture true diffusion and impact at scale.

By institutionalizing these practices, scaling practitioners can ensure that research investments not only generate innovations but also deliver them at the scale and speed required to transform food systems, strengthen resilience, and improve incomes and nutrition worldwide.

1.0 Feed the Future Scales Up (2011–2020)

1.1 Aim of Section 1.0

The purpose of this section is to:

- Share lessons learned from over a decade of scaling Feed the Future-funded research and innovation;
- Introduce a framework for innovation commercialization and scaling;
- Explain the theoretical foundations behind this framework;
- Recommend a path forward for coordinated scaling efforts across stakeholders.

A Decade of Learning. The Bureau for Resilience, Environment, and Food Security (REFS) - then known as the Bureau for Food Security - first embarked on its journey to scale up programs and innovations in Feed the Future target and aligned countries in 2013. At that time, USAID missions in target countries initiated a series of "Scaling Action Plans" with the intent to identify a limited set of technologies that could advance sustainable, broad-scale, high-impact scaling. This undertaking was accompanied by Global Learning and Evidence Exchange events to advance missions' efforts by facilitating information exchanges. Concurrently, REFS engaged scaling-up experts through literature review, case studies, and expert roundtables to put scaling-up strategies into practice. Since then, REFS has built up a body of work drawing on the lessons learned from these (and others') experiences. Staff developed and validated a framework for scaling up as the basis of an Agriculture Scalability Assessment Toolkit and documented some successes of scaling certain innovations.

Among the most important lessons learned over the decade are:

- **Design for Scalability**
  - Assess scalability as early as possible. Identify the prospects and likely challenges that will be faced, which allows everyone involved to make informed decisions about whether and how to proceed, and to take specific steps to mitigate potential scaling obstacles or negative externalities. Key parameters for assessing scaling potential are: importance of the problem, credibility of the solution, ease of adoption, business case for users, business case for the market system, and the enabling environment.
  - Plan for scale upfront. Design projects and innovations with scale in mind. Plan an exit strategy, with indicators and milestones, without defaulting to an invisible hand, assuming the market will simply lead to scaling up.[3]
  - Different models need to be considered. A pilot program may scale from an implementing partner to intermediary organizations that then drive systems change.
  - There are different pathways to scale depending upon the characteristics of a good or service, including whether these characteristics lend themselves to commercial pathways, public-private partnership pathways that are supply constrained, public-private partnership pathways that are demand constrained, public pathways, or bundles of goods, necessitating leadership and involvement of different stakeholders. Strengthening of these pathways can contribute to systems change.

[3] Kohl, Richard & Colm Foy: "Briefing Note - BFS Scaling Cases," p.7. (Briefing Note - BFS Scaling Cases (Final).pdf)

- The most appropriate scaling pathway largely depends upon whether the characteristics of the innovation to be scaled are predominantly private, public, club or common goods (see Section 1.3).

- **Implement and Deliver**
  - Factors that facilitate achieving scale include a conducive enabling environment that supports trade and movement of, and access to, goods, services and information, an inclusive and accessible financial system, functioning infrastructure, and protection of public and private resources, including intellectual property rights.
  - In order to scale innovations for development, evidence[4] suggests a strong preference for private sector scaling based on two assumptions. First, in many middle- and low-income countries the public sector lacks the resources, incentives, and ability to scale. Second, donors have neither the mandate nor resources to support scaling beyond five to ten years. If scaling a particular innovation is profitable for private sector actors, it is likely to be sustainable and eventually approach maximum scale potential. Despite the preference for private sector scaling, research suggests that other stakeholders, including public sector actors, play important intermediary and supporting roles, *e.g.*, regulatory approval and quality assurance, extension and marketing that raises awareness of novel products to drive demand, trains end users to properly use them, and supports a feedback mechanism linked to research and innovators.
  - Market and other intermediaries play critical roles in scaling and are often ***the*** missing factor when no other entity can drive scale. Few interventions or innovations transition successfully to scale without someone performing a variety of "intermediation" functions. Now crop varieties or fertilizer formulations, for example, are unlikely to reach farmers without the intermediation of seed companies and agrodealers.
  - When markets fail, public-private partnerships (PPPs) can be leveraged to play essential roles -- with the right institutional arrangements and incentives, as evidenced by the PPPs that supply early generation seeds for many crops. When markets are more robust PPPs are likely to be supplanted by profit-seeking firms.
  - Donors can serve to safeguard and facilitate inclusive scaling alongside local actors and may be indispensable when there are strong public benefits and a willing but under-resourced public sector and/or commercial partner. Donors can play this facilitation role by linking up investors, safeguarding and de-risking finance, and linking manufacturers and distributors to small- and medium-enterprises, or other entities that could benefit from the product or service, and supporting extension or training.
  - The choice of business model may be the difference between success and failure for an innovation.

- **Support inclusive access**
  - Scaling pro-poor agricultural products and services should be accompanied by finance at a matching scale, which is contingent on significantly reducing the risk or transaction costs associated with investment in pro-poor food systems.

[4] Op Cit., "Scale Up Sourcebook," Chapter 3.

- Government and/or donor action is often required to promote inclusive market development when the private sector is unwilling or unable to absorb the costs of reaching remote and dispersed smallholders or other disadvantaged groups.

- **Monitor and Adapt**
  - Monitoring impact is complicated; there are few feedback mechanisms and the ones that exist are costly, especially for less commercial technologies for which there are fewer incentives to track diffusion.

1.2 REFS and GFSS further integrate scaling

In 2020, USAID and missions doubled down on systems approaches to agricultural development, particularly with the global recognition of a "food systems" approach.[5] Over the decade since the Feed the Future Initiative's inception, understanding of scaling programs, likewise, shifted toward a systems-oriented view.

The **Global Food Security Strategy (GFSS)**, which guided the Feed the Future Initiative, embedded a **"scaling up agenda"** as one of its core commitments, including:

- **Making innovation scaling central to food security programming** – ensuring that R&D, interventions, and partnerships were designed not just as pilots or short-term projects, but with the explicit goal of achieving **widespread, sustainable adoption** of innovations and approaches.
- **Embedding scaling into the research-to-use pathway** – using the **Product Life Cycle (PLC) approach and pathways-to-scale framework** to evaluate innovations early, identifying those with high potential, and prioritizing investments that could realistically achieve impact at scale.
- **Leveraging multiple pathways** – recognizing that different innovations require different delivery models: private-sector markets for commercial goods, public programs for public goods, and public-private partnerships for common goods and practices.
- **Strengthening enabling environments** – addressing the policy, institutional, and market conditions necessary to allow scaled innovations to spread, adapt, and persist, including incentives for local and private-sector actors.
- **Prioritizing inclusivity and systems thinking** – ensuring that women, youth, and marginalized groups were not left behind, and framing scaling within a broader **food systems** perspective rather than focusing only on individual crops or technologies.
- **Building accountability for scale** – incorporating expectations that USAID missions, implementing partners, and researchers integrate scalability assessments, economic analysis, and monitoring of real-world diffusion into their program design and reporting.

During reorganizations and revisions beginning in 2020, scaling became more widely recognized as integral to achieving the GFSS objectives of reducing poverty, hunger, and malnutrition. In March 2020, REFS restructured from the Bureau for Food Security to the Bureau for Resilience and Food Security and reaffirmed its commitment to scaling, evident in the new strategic roles and teams that were created,

[5] USAID GFSS -- https://www.usaid.gov/sites/default/files/documents/Global-Food-Security-Strategy-FY22-26_508C.pdf. A preference for the use of "food and agricultural systems" is used to better capture the non-food aspects of our work under the GFSS. Here, we use the term "food systems" to reflect the strategy directly but felt it was important to acknowledge the current debate

such as the Center for Agriculture-led Growth's Commercialization and Scaling Team and the Technology Transfer Team.

The updated GFSS, was released in October 2021. Scaling up was more widely recognized as integral to achieving the GFSS objectives of reducing poverty, hunger, and malnutrition with 91 references to scaling up programs or innovations. GFSS Objective 1:, 'Inclusive and sustainable agriculture-led economic growth,' highlighted the need to strengthen the public and private delivery pathways that get cutting-edge innovations and information into the hands of producers and entrepreneurs:

> *Inclusive and sustainable agriculture-led growth requires widespread adoption of improved technologies, practices, and approaches by all system actors, including local service providers, input suppliers, smallholder producers, and processors…by developing and strengthening public and private delivery pathways to link appropriate solutions to demand.*[6]

The GFSS scaling-up agenda also referenced food systems, nutrition, climate change adaptation technologies, supply chains, capacity development, and research approaches.

GFSS defined the scaling of proven technologies and practices as, "the process of sustainably increasing the adoption and diffusion of a credible technology or practice, or a package of technologies and practices, to retain or improve upon the demonstrated positive impact of the technology or practice and achieve widespread use by stakeholders."[7] Adoption of improved technologies and practices by a small number of adopters will not accomplish development goals. In order to yield maximum impact, the widespread adoption of improved technologies and practices must be achieved.

The GFSS Technical Guide for Scaling[8] provided guidance for incorporating the scaling of improved technologies and practices into development efforts aimed at reducing hunger, malnutrition, and poverty. Proven wide-scale adoption, as witnessed in the Asia and Latin America Green Revolutions, is transformative and affects sustainable economic development.

REFS supported a facilitative **approach** that strengthened the actors and their respective functions that make up the public and private scaling pathways at the systems level, diffusing innovations beyond program boundaries and allowing for widespread adoption of improved technologies and practices at the population level (e.g., hundreds of thousands to millions).

[6] Global Food Security Strategy FY22-26, pg.26

[7] Op Cit., "Scaling for Widespread Adoption of Improved Technologies and Practices"

[8] 2017, Global Food Security Strategy Technical Guidance, "Scaling for Widespread Adoption of Improved Technologies and Practices" GFSS Technical Guidance Scaling).

1.3 Scaling up programs and systems change

In distinction from scaling up individual technologies, there are several ways to define "scale up" of programs.[9,10] When referring to the scaling up of programs,[11] it means that *impact* is being scaled, rather than increasing only the number of program participants or beneficiaries, outputs or approaches. This meaning aligns most closely with what has been referred to as "transformational scale", or "...creating significant change by engaging with a broader and deeper number of systems to create more space for scaling…"[12] Programmatic scale should be understood as changes in behavior, benefits, and other outcomes facilitated by the program, linked to a corresponding change in underlying incentive structures that influenced these.[13]

This concept of transformational scale matters when considering activities' roles (pilot or other stage), the tools to implement them, and how they facilitate systems change at scale.[14] Programmatic scaling may begin with pilot activities to determine the efficacy of an approach, of a technology, or to achieve certain results. Not all pilots can be expected to reach scale, but while donors have had some successes a significant number of cases do not scale.[15] Activities and pilots can also generate evidence to support the effectiveness of specific interventions, perfect an innovative method, or ground-truth an approach in different countries and contexts. However, much as technologies must be developed with scale in mind from the beginning, activities must be designed with a vision for impact beyond the life of a program.[16]

Finding ways to lay the groundwork for scaling, pivot to a new entry point, transfer an innovative pilot, adapt to push on a different lever, or determine when to abandon an intervention, are all important to set the stage for impact at scale.

For a program to scale, it must be catalytic and effect sustainable change in a food or other system and achieve broad impact. These changes take time and don't fall neatly within a five-year program cycle. There is an incentive to focus on increased beneficiary numbers and other easily reportable indicators. Additionally, measuring significant change and outcomes are challenging. Increased investments in consistent monitoring, impact studies, and ex-post studies can help drive change toward assessing program impact.[17] See Appendix One for two examples of what successful scaling programs can look like in practice.

---

[9] https://www.usaid.gov/sites/default/files/documents/1864/Scaling-Up-Discussion-Paper-508.pdf -- specifically the definition of scale up: "...a process of expanding {nutrition} interventions with proven efficacy to more people over a wider geographic area that maintains high levels of quality, equity, and sustainability through multi-sectoral involvement." We do not believe this definition applies in the context of USAID's work and greater emphasis from FTF on systems change, rather we believed that in seeking scale, programs should consider impact as opposed merely to reach.

[10] USAID Toward Transformational Impact: Synergies of PSE & MSD

[11] Other appropriate language here, in place of "activity" could be program, project, pilot, or initiative. We have chosen to use the term "activity" in alignment with USAID ADS 201's definition, "An implementing mechanism that carries out an intervention or set of interventions to advance identified development result(s)..."

[12] Scaling and Systems Issue Paper: https://www.scalingcommunityofpractice.com/wp-content/uploads/bp-attachments/8666/Scaling-and-Systems-Change-Issues-Paper.pdf

[13] Fowler, B., Sparkman, T., Field, M., LEO Brief: Reconsidering the Concept of Scale in Market Systems Development

[14] Kohl, Richard, "Scaling and Systems: Issues Brief," May 2021. (https://www.scalingcommunityofpractice.com/scaling-and-systems-issues-paper/)

[15] See "The Voltage Effect: How to Make Good Ideas Great and Great Ideas Scale," by John A. List, for discussion of why pilot programs often do not scale.

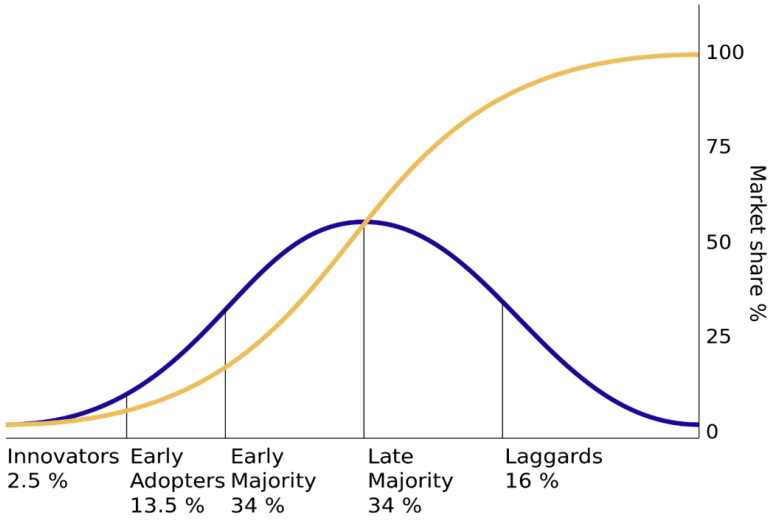
[16] Scale Up Sourcebook Ch. 1: https://docs.lib.purdue.edu/scaleup/sourcebook/book/

[17] Fowler, B., Sparkman, T., Field, M., LEO Brief: Reconsidering the Concept of Scale in Market Systems Development

1.4 Frameworks for scaling up innovations

In contrast to scaling up a program from a pilot to higher-level systems change, scaling up an individual innovation may or may not require changing a system.[18] "Innovations" are products, services, or practices that are original and can be useful for adopters. The familiar scaling sequence of innovations is an S-curve, depicted as follows:

Figure 1. Adoption of technology and/or practice over time.



"Takeoff" is the key inflection point from which an innovation scales through indirect diffusion driven by user demand and natural market forces. The takeoff point varies with the type of good. Consumer goods companies typically plan for a 16.6% adoption rate for takeoff. REFS' experience is that agricultural goods reach takeoff when the adoption rate is estimated to be between 25 percent - 35 percent of a potential market. Understanding the takeoff point for an innovation is critical because it suggests how much donors and implementers need to invest in linkages, market actors, and delivery pathways in a particular market before adoption occurs naturally.

REFS commissioned several studies on innovation scaling which provided the theoretical underpinnings for future work on scaling research.[19]

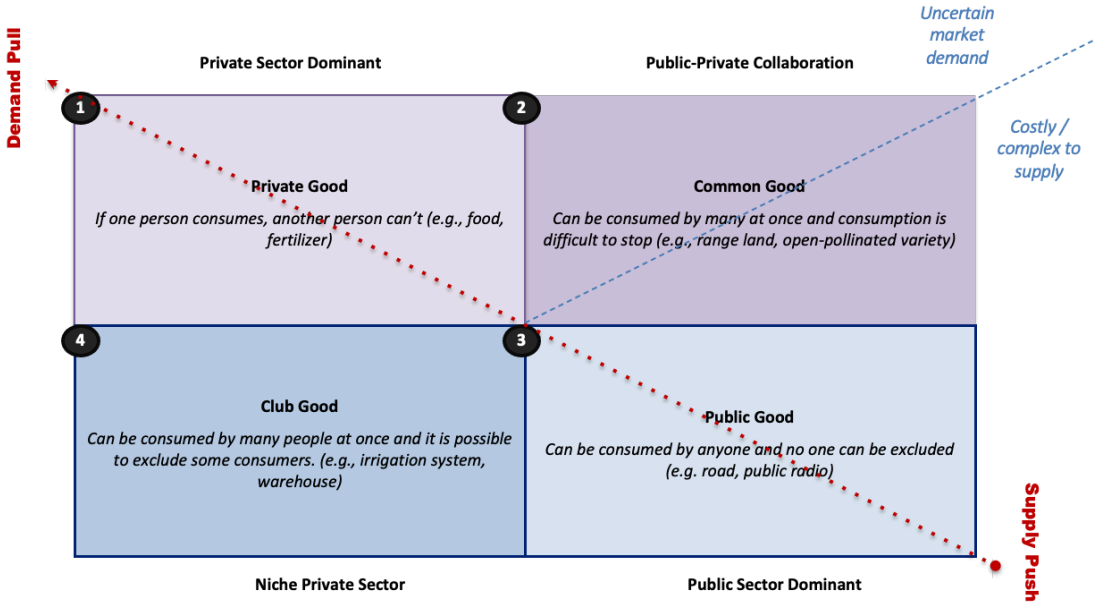
REFS, with other partners, documented, developed, tested, and refined a scaling-up framework for assessing pathways to scale. This framework is grounded on well-established economic theory, originating from research on the economic theory of goods, and applied in Feed the Future to constraints to early generation seed use[20] and scaling case studies.

[18] There is nuance to this point that is worth noting. Within the scaling literature (Rogers, 1983; Kohl, Foy, 2018, etc.) there is discussion of characteristics of innovations that facilitate scaling. These characteristics, namely compatibility, complexity, trialability, or collectively ease of adoption (i.e. "plug and play") are closely related to whether systems change may be required to see an innovation scale.

[19] Op Cit notes 1-4 and, for example, Technology Adoption Reference -Technical Note #2 v4.docx

[20] See Early Generation Seeds study series at https://agrilinks.org/post/case-studies-early-generation-seed-systems-project-overview-0

Figure 2. Categories of goods, with delivery pathways added. A good can fall between categories and it can move between categories over time.



In this framework, products and services have particular characteristics that facilitate their scalability as follows:

- **Private goods**: Access is based on payment, or some form of remuneration and non-payers are effectively excluded from use of the good. Private enterprises are the means through which scaling is achieved. Examples of private goods include everything from fertilizer to harvested crops.

- **Common goods**: Access is not controlled by payment, but access to the resource is restricted to entitled users. Such goods are subject to demand constraints mainly due to issues of demand uncertainty or supply constraints because of high costs or delivery complexities. Public-Private partnerships or related institutional arrangements are necessary to address such constraints. Rangelands are a classic example of common goods.

- **Club goods** (niche private sector): Access is based on payment, but the goods can be simultaneously used by multiple consumers until congestion occurs, or rationing is necessary. Private enterprises achieve scale of these goods until demand is met, at which point it typically collapses, or demand must be tightly managed. An irrigation system is a club good. A grain elevator functions much like a club good when 100 percent capacity utilization is reached, demand for more grain collapses.

- **Public goods**: Access is not controlled by payment, and the goods can be simultaneously accessed by multiple consumers. Public goods are the responsibility of governments (or, temporarily, donors) to deliver, although with the right institutional arrangements there may be private delivery options. Roads for transporting grain are public goods.

Private goods are subject to demand-pull by markets; that is, there are profitable financial returns to individual actors, which incentivizes them to participate actively in the market. Public goods are subject to supply-push forces as there are low- to no- returns to individual actors.

Scaling up products and services follow one of the foregoing trajectories. Scaling up *practices*, for which often there is no demand-pull, typically requires a bundling strategy where a practice can be bundled with a product or service that is in demand. Otherwise, if there are no bundling opportunities, practices will have to scale through the public sector.

The objective of this framework is to help stakeholders understand how the type of good—private, common, club, or public—shapes the pathways and constraints for scaling. By diagnosing the nature of the good, practitioners can identify whether market incentives, public–private partnerships, or public provision are most appropriate. The framework can thus be used as both a learning tool, to interpret past experiences with scaling, and a practical guide, to design future interventions and align scaling strategies with the institutional arrangements most likely to succeed.

1.5 Case Examples and Evidence from the Research Rack Up

Feed the Future Innovation Labs generated a collection of innovations, including but not limited to new crop varieties, improved practices, and better technologies, for which data was cataloged in a basic, MS Excel-based database internally referred to as the Research Rack Up (RRU). Data collection started in 2015 and included innovations from as early as 2011 and covered information as technology name, description, various categorizations of the technology, implementing partner, stage of research,[21] and other information. The innovations in the RRU represented a decade of investment in Feed the Future in solving problems that plague smallholder farmers and others in agriculture and food systems through research solutions.

As of end 2021, over 1,500 innovations in the RRU had reached the point of being "ready for uptake'' or showing "evidence of scaling." REFS specialists analyzed these phase 3 and phase 4 innovations, assessing the innovations' likely pathway to scale, supply or demand constraints, and initial reports about dissemination to try to learn the extent to which these innovations had achieved scale. Phase 4 innovations were examined to see if they were reaching end users directly or through diffusion, and for lessons learned from those innovations that had reached larger populations of farmers.

REFS and missions were committed to scaling the most promising of these innovations, through ongoing and new partnership platforms and by relevant programs and projects. Together they spearheaded a three-pronged approach to scaling these promising innovations:

- Linking promising products and services to potential partners through:
    - Highlighting innovations at regional platforms including 13 high priority products[22] at the Africa Food Systems Forum in a virtual showroom in September 2021 and innovation showcases in other venues, involving innovation developers, missions, and implementing partners.

[21] Stage of research related to Feed the Future standard indicator "Number of technologies, practices, and approaches under various phases of research, development, and uptake as a result of USG assistance," with the phases being Phase 1: under research as a results of USG assistance; Phase 2: under field testing as a result of USG assistance; Phase 3: made available for uptake as a result of USG assistance; and Phase 4: demonstrated uptake by the public and/or private sector. Phase 4 was added as a disaggregate in 2018; previously phase 3 was the final phase.

[22] Not including seeds of improved crop varieties, services, or practices.

- Brokering partnerships for selected products via the REFS Market Systems & Partnerships (MSP) project with participating missions and implementing partners.
- Limited direct support for pilot scaling efforts under REFS research mechanisms.

- Promoting RRU crop varieties in conjunction with Syngenta Foundation's Seeds2B spin-off, the Seed Systems for Development Activity, and AGRA.[23]

- Bundling agricultural practices strategically with prioritized products and services.

Additionally, selected practitioners identified systemic barriers that limit scaling of promising technologies and developed guidance to overcome key constraints (see the accompanying Addendum).

REFS investigated how intellectual property (IP) rights from research partners can be better supported, which suggested that licensing, trademarking, or patenting do not represent a hindrance to moving technologies off the shelf. Discussions among REFS and stakeholders interested in IP and its effect on scaling elicited a few themes. Scaling through the use of IP, e.g. patenting or trademarking, is expensive, particularly if the potential market goes beyond one or two countries. And only a limited set of technologies can garner the returns necessary to cover all legal and administrative costs associated with patenting, trademarking, and exercising Plant Breeders Rights. Second, absent specific efforts by the Innovation Labs and their university partners, the vast majority of technologies in the RRU could be widely scaled without legal–specifically IP–concerns. Third, for those technologies that are not viable for a purely commercial scaling process, partnering opportunities could facilitate wider distribution of technologies. For instance, Purdue's Business School hosts the 'Purdue Foundry' that provides a business lens focused on entrepreneurship and the commercialization of Purdue-derived technologies to help them achieve commercial success. Technologies are assessed for potential market viability through workshops, feedback and a ground truthing process with students and staff.

1.6 Early Challenges and Findings in Monitoring and Systems Change

FTF implemented a rigorous monitoring, evaluation, and learning (MEL) framework to track progress at different levels, support evaluation and analysis, enable performance-based and adaptive management, and remain accountable to its commitments. This framework also sought to generate evidence on effective, evidence-based approaches to improving food security and nutrition.[24] Through the MEL framework, FTF promoted a common set of standard indicators that served several purposes: monitoring activity performance, ensuring accountability, and measuring high level results and impacts at the activity, Zone of Influence, and national levels. The main challenge was designing indicators that could capture meaningful outcomes across a broad range of programming and align with FTF's high level goals and objectives, while also minimizing the reporting burden for partners and USAID staff.[25] See Appendix Two for an explanation of the types of data and information that were captured in FTF's reporting system.

[23] Nine Innovation Lab varieties were showcased at the African Seed Trade Association congress in 2021. USAID determined that there were 36 varieties (of over 280) in the RRU that year that were candidates for further support, not including drought, heat and stress tolerant maize varieties that are fully supported for advancement by CIMMYT.

[24] Global Food Security Strategy, 2022-2026

[25] The Feed the Future indicator framework is composed of 53 required-as-applicable indicators to be selected by the results that programming is expected to achieve; 20 are Zone of Influence-level indicators which target countries report on every 4-5 years, 26 are annually reported implementing mechanism or activity level indicators, and seven are national or multilevel indicators (which rely on the type of programming of target and/or aligned countries) reported at different frequencies.

Tracking the scaling of innovations through the FTF Monitoring System proved challenging. While standard indicators existed for implementing partners and field staff to report on scaling efforts, they often reflected only a part of the story due to limitations in available data, timing, and geographic coverage of donor funded R&D activities.

Why is tracking diffusion of innovations so difficult?

Tracking the diffusion of innovations is inherently difficult because it serves multiple purposes — from accountability and reporting to adaptive management and learning — and each purpose may require different data, collected from different sources, over varying time periods and geographic areas.

At a minimum, monitoring of scaling seeks to answer:

- What innovations are being used?
- Where and by whom are they being used?
- To what extent has a particular intervention reached its potential market?

Beyond these basics, monitoring can capture the various phases and pathways of scaling across multiple levels — policy and enabling environment, systems, enterprises, and farmers/households. Measures may include:

- Estimates of total potential market
- Identification of market system constraints
- Critical mass of early adopters
- Profit/risk incentives for all actors in the value chain
- Risk and return for "average" users
- Adoption rates among direct and indirect beneficiaries
- Production, sales, and distribution data
- Progress toward commercial sustainability
- Relevant policies and subsidy regimes
- Access to and affordability of innovations, finance, spare parts, technical assistance, and extension support

Measuring scaling can also extend far beyond what implementing partners directly influence or what donor programs require for reporting. For example, assessing whether an innovation truly scaled may require data on widespread adoption at the population level, not just uptake by direct project beneficiaries.

Questions beyond what to measure

Tracking the effectiveness of scaling raises not only the question of *what* to measure, but also *how* to measure it, how often, from whom, and in what locations. In complex systems, it is rarely possible to claim direct causation, or credit, for scaling outcomes. Instead, "plausible association" — linking funding, investments, and partnerships to downstream outcomes — is often more realistic.

Contribution analysis offers one methodology for establishing these linkages. Rather than proving with certainty that an intervention caused specific changes, it builds an evidence-based narrative showing

how and why these changes occurred. While **randomized control trials (RCTs)** are the gold standard for establishing causality, they are difficult to apply to innovation scaling "in the wild," where multiple actors, market dynamics, spillovers, and the absence of a clean counterfactual complicate analysis.

Measurement challenges at different levels

At the farm level: Tracking the use of specific innovations, (e.g., crop varieties, services, fertilizers, and practices) at the individual farmer level is **expensive**. USAID invested in numerous innovations, which can be applied at different points in the production cycle, often in partial or mixed packages across different parts of a farm. This sheer variety can require a large sample frame and a complex survey instrument (potentially complemented by other methods, including visual confirmation, soil sampling or crop cuts). Visual verification works for some farming practices, like planting in rows or irrigation, but not others. Full adoption may be **difficult to validate** as farmers frequently adopt practices selectively and not as a package. The prevalence of counterfeit goods in some locations can distort results.[26]

At the project level: Scaling takes a long time and often does not fit neatly into the typical donor five-year program cycle. By the time the innovation hits the field or is handed off to a scaling partner, project **funding may have ended**.[27] The research partner may have "handed off" the innovation to another entity, including an NGO or a NARS, who may not have links to the donor. Ultimately, **no entity is responsible** for reporting on dissemination outcomes further downstream. Tracking adoption after project close-out, including outside intervention areas, is critical but rarely funded.

At the MSME level: SMEs may **lack the resources or incentives** to collect (and report on) customer and sales data. Many don't recognize how data could improve profitability and customer support.[28]

Opportunities for better tracking

- New, more cost-effective methods, including **DNA fingerprinting**, can accurately identify varieties in farmers' fields. With prices lowering, this method is becoming more viable.
- There is strong justification for using **digital technologies** to track innovation diffusion. Remote sensing may be used for certain practices; offline data collection via mobile device in low-connectivity areas has become the norm; mobile-enabled extension through extension agents, village-based agents, or agrodealers can reach more farmers, faster, enabling innovations to make it into the field quicker than ever before and provide a digital footprint of who accessed information and when.
- Leveraging **national agriculture censuses** and surveys. : Engage with initiatives like the World Bank's LSMS-ISA and 50 x 2030 initiatives to include innovation adoption questions that are of national and regional significance. The report, "Shining a Brighter Light: Comprehensive Evidence on Adoption and Diffusion of CGIAR-Related Innovations in Ethiopia," describes the

[26]Oruko, Leonard et al., "Diffusion and Adoption of Improved Rice and Maize Varieties in Tanzania: Application of Genetic Fingerprinting Technique." October 2015. (https://agra.org/wp-content/uploads/2020/07/Tanzania-Rice-and-Miaze-adoption-study-using-DNA-Fingerprinting.pdf)

[27] The data suggests that it can take 15 years for full commercial scaling to occur, project planners need to identify workable break-points and milestones consistent with USAID's time horizons and constraints.

[28] The Feed the Future Market Systems & Partnerships program was doing innovative work to equip SMEs with the tools and incentives for customer, supplier and sales data, including in all partnership agreements a requirement to complete customer or supplier (depending on the nature of the business) "insight surveys" that could be used by the business to reinforce their own positive feedback loops. See "Shifting the Locus of Learning" to learn more about how MSP was doing this and how businesses might use the approach going forward.

process and methodology where the collection of data on the diffusion of 18 agricultural innovations developed by the CGIAR were incorporated into the Ethiopian Socioeconomic survey, providing nationwide estimates on the reach of these 18 innovations.[29] In this vein, FTF Innovation Labs' innovations also passed through the hands of various scientists and research institutions, particularly the CGIAR since it acts as a bridging institution due to its inherent advantage of having more in-country presence.

- Leverage **partnerships** with other donors in the area, such as the Gates Foundation work on DNA fingerprinting.[30]
- Support **agri-MSMEs** to collect, analyze, and use data on dissemination for those innovations that have a commercial pathway, including sales, distribution, transaction costs, and profitability. Demonstrate profitability gains from targeted growth strategies using a data-driven approach. For instance, knowing where sales are growing or where licenses are awarded would enable them to better target future growth opportunities.

1.7 Decade-long lessons

In 2013, REFS embarked on an initiative for USAID missions to develop scaling plans for scaling up innovations emerging from the Innovation Labs that would make a significant impact on food security in FTF target countries. Select practitioners identified innovations with high scaling potential that were already available for uptake, as well as new innovations developed by the FTF Innovation Labs and One CG partners. Three significant differences steered REFS' approaches to scaling. First, REFS was guided by nearly a decade of learning, a comprehensive scalability assessment toolkit, and experience of applying these scaling approaches to real world applications. Second, REFS had instituted a rigorous Product Life Cycle approach to its agricultural research investments that integrated scaling criteria into stage gates. Finally, REFS' implementing partners had also gained significant experience of scaling both innovative systems and technologies.

Lesson 1: Institute a Product Life Cycle for innovations -- a system change

REFS launched the Product Life Cycle approach (PLC) in 2021 to drive improved diffusion of innovations and research investments by USAID and its partners. The PLC approach is an industry standard for product development, but for REFS, the PLC represented a novel approach to thinking about research investments and engaging research partners. The PLC embedded an increased emphasis on systems change, emphasizing both the technology scale potential as well as adoption potential. Designed with stage gates, the PLC guided R&D developers to consider a pathway to market for their innovation, including conducting market research, identifying and solving for barriers to adoption, and connecting with downstream partners along the technology's trajectory development and scaling pathway. The PLC is intended to assist R&D developers in the journey to scale without requiring separate scaling programs for each innovation. The PLC was implemented through an iterative learning process that guided its further refinement.

[29] https://cas.cgiar.org/sites/default/files/images/Publications/Ethiopia%20Strategic%20Review%20SPIA%202020.pdf

[30] IMAGE (Institutionalizing Monitoring of Crop Variety Adoption Using Genotyping) is a 5-year program funded by Bill and Melinda Gates Foundation (BMGF) and the implementer is Context Global Development. IMAGE plans to implement a program to institutionalize the monitoring of adoption of improved crop varieties using genotyping. It will bring together three countries (Ethiopia, Nigeria, Tanzania) to work on four selected crops per country (e.g., Maize, Cassava, Common Bean, Wheat, Cowpea, Rice, Teff) and analyze two rounds of monitoring data per crop based on conducting up to two rounds of monitoring over five years as well as using current baseline surveys where available.

Questions still being considered through the PLC rollout included:

- In what ways can the PLC stage gates and criteria be adapted to better support development and scaling of REFS-funded research investments, including better defining markets and possible business models?
- How can the PLC engage in product portfolio strategy and management to better serve local agribusinesses' needs and capacity gaps? How can larger, capable firms leverage behavioral economics research to understand their supply chains, motivate suppliers/distributors/retailers, understand customer behaviors, and how to work with those when possible or shift them if necessary?
- What are the other enabling, or wrap-around supports required for adoption of the product by the end user? To what extent are those in place? How can market actors be motivated to provide them, if appropriate?[31]

These questions will remain unanswered by USAID.

Lesson 2: Align strategic partners

Alignment of strategic partners is essential to defining appropriate and context specific technology bundles, including new innovations, for scale. REFS' Scaling Team assessed country- and FTF Zone of Influence-level characteristics to alleviate constraints to scaling technology bundles that were best suited to maximize relevance and value. Individual Mission operating environments were unique and necessitated a customized technology 'bundle' of products and services aligned with distinct country-level attributes and constraints such as farming systems,[32] agro-ecological zones, current and projected climate patterns, farmers' sophistication, market institutional arrangements, readiness of private sector actors, level of host country government capacity, supply chain accessibility, and barriers to entry.

Short-listed technologies, practices and bundles suitable for the country and capable of overcoming country-specific constraints were presented to Missions. REFS and Mission staff held ongoing discussions to clarify contexts, priorities, constraints, and opportunities to ensure relevance of technologies. Following these discussions, REFS and missions engaged strategic partners with potential interest in tailored technology bundles to support USAID country programs. Washington-based technical experts, technology developers, agricultural officers, Mission staff and field-based implementing partners participated in informative presentations on country-specific technology baskets. One session was a virtual agriculture marketplace of Innovation Labs' technologies for missions and their implementing partners to increase awareness of, and possibly broker, those innovations to potential market actors.

To further guide the uptake and diffusion of innovation baskets, REFS identified success stories that communicated lessons learned and informed best practices. These stories and lessons identified the critical efforts to most efficiently and effectively achieve diffusion at a wide scale. Success stories also provided a 'proof of concept' and reassured partners of the benefits realized when an innovation concept successfully scaled.

---

[31] Above questions were articulated by Kristin O'Planick for feedback on the REFS Research Strategy Update.

[32] Dixon, John A., David P. Gibbon, and Aidan Gulliver. *Farming systems and poverty: improving farmers' livelihoods in a changing world*. Food & Agriculture Org., 2001.

Lesson 3: Learn by looking back and looking forward

Across REFS, learning about the mechanics of scaling took diverse forms, including examination of programming, partners, innovations, literature, and building on earlier research. Driven by the main objective of disseminating productivity-enhancing innovations widely from its research investments, REFS focused on available levers, namely improving programming and technical assistance, including learning and analysis, leveraging relationships with different partners and the private sector, guiding the REFS-funded portfolio, and supporting missions.

The following learning questions were intended to advance the Bureau's continued learning agenda about how to realize scaling success:

From a farmer's perspective:

1. To what extent do innovations address farmers' expressed needs and priorities and what are the competing alternatives?
2. To what extent can farmers access and afford the innovation, and what mechanisms reduce financial and adoption risks?
3. To what extent can farmers easily integrate (i.e., plug & play) innovations into their existing farming systems and practices?
4. To what extent do training, demonstrations, peer-to-peer learning, and marketing efforts build farmer trust and confidence in adopting and using innovations?
5. To what extent is potentially increased production linked to markets that enable farmers to capture value from productivity gains?
6. What does the return on investment of the innovation for producers or other users versus what they are using need to be to support adoption?
7. To what extent can innovations better enhance inclusion (delivering benefits to women, youth, marginalized groups) and strengthen resilience to climate, pests, and market shocks?

From a market perspective:

8. Which REFS-supported innovations, including technologies, practices, and approaches, that are ready to scale have the greatest likelihood to scale from a market perspective? And factors supporting scaling?
9. What innovations have the potential to scale but need additional support to be more viable? What types of interventions can reduce these barriers and increase the "scalability" of these innovations?
10. What are the pervasive gaps in country-level agriculture research and development systems that, if addressed, would facilitate successful transfer and delivery of innovation by market actors independent of donor support?
11. What mechanisms are available to reduce real and perceived private sector investment risk in agricultural technologies funded by donors or governments?

From a landscape perspective:

12. What are countries' yield gaps in relation to their agroecological zones, and do they have a high potential to benefit from productivity enhancing innovations?

13. What are the innovations that are most suitable for these regions? How can appropriate innovations be promoted in these areas? How do practitioners know, or how can they be sure, that specific innovations are best suited to particular eco-zones?

Measurement:

14. What are the best methods, measures, and approaches to track diffusion of REFS-funded innovations and technologies to beneficiaries and beyond? What are the pros and cons of these different methods?

15. To what extent have REFS-funded technologies and innovations been adopted and used by farmers? How can farmer benefits be quantified, including for women, youth, and marginalized groups?

16. Can REFS determine whether a demand-driven and client-focused industrial research model yields higher returns on research for development investments than the traditional supply-driven academic model?

Lesson 4: Donors should incorporate learning into future research partnerships

REFS' experience at the 2021 African Green Revolution Forum (now the Africa Food Systems Forum) underscored the importance of embedding scaling considerations into research from the outset. Innovation Labs, while not tasked with scaling outputs themselves, were expected to design research for scale, apply Product Life Cycle (PLC) stage gates to ensure readiness for uptake, and use feedback loops to improve design and facilitate hand-off to market actors. This experience showed that scaling requires more than good research—it requires continuous engagement with potential adopters, early partner linkages, and adaptive learning at each stage. Donors can strengthen this process by supporting researchers through convening, brokering, building institutional capacity, and influencing policy, ensuring that research partnerships are structured to move innovations smoothly from discovery to widespread use.

2.0 Prioritizing Commercial Pathways (2020–2024)

2.1 Aim of Section 2.0

Diffusion of innovations through commercialization is an attractive prospect as a hand-off to a commercial partner could lead to positive outcomes for farmers and the commercial partner. As users adopt the technology, more energy can be devoted to marketing the technology and extending its reach and impact through the sharing of application-specific success stories and field-based results.

The following key findings provide entry points for helping innovators scale their innovations on a commercial pathway.

There are two important framing points to consider. As referenced in Section 1.0, there are a number of pathways to scale, including public and public-private partnership (PPP) pathways. The work discussed in this section generally focuses on a commercial pathway to scale. Technologies that may be better suited to a public or PPP pathway still have use and are crucial to development impact, but they are not

emphasized here.[33] Second, there are many possible methods and tools for R&D management. The Product Lifecycle (PLC) is one approach, which USAID deployed to improve its agricultural research and development pipeline. The innovations discussed here are research outputs that have been classified as "ready for uptake."

Important learning points include:

- ***Business models need to be developed early in the R&D process****:* A business model identifies the products or services the business intends to sell, how it will sell its products or services, inputs suppliers and output buyers, its identified target market, and any anticipated expenses. Innovation developers (or another stakeholder) need to consider what business model will most effectively scale their innovation (or where), e.g. direct sales, franchising via village agents, etc.
- ***Data is lacking***: Economic information on innovations coming out of the R&D phase tends to be incomplete (e.g., for fixed/variable costs, suggested pricing, potential revenue) and this lack of data can limit market interest.
- ***Strengthening marketing channels alone is not sufficient***: Promoting innovations through marketing channels like events, digital platforms, and hands-on brokering can be costly and insufficient for achieving desired results. Practitioners should seek to facilitate the pull of innovations by potential users - i.e., strategically matching the innovation to likely market demand.
- ***Consider complementary technologies or information that will boost farmer profitability***: Utilization of technology bundles is not yet robust, which limits adoption and returns to the farmer.
- ***Institutional arrangements can be the difference between successful or failed markets*** for innovation delivery at scale. Factors for successful market arrangements are rules (legal framework), roles (clear division of responsibilities), resources (sustainable financing), relationships (trust, accountability, and dispute resolution), and resilience (capacity to adapt).
- ***New focus, skills, and experience are needed***: Transitioning from academic research (discovery) to the delivery of market-led solutions requires different skill sets. Technology developers may not know how to develop business plans, assess markets, and maximize outcomes for farmers.

The discussion below describes the process followed to reach these conclusions, ending in a proposal for next steps.

2.2 Key Findings & Strategic Recommendations

This section distills lessons from 2020-2024 efforts to transition agricultural innovations from research to commercial adoption. While recognizing the value of public and PPP pathways, the focus is on commercial scaling, where viable business models, robust economic data, and effective marketing channels are essential to success.

[33] There are several reasons why a technology may have no clear commercial pathway to scale, including but not limited to: The technology was developed for use by small farmers and includes on-farm assembly or can be reproduced with local resources - there may not be any components to sell, but there may be substantial resource needs for education and awareness-building around the technology; The innovation is not a technology but a production method and may directly accompany a specific technology or improved seed variety in a 'bundle' of innovations; The innovation may not have demand because it has an indirect value proposition for intended users, such as innovations targeting issues related to public health or environmental quality, and this focus on public goods means an innovation would need to rely on public support because it would require substantial awareness-building resources.

Key Findings - linked to learning points above

- **Business Models Drive Scale**: The choice of business model must align with the innovation, market size, and target customers. Partners including agrodealers, business service providers (BSPs), business to business (B2B) relationships, fabricators, cooperatives, and licensing arrangements each offer distinct advantages and limitations. Early alignment of business models within the Product Life Cycle (PLC) research process enables more strategic commercialization.
- **Economic Analysis is Critical**: Investors and adopters require clear cost-benefit data, including production costs, pricing, return on investment (ROI), and market size. Standardized economic data templates would improve readiness for investor engagement and digital platform dissemination.
- **Delivery Channels Matter**: Effective scaling depends on reaching users through appropriate delivery networks such as agrodealers, BSPs, co-ops, fabricators, B2B actors, distributors, and digital platforms. Demonstrations, trade shows, and strategic partnerships enhance credibility and reach.
- **Showcasing Works–With Preparation**: Virtual and in-person showcases generate interest but only succeed when supported by investor-ready materials with specific pricing, distribution, and performance data.
- **Brokering & Partnerships Accelerate Uptake**: Strategic matchmaking between innovators, investors, and distributors–supported by tailored technical assistance–can bridge the gap from demonstration to adoption. Partnerships with organizations like Peace Corps, Syngenta Foundation's Seeds2B, and the African Seed Trade Association illustrate scalable models.
- **Communication Strategies Need Embedding**: Early development of sell sheets and prospectuses-tailored to specific audiences-improves visibility and credibility. These should be budgeted and planned from the start of R&D.

Recommendations

Summarizing strategic recommendations from these four years for scaling practitioners:

- Embed business model planning, economic analysis, and communications development into early research stages.
- Standardize economic data collection to meet user, investor and platform requirements.
- Use targeted delivery channels and events for strategic partner engagement.
- Institutionalize brokering functions that link innovations to commercialization partners.
- Leverage appropriate digital platforms and strategic partnerships for sustained diffusion.

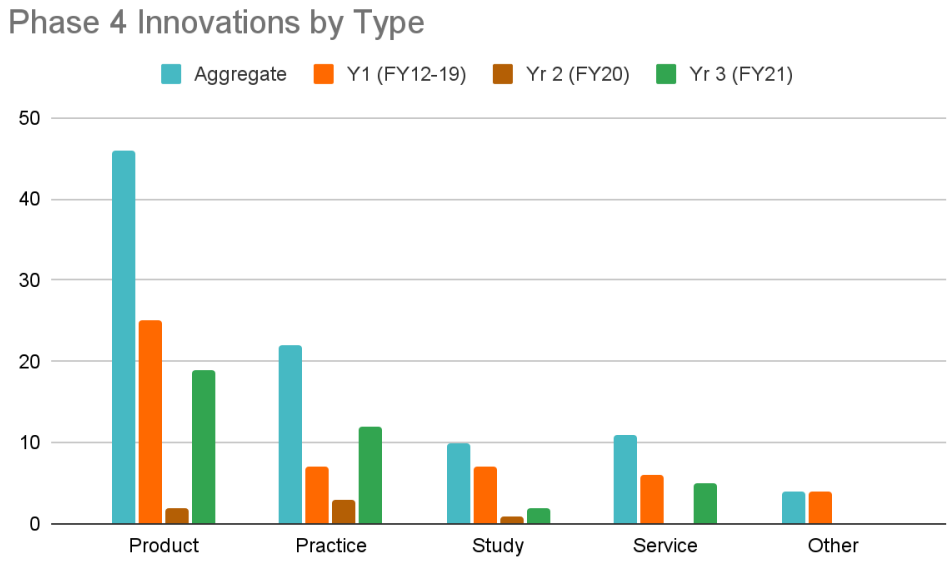
By institutionalizing these practices, scaling practitioners can strengthen the bridge between innovation and impact, ensuring that research outputs reach farmers and markets at the scale and speed required to drive food security, resilience, and income growth.

2.3 Deep Dives: Scaling Feed the Future Research Investments, an Experimental Approach

Until its discontinuation, Feed the Future's innovation environment was one in which research investments were faced with a supply problem. Until its discontinuation, Feed the Future's innovation environment was one in which research investments were faced with a supply problem. Research

investments were driven at a very high level by the objectives of Feed the Future[34] so investments were developed to support agriculture-led economic growth, nutrition, and resilience, but too often were not, from the earliest stages of development, connected to rigorous economic and financial analysis or an understanding of potential demand,[35] underpinned by viable business and delivery models, and engaged with appropriate channels for dissemination.[36] The most obvious way that this supply-driven challenge manifested itself was through data collected for the Research Rack Up (RRU) (please refer to Section 1.4). Many innovations were developed and reported in the RRU. However, there was limited evidence of widespread scaling of these innovations, demonstrating a clear opportunity to better understand the constraints that could prevent smallholder farmers from using them and getting their benefits, including increased productivity, nutrition, income, and resilience, among others. Low levels of uptake were seen across all scaling pathways, commercial, public, and PPP.

As can be seen in the chart below, very few innovations - less than 50 for each type of innovation - moved into Phase 4 (Demonstrated uptake by the public and/or private sector) as defined by the FTF Indicator EG.3.2-7: Number of technologies, practices, and approaches under various phases of research, development, and uptake as a result of USG assistance.[37]



A total of 604 Phase 3 and Phase 4 innovations were analyzed, available from RRU data that spanned approximately FY13 to FY21. Phases 1 and 2 innovations were intentionally filtered out. The above chart shows the number of phase 4 innovations in the RRU per year of the Scaling team's analysis by the type of innovation, with most Phase 4 innovations being products.

[34] The objectives of the Feed the Future Initiative are: Inclusive and sustainable agriculture-led economic growth, strengthened resilience among people and systems, and a well-nourished population, especially among women and children

[35] Feed the Future Research Output Dissemination Study (RODS) Case Study Summary, full RODS report referenced on page 5 of this document.

[36] Berlin & Winter, August 2021, Syngenta Foundation for Sustainable Agriculture, "Progressing innovations toward scale up: from learning to action".

[37] Feed the Future Indicator Handbook, 2019. See pages 85-87. Phase 1: Under research as a result of USG assistance; Phase 2: Under field testing as a result of USG assistance; Phase 3: Made available for uptake as a result of USG assistance; Phase 4: Demonstrated uptake by the public and/or private sector.

REFS intended to address the supply problem for innovations in the research pipeline with the full roll out of the PLC, by integrating demand and market considerations into each phase of research and stage gate.

Meanwhile, REFS focused on demand-driven approaches to connect existing research innovations, sitting "on the shelf", with a potential market(s). Using a variety of methods, REFS' scaling team identified and connected existing, viable innovations with potential investors or markets - in other words, connecting them to demand. These methods took a variety of forms discussed below. What underpins each method is the alignment of incentives and interests between businesses, investors, and the solution the innovations provide. In line with general scaling theory, such innovations should display a relative advantage to existing innovations, be trialable, compatible, observable, and with their degree of complexity considered.

Brokering Efforts

The scaling team engaged the FTF Market Systems and Partnerships program (MSP) with the goal of identifying 3-4 innovations with good potential to reach an intended market and then move those forward on the path to commercialization. The work occurred in two phases: Phase 1 to filter and select the innovations for brokering support; and Phase 2 to facilitate partnerships to scale these innovations and to develop a pipeline of potential investment opportunities and relationships. Phase 1 was completed in 2022, and Phase 2 in 2023.

In Phase 1, consultants developed selection criteria to filter and review a total of 35 promising innovations. They ultimately selected two - the Multi-Crop Thresher and the GrainMate Moisture Meter - to receive scaling support. A Learning Memo documented the process that the MSP team undertook to filter and select the innovations that would move forward into Phase 2 and what challenges they faced to complete this process.

During Phase 2, MSP facilitated the arrangement of partnerships and investment opportunities for the innovations (or the businesses behind them, depending on the situation). One of the key outcomes of this work was the necessity of identifying a business model and delivery channel from the earliest stages of innovation development.

Business Models

A business model is a company's plan for making a profit. It identifies the products or services the business intends to sell, its identified target market, market actors that engage with the innovation, and anticipated expenses. A business model describes not just what benefits the innovation will bring but ***how the benefits will be delivered***. An innovation needs a viable business model that includes the right data so inventors and investors can track expenses, income, and the breakeven point. Business models also need information about potential markets. The choice of business model will determine how an innovation scales through commercial pathways and needs to be appropriately matched with the innovation. The wrong business model for an innovation will not scale. As discussed in Section 1.0, scaling up products and services as private goods means they are subject to demand-pull forces by markets.

Business models engaging different market actors, and their related functions in FTF programs include the following:

- **Agrodealers** are generally physical stalls or stores that sell agricultural inputs, farm implements and can also provide technical advice. There are several categories of agrodealers including hub agrodealers, which service other agrodealers and large commercial farmers, agrodealers that just supply farmers, and village-based advisors if they sell inputs directly or on commission. Agrodealers often operate in networks where hub agrodealers supply smaller dealerships, which in turn may supply smaller dealerships and so on. Agrodealers are often key links for reaching smallholder farmers with improved products and services from Innovation Labs, such as new crop varieties sold by seed companies through these venues.

- **Business service providers** (BSPs) manage and operate standardized business processes on behalf of its customers and delivers its service to multiple customers, often using a "pay as you go" payment model. BSPs typically provide functional services (usually mechanized) to farmers or farmer groups, such as maize shellers, tractor operators, maize dryers, etc. Examples of BSP models that have taken up Innovation Lab technologies include Hello Tractor's digital app for plowing and other services provided by tractors and the Soy Innovation Lab's (SIL) multicrop thresher.

- **Business to Business** (B2B) is a type of commercial transaction between businesses where one business provides products and/or services to another business; examples include the manufacture of early generation seeds for seed companies and equipment for processors, such as is done by Seeds2B. A specific Feed the Future example is the drying beads developed with support of the Horticulture Innovation Lab. The drying beads, which draw out moisture from their surroundings, were deployed through a B2B model in Bangladesh where seed companies use them to dry their seeds prior to conditioning and onward sales. Farmers are the downstream beneficiaries of higher quality seeds, but the seed business model does not include the drying beads. Other B2B examples from the Innovation Labs include Sesi Technologies' moisture meter in Ghana and the Post Harvest Innovation Lab's BAU-STR rice dryer in Bangladesh. Hub agrodealers may be exclusively a B2B model if they only supply smaller agrodealers.

- **Fabricators** make things by combining or assembling diverse, typically standardized parts, usually copying products or designs. Multicrop threshers, Dry Cards, portable solar dryers and evaporative cooling (clay pot) technologies are all Innovation Lab examples of technologies that can be made locally by easily obtained materials .

- **Associations and Cooperatives** are groups of farmers, businesses, or other organizations with a common purpose under a formal structure, which are often owned and run jointly by members, who share the profits or benefits. Farmers join together in many types of groups such as water user management associations, seed banks, and marketing agents. These farmer organizations often provide services to farmers including plowing, planting, crop management, harvesting, and aggregation. Each of these services can be made more efficient by the application of technology so that, for example, plowing or planting across members' farm plots is much more efficient using tractors and their accessories.

- Under **Distributor--license agreements**, the business owner, the licensor, grants a licensee the right to use the licensor's intellectual property. Under a distributorship the Licensee is responsible for any manufacturing. The Partnering for Innovation program facilitated such a relationship with Bell Industries to manufacture PICS bags in Kenya using Purdue's trademark.

With REFS' migration to a PLC research management system, the development of a business model for each innovation was set at Stage 1. Once a research question and potential solutions or innovations have been identified to address the target population's needs, business model planning should be undertaken as the next step in the process. In the case of a new crop variety, farmers are facing low yields, new pests and diseases, and a shortened growing season. Researchers may define the question as how to maximize yields for a 100-day season with certain pest and disease resistance characteristics, and high

protein or other nutrients. There is a potential adopter population of several million farmers in the region. For successful scaling, certain business model elements must be planned in advance such as: how will the variety be licensed, and exclusively or non-exclusively; how will the variety generate a profit for a seed company, a brewer or a miller; what network will multiply, deliver, and train intermediaries and users on this variety. These questions, at a minimum, are relevant at this early planning stage as it influences who trials the variety and where, how much farmers are willing to pay, or if hand-off to a value chain anchor (e.g., a brewer) will be a better strategy. These decisions are even more pertinent for complex innovations. REFS found that one thresher was preferred over another for its transportability, even though the first thresher was more versatile in the field. The stage gate checks designed into the PLC forces researchers to address such questions several times throughout the cycle.

The choice of business model strongly influences the delivery channels that are most suitable to reach potential users downstream. Some innovations may be amenable to more than one channel, depending on the business model. For example, the Dry Card could reach users through several channels including agrodealer networks, associations and cooperatives, and even via multi-national corporations for selected cash crops. In most cases, though, the choice of business model limits the innovation to a single channel. For example, the solar vegetable dryer in Senegal, discussed in the RODS Report, uses a single-manufacturer business model which defined the market as vegetable processors who export their products to Europe. The size of this market turned out to be tiny, and the majority of exporters were uninterested in this dryer. However, the planned business model could have instead used a BSP model with a mobile dryer that could serve numerous villages, and the market could have been in the thousands, and more sustainable, because of the market's size and the technology's mobility. In both of these examples the business model, driven by the definition of the target market, determined the viability of channel options that were available.

When determining what type of business model works best for scaling up an innovation, some important questions should be considered:

1. What problem does the innovation solve, and how large is the potential market for the solution?
2. What is the competitive landscape, and how does the innovation compare to existing solutions?
3. What is the most effective way to monetize the innovation, and what pricing model should be used?
4. How will the innovation be distributed or sold to customers, and what partnerships or channels will be used?
5. How will information and training about the innovation be conveyed to intermediaries and end users?
6. What are the costs associated with scaling up the innovation, who are the different stakeholders involved in the manufacturing, multiplication, and selling, and what funding sources are available?
7. What are the regulatory requirements, if any, for bringing the innovation to market, and how can these be navigated?
8. What is the best organizational structure for scaling up the innovation, and what talent is needed to execute the strategy?

9. How can data and analytics be leveraged to optimize the business model and improve the innovation over time?

Answering these questions can help identify the most viable business model for scaling up the innovation, as well as potential roadblocks and areas that may require additional research or development. Ultimately, the goal is to create a sustainable and profitable business model that effectively brings the innovation to market and meets the needs of customers.

Economic Analysis

The economic analysis of an innovation, elements of which feed into the business model, must provide estimates of potential market size and the suggested selling price. Price will vary by location, but the cost composition should be itemized and comprehensive.

Many innovations in the RRU lacked detailed economic analysis, particularly from the perspective of manufacturers and distributors. While there were some basic cost estimates for end-users, they were often incomplete or failed to account for ongoing operating expenses. Few studies capture the full cost structures associated with production and distribution, leaving innovators and partners without a clear picture of what is required to scale. Market size estimates and the costs of last-mile distribution are especially underexplored, even though they are essential for demonstrating profitability and ensuring sustainable delivery.

Economic analysis encompasses four areas of concern for potential technology investors. Investors want to know the fixed and variable costs of producing a technology, the suggested price, the prospective revenue with an eye toward the breakeven point, and the economics of the business model through which a technology might scale. Most investors are interested in businesses that will scale a technology versus scaling a technology by themselves. Additionally potential innovation users, whether market intermediaries or farmers, require specific cost and benefit information in order to make an informed uptake decision, which feeds into demand projections.

Economic data is sought not just by investors and adopters but also by hosts of digital innovation portals, now much in use, such as the Technologies for African Agricultural Transformation (TAAT) Clearinghouse. These hosts seek to elevate awareness of innovations by increasing their dissemination to a broad range of potential adopters and can serve as delivery channels in the context of donor projects. The innovation portals all require specific economic data related to the innovations, each in its own format. Although the economic data that portals need vary slightly, data requirements tend to be similar standardized economic data. As an example, the TAAT Clearinghouse template requires economic data including initial cost, operational cost, return on investment, and economic advantage (cost savings, improved efficiency) prior to upload into the digital catalog.

In short, closing these data gaps is vital for building the case for investment, guiding design and distribution strategies, and enabling adoption at scale. Without strong evidence on comparative performance, customer benefits, and economic viability, innovations risk stalling before they achieve meaningful impact.

Data Needs and Gaps

Assessing the potential of an innovation requires reliable and comprehensive data. Without it, both investors and end-users face uncertainty that can slow adoption and reduce the chances of scaling. Three categories of data are particularly important: the competitive landscape, customer segmentation, and the economics of adoption.

Competitive landscape data provide the context needed to understand the potential value of an innovation. This includes identifying existing products, their suppliers, and traditional practices that already serve the target market. Establishing baseline metrics, such as yield levels, efficiency rates, or the costs of current practices, allows for a clear comparison of benefits. At the same time, analyzing the cost and performance of competing technologies helps position an innovation's unique advantages in terms of efficiency, affordability, or other value propositions.

Customer segmentation data are equally important, since different groups along the innovation pathway will experience costs and benefits differently. Investors are interested in potential returns, while manufacturers and distributors focus on margins, risk, and scalability. End-users, by contrast, are primarily concerned with affordability, ease of use, and the potential for savings or income gains. Understanding how adoption impacts each group is critical for designing incentives, aligning interests, and ensuring market uptake.

Economic data form the foundation for even the most basic analysis of adoption potential. For end-users, this requires estimates of the initial cost of adoption, ongoing operating costs, and the expected savings or profits associated with use of the innovation. For manufacturers and distributors, data are needed on equipment, facilities, and licensing, as well as the labor and material costs required to bring an innovation to market. Additional costs for transport, marketing, and last-mile distribution determine not only the price passed on to the end-user but also the minimum selling price necessary for profitability. At the broader market level, demand estimates and competitor pricing data—such as those available through resources like the *Engineering for Change Solutions Library* or the *FAO Sustainable Agricultural Mechanization Database*—help frame the overall economic landscape.

A key objective of REFS' scaling team was to identify delivery channels to reach potential adopters and investors for these innovations. Delivery channels, in the context of reaching beneficiaries with new innovations, are the people, organizations, and processes that engage in functions to transfer new technologies from the point of introduction (e.g. registration, manufacture, etc.) to the point of uptake by end users. Delivery, or market, channels are the way in which new innovations reach the intended users and comprise supply-chain segments, or functions, including producers and suppliers, distributors and intermediaries, information providers, consumers and end-users, and the financial intermediaries that underwrite most of these supply-chain segments. Delivery channels and their actors should also be included in the business plan, as it factors into the business model, income, and expenses.

Findings related to delivery channels, FTF Innovation Labs and implementing partners, certain business models, and market actors are described below.

- **Hub Agrodealers**: Innovation Labs and other implementing partners are only able to reach agrodealers indirectly for the most part. Most agrodealers are too small or too remote to work with implementing partners. The best channels for an Innovation Lab to reach agrodealer networks are via hub agrodealers, agriculture inputs companies, farmer demonstration events, or

industry associations. A majority of the product innovations developed by FTF Innovation Labs would likely have reached farmers through agrodealer channels if they were linked up with these market actors.

- **BSP networks**: The value of agricultural technologies generated by the Innovation Labs must be evident both to potential BSPs and to the farmers who stand to benefit from the associated services. Reaching BSP channels with relevant innovations is not straightforward. Farmer demonstrations are the most prevalent opportunity for showing farmers the usefulness of agricultural inputs and equipment, but BSPs don't always attend these events. A more likely channel is via hub agrodealers, many of whom have showrooms. Implementing partners may be the most direct channel to hub agrodealers; however, such agrodealers are unlikely to showcase new equipment for service providers based on a single model or a set of designs fresh from research trials.

- **Fabricators**: Fabricators have proven very difficult to reach. Fabricators are oftentimes small in size and operate informally, providing services to a specific geographic area. Fabricators generally use locally-procured materials (wood, scrap metal) as the primary inputs to their final products which are supplied to smallholder and cooperative customers. Innovations using locally sourced materials have the potential to be widespread and affordable. There are many open-source blueprints, specifications, and plans for technologies that could be of high value to fabricators and their customer base, but channeling these plans to fabricators has been challenging.[38] Examples of such plans included a chimney solar dryer, a pallet dryer, and a pot-in-pot evaporative cooling system. Identifying and locating these micro and small enterprises will remain a challenge for those seeking to disseminate improved designs and plans.

- **B2B networks**: Channels to B2B networks can be easier to reach directly as these partners are situated more centrally in value chains and are familiar to many donors, INGO, and implementing partners. Investor channels to B2B entrepreneurs are often direct as well.

- **Associations and Cooperatives**: These entities often arrange business services, demonstrations, and other learning opportunities for farmers. Where present, they may be one of the best conduits to reach smallholder farmers directly with innovations. Cooperatives in northern Mozambique, for example, have successfully introduced farmers to soybean production systems including new varieties, equipment, and inoculants.

- **Distributorships and Licensees**: Many of the Innovation Labs' technologies can be categorized as bottom-of-the-pyramid technologies[39] and not of much interest to university technology transfer departments. REFS found no examples of universities patenting Innovation Lab technologies. Opportunities for licensing and trademarking innovations vary considerably by innovation, yet downstream beneficiaries have expressed interest in obtaining licenses because their potential investors and lenders may require such arrangements.

REFS' implementing partners did not observe some types of delivery channels that are prevalent in sophisticated markets, such as direct-to-consumer channels, joint ventures, crowdfunding, etc.

The matrix below shows how market actors can be reached by innovation developers by type of business model and market actor, indicating if the channel is a direct or an indirect medium, where commercial applications are possible:

[38]In the lead up to the 2022 African Green Revolution Forum (now Africa Food Systems Forum), REFS attempted to locate a fabricator near to the event (held in Kigali, Rwanda), so that innovation designs could be demonstrated at the event with real-time localized assembly. Even with assistance from the Mission, no local fabricator was found.

[39] Bottom-of-the-pyramid (BoP) technology refers to products, services, or innovations specifically designed to meet the needs of the world's poorest populations—typically the 4 billion people living on less than about $2–3 per day.

Business Model/Market Actor						
Innovation developer	*Agrodealers*	*Coops*	*BSP*	*B2B*	*Fabricators*	*Licenses*
IPs	Direct	Direct	Both	Direct	Indirect	Both
Digital	Indirect	Indirect	Indirect	Indirect	Indirect	Indirect
Hubs	Direct	Direct	Direct	NA	NA	NA
Demos	Both	Direct	Both	Direct	Direct	NA
Shows	Indirect	Indirect	Both	Direct	NA	Direct

Direct - zero degrees of separation between the source and the purveyor

Indirect - one or more degrees of separation between the source and the purveyor

Both - purveyors can access a source directly and/or indirectly

NA - Not applicable to this business model

Where (including examples):

- IPs are Implementing Partners (Seeds2B, Winrock/Senegal Enabling Farmers for Agricultural Transformation Activity)
- Digital indicates digital platforms accessible by electronic technology such as smartphones (TAAT, IFAD)
- Hubs are hub agrodealers and farmer networks (Syngenta Foundation and Peace Corps Farmer hubs)
- Demos are generally rural demonstrations (Field-based)
- Shows are conventions, conferences, and all other media (television, radio) (AGRF, AfSTA)

2.4 Criteria to Assess Scaling Readiness

As noted in Section 2.3, Brokering Efforts, the MSP program focused on filtering and selecting viable innovations from the RRU for possible brokering support in Phase 1 of their engagement. As the team of consultants began filtering a list of 27 innovations provided by the scaling team, it became clear that existing tools for assessing scalability would be too cumbersome for the rapid assessment required in this phase. Drawing on work described in the earlier publication of the Agribusiness Scaling Assessment Toolkit, rapid assessment criteria were refined to winnow promising Innovation Lab technologies to a smaller and more manageable number for intensified scaling efforts. The criteria were useful but imperfect for screening innovations for scale. While data collection for each category was uneven, the criteria helped to structure discussions, highlight gaps, and guide next steps.

Following is a breakdown of the criteria. These simplified criteria may help practitioners assess scalability more effectively and identify where additional work is needed before innovations are ready to scale.

***1. Development Impact*:** This was the **easiest category** to score. Most innovations supported key development goals like food security, resilience, and poverty reduction, often across multiple countries. However, nearly every innovation scored high, so it wasn't helpful in filtering the list. Future criteria to consider include **market size by country and user segment** to add value.

2. Technological Efficiency: Most innovations had strong **lab or trial data**, but **real-world evidence**—especially under typical farming conditions without special support—was lacking. When available, customer feedback helped fill the gap. Field trials with regular users in real settings should be a standard part of future evaluations and assessments.

3. Value Proposition for End Users: This was the **most challenging category**. Cost data was often outdated or based on prototypes made in the US, not reflecting local costs, production, or pricing. Few innovations had solid business cases showing how end users (especially service providers) would benefit financially. Criteria to consider include **ROI calculations, risk-adjusted returns, end-user profitability**, and **user feedback on ease of use**.

4. Competitive Advantage: Innovations need to be clearly **better than current alternatives**. Some innovations had comparative data on productivity or price, but **few had user-persuasive evidence** on aspects like ease of use, cultural fit, or added benefits. Consider comparing competing solutions and the new innovation side by side to compare key features directly.

5 & 6. Market Opportunity & Business Models: These two categories had the **least available information**. Even when a commercial partner existed, it wasn't always clear whether the model was a scalable market opportunity. For example, some production methods (like artisanal fabrication) are not likely to be viable at scale. For such opportunities, more attention is needed to verify demand, profitability, and whether a **business plan** exists or can be developed.

7. Intellectual Property (IP): IP issues only became relevant in cases involving **multi-country scaling**. Most innovations were open-source or owned by the research partners. However, some had third-party ownership, which may require negotiation. Early clarification of IP rights is essential for planning commercial pathways.

Using the rapid assessment criteria outlined above, a manageable number of technologies were shortlisted, enabling a systematic identification of scaling pathways, differentiation of technology types, and evaluation of uptake prospects.

2.5 Strategic engagement and remaining gaps

Showcasing technologies:

USAID hosted the Innovation Showcase Overview, highlighting 13 technologies and featuring two innovations, a multicrop thresher and an affordable moisture detection card, in a live, virtual presentation during the AGRF (now known as the Africa Food Systems Forum) Virtual Marketplace in September 2021. Prospectuses were developed to showcase these 13 Innovation Lab technologies. Developing 13 prospectuses for these innovations was complicated because the information needed to create a complete prospectus was largely unavailable. It took months to get the necessary information from the Innovation Labs; in some cases there was no further information available because the researchers had moved on or the Innovation Lab performance period had ended.

The prospectuses, although lacking economic data and not sufficiently addressing the needs of prospective investors and adopters, proved invaluable to sparking audience interest.

On-line participation for each of the two overview sessions was around 150 – 160 potential adopters. During each of the one-hour overview sessions, several dozen participant questions were submitted. The number of attendees, questions raised, and technology inquiries received, all indicated a strong level of interest from participants.

At the 2022 AGRF, Innovation Lab technologies were demonstrated in person by a regional distributor, as well as a local entrepreneur. Although numerous product inquiries were received from AGRF participants, the technology representatives were challenged in providing specific selling prices and potential volume discount estimates. This experience demonstrated that innovation representatives presenting live demonstrations needed to be prepared with specific pricing, availability, and volume discounting figures.

Showcasing Technologies Locally: Working with Peace Corps Senegal

In February 2023, the Scaling Team organized a briefing for Peace Corps Volunteers (PCVs), in Dakar, Senegal. The PCVs gathered in Dakar prior to departing to the field where they would work with a 'Master Farmer' network historically supported by the Peace Corps and USAID/Senegal. The intent of this briefing was to raise awareness of innovations in the Research Rack-Up and inform the PCVs of the benefits and cost implications of the technologies, with the intent that this information could be channeled and disseminated throughout the field with the Master Farmer network. Two innovations, the Dry Card (UC Davis) and the Hygrometer (Purdue University) were presented in a hybrid interactive training program. Detailed benefits and cost implications were shared by both Innovation Lab partners, who fielded questions from the PCVs. Samples of the Dry Card were also provided to the PCVs beforehand, so that they could be demonstrated to their Master Farmer partners. Also present in the virtual audience were representatives from USAID/Senegal's recently-launched 'Enabling Farmers for Agricultural Transformation', (EFAT) pilot activity. Following the PCV training, the EFAT program has been in touch with the Innovation Lab partners.

Representatives from the Senegal Office of the Syngenta Foundation for Sustainable Agriculture (SFSA) also attended the PCV training event. SFSA supports 24 Master Farmers across Senegal in the showcasing and demonstration of improved horticulture production practices. Each Master Farmer provides training to approximately 150 smallholder farmers located within a 200-kilometer radius. Farmers are informed of improved technologies (including light mechanization, irrigation systems, transport, and cultivation techniques). These innovations are then demonstrated at select 'Famer Hubs' throughout Senegal.

The Scaling team continues to monitor developments from this training session while facilitating follow-on introductions and relationship building among participants. The training event culminated following close consultation with Mission and Peace Corps stakeholders. It was hoped that this Mission-centric showcasing of technologies would foster country-level uptake through localized networking channels. If successful, similar approaches can be used to engage broader groups of stakeholders.

Following the showcasing at AGRF, REFS' scaling team identified additional opportunities to promote knowledge dissemination and uptake of innovations to targeted end user groups.

In an effort to promote new and improved crop varieties developed by the Innovation Labs,, REFS, Innovation Lab staff, and Seeds2B staff met virtually with African Seed Trade Association (AfSTA) in November 2022. As a result, Seeds2B joined the 2023 AfSTA Congress in Dakar, Senegal to further

elevate awareness of seeds of new and improved crop varieties originating out of the Innovation Lab network. Seeds2B staffed a booth, fielded inquiries from attendees, and provided Quick Reference (QR) codes so that attendees could easily gain access to 26 new and improved variety 'sell sheets' across the soy, sorghum, bean, and cowpea categories. Roughly 30 new leads were generated by the Seeds2B team on both the research and commercial sides of the business. REFS monitored follow-ups and documented the steps required towards successful transactions for future replication.

These experiences demonstrated the need to identify and engage multiple channels in order to increase innovation awareness. Using a variety of channels can disseminate knowledge more broadly. Innovation showcasing has also demonstrated the necessity of especially preparing financial data before engaging with private sector entities. The economic analysis referenced in Section 2.3 is a requirement for any private sector entity with interest in a particular technology. The prospectuses and sell sheets were a necessary first step in generating awareness of Innovation Lab technologies, but ultimately insufficient for generating subsequent downstream uptake of these innovations without robust financial data.

Clearinghouses & Digital Platforms

REFS also assessed multiple digitally-based technology clearinghouses as possible avenues towards increased dissemination and awareness of the Innovation Lab technologies, including the Technologies for African Agricultural Transformation (TAAT) Clearinghouse, an affiliate of the African Development Bank and the IFAD Rural Solutions Portal.

Both the TAAT Clearinghouse and IFAD Rural Development Portal utilize technology-specific data sheets, containing required fields in order to showcase the innovations through the portals. REFS selected several phase 3 and 4 technologies possessing solid field trial results to populate the TAAT and IFAD data sheets. Although application and results pertaining to these technologies were readily available, again, the required economic and finance-related (estimates continued to be a challenge. Specifically, the lack of business and economic case- specific data, including cost, benefits, and return on investment, for each innovation was a notable gap. REFS worked directly with Innovation Labs to address these gaps, (see Section 2.3, Economic Analysis) and revamped research management at the Innovation Lab level adapting the PLC approach to identify key business case factors early in the development of an innovation.

Other Digital Innovation Platforms

REFS identified several other web-based platforms used to highlight agricultural innovations for international development to attract partners or facilitate adoption by end-users. Clearinghouses fall into several categories with differing levels of required information as seen below.

Clearinghouse Type	**Example digital catalogs**	**Overview of information required**
Moderated forum	Appropedia	As desired, typically background and how-to
Curated resource libraries for development practitioners	• Practical Action Knowledge Center • ECHO Global Farm EchoCommunity	Fact Sheets on how to implement solutions - typically materials lists and instructions for appropriate technologies
Catalogs of commercially available technologies	• FAO Sustainable Agricultural Mechanization Database • Engineering for Change Solutions Library	Requires existing commercial partnerships and pathways
Repository of Completed Projects (no longer operational)	• CGIAR Innovation Explorer • IFAD RSP	

Investor Engagement

There are numerous and diverse ways of building connections between potential investors and partners, but nothing systematic. REFS explored engagement with private sector investors and generally found two types of investors with different interests.

- **Investors who are enterprise focused**: These investors are mainly interested in investing in a promising enterprise, scaling it up and profiting from their eventual exit. Sometimes an enterprise is built around an innovation, but this is not the driving impetus. Because most Feed the Future innovations lack a commercial partner, enterprise-focused investors are rarely the right scaling channel; Innovation Labs must instead position innovations for alternative pathways and partnerships or interest existing enterprises in the opportunities that an innovation creates.
- **Investors who are technology focused**: These investors are interested in scaling up promising new technologies and their associated intellectual property. Their profit will come from revenue generated by these technologies. They often specialize in scaling through particular business models, specific value chains, and/or target geographies. Such investors could be prime targets for Innovation Lab technologies.

The second type of investor is difficult to find and must be approached at the right time in their investment cycle or there will be little opportunity of getting their interest.

Brokering investment through technology-engaged (and, in rare cases, enterprise-engaged) investors can sometimes help a few high-potential innovations reach scale in the short term. Yet this pathway is time-intensive, case-by-case, and therefore not a sustainable solution for the majority of Innovation Lab

research outputs.[40] Even when investors express interest, negotiations frequently stall over intellectual property. Investors need clarity on ownership, rights of use, and the disposition of IP within agreements between Innovation Labs and innovation users. Without transparent frameworks for managing IP, investor confidence is weakened, making it difficult to establish the kinds of commercial partnerships that could carry innovations forward. Investors are concerned about the disposition of intellectual property, an important point made by some commercial partners. They want to know the status of the intellectual property represented by any agreements between the Innovation Labs and innovation users. Intellectual property has been a sticking point for some investors. This was a technical area that the Bureau was developing a position paper on.

Strategic Partnerships as models for engaging facilitators and intermediaries

The discussion above of showcasing technologies in conjunction with Peace Corps volunteer programming highlights the importance of strategic partnerships to reach potential innovation adopters. An ideal strategic partnership would engage market facilitators (if they exist) and market intermediaries at the inception of the search for an innovation that solves an important problem. This extended team should be invited into the innovation discussion early so that awareness levels are increased, guidance is solicited, linkages among the different market actors are strengthened, and opportunities for incorporating the innovations can be woven across a partnership's portfolio. Incorporating specific innovations early into a partnership requires an extended team effort (researchers, planners, market facilitators, market intermediaries, government, and target beneficiaries).

The **iREACH initiative** represents a strategic partnership that links research, extension, and advisory services across West and Central Africa to accelerate the uptake of improved agricultural technologies and practices. By coordinating USAID-funded activities and aligning them with national research systems, iREACH reduced duplication, strengthened collaboration, and ensured that proven innovations reached the farmers who could benefit most.

A central feature of the partnership is the establishment of **Agricultural Technology Parks** at national research centers, which served as demonstration and training hubs. These parks provided farmers, extension agents, and private sector actors with hands-on exposure to new crop varieties, practices, mechanization, and digital tools, while also building the capacity of national institutions to sustain outreach. Through this model, iREACH not only showcased innovations but also built the ecosystems—linking governments, donors, research bodies, and private actors—needed to scale technologies effectively and sustainably.

There are examples of such strategic partnership approaches in Malawi via the Peanut and Soybean Innovation Labs, and in Ethiopia through Livestock Systems Innovation Lab and introduction of meat safety innovations. A strong strategic partnership could include other partners such as potential investors, delivery channel partners, and other key market system actors.

Seeds2B and the success of varietal commercialization: Syngenta Foundation for Sustainable Agriculture (SFSA) in 2017 had a promising start-up program called "Seeds2B" that worked with private clients to test the viability of their crop varieties in a different geographic location through discovery,

[40] It is for this reason that the Scaling team had begun to work with the AgResults Design Support Unit, with the goal of developing a more sustainable, incentive-based model to link innovations to markets. This work was planned to have the goal of providing a more effective model to bridge the period of time between now as RRU data continues to be reported in and when the PLC is fully rolled out and begins to be established. With the dissolution of USAID, it was not able to be fully designed and will not be launched.

trialing, and commercialization services. REFS challenged the Seeds2B team to pilot the same service offering for FTF-funded publicly-bred varieties coming from the One CGIAR and Innovation Labs. REFS established a Global Development Alliance (GDA) with SFSA for this purpose.

Six years later SFSA proved their B2B model for transitioning publicly-bred crop varieties from research through commercialization to seed companies for smallholder farmers' use. The Seeds2B GDA had resulted in nearly $15 million in seed sales, equivalent to 9.2 million metric tons of quality seeds of improved, mostly publicly-bred crop varieties originating in Innovation Labs and One CG Centers. Almost 200,000 hectares were under production of these improved crop varieties. Sixty new varieties moved from research to commercial production stages, and 49 of these varieties have been taken up by over 500 seed companies, cooperatives, and other users. In the process, $140,000 of royalties have been remitted to National Agriculture Research Systems, in part through 83 licensing deals.

Seeds2B achieved this via its systematic Product Life Cycle approach. Starting with the development of a Target Product Profile delineating the most desired characteristics for a new crop variety, Seeds2B conducted extensive field trials of prospective varieties to determine which ones would outcompete varieties already in use. Data from these field trials were captured in a field trials app for eventual hand-off to seed companies and other downstream users. Receiving this data package enabled these users to shorten the time frame needed to integrate the new variety into their portfolio and lowered their own field experimentation costs, ultimately accelerating research outputs into use.

This success demonstrates that *a systematic facilitative process can advance research into use* and that *market intermediaries can play a key role in creating an innovation delivery channel and driving innovations through that channel.*

Communication Strategies

As mentioned above, the lack of relevant communication materials for users and investors proved to be a consistent gap. Previously, Innovation Lab socialization and marketing materials were not wholly effective at relaying information about innovations to investors and market actors. Securing the necessary information about selected innovations proved to be one of the most difficult and time-consuming steps for REFS and partners, an observation reinforced by the iReach team. Communication materials are essential to adequately support and facilitate innovations along their pathway to scale, and research partners need to plan, collect, analyze, and share this information from the earliest stages of R&D. They should be budgeted and developed prior to the end of an agreement.

Providing specificity about the extent and type of budget and financial data should be shared with research partners during the early R&D phases. When REFS was able to provide clear and specific requests for information and engagement, Innovation Labs were able to better engage downstream stakeholders and gather data that was needed to reach beneficiary and investor audiences.

Two types of communications materials - sell sheets and prospectuses - had the information needed for downstream stakeholders, including investors, seed regulation authorities, seed companies, and agribusinesses.

Sell sheets: Sell sheets provide agronomic and genetic information about specific crop varieties. They are a short and succinct communication tool highlighting the key attributes and intended geographies for new and improved seed varieties originating from research partners. Sell sheets convey the seed

type, country of origin, expected yields, optimal production environment characteristics, planting recommendations, and unique characteristics such as improved drought tolerance.

Prospectuses: Prospectuses describe specific products and services and focus on innovations that are likely to generate commercial interest from potential downstream users. The prospectus approach generates interest in a new innovation by presenting a structured, transparent, and data-driven case for investment. It defines the problem and positions the innovation as a credible solution, highlighting its value proposition in terms of cost savings, efficiency gains, or income generation. Market opportunity is emphasized through competitive landscape analysis, customer segmentation, and estimates of market size and potential adoption. The approach also includes financial projections and a clear explanation of how funds will be used to scale the innovation, while transparently outlining risks and mitigation strategies. By combining evidence, economic rationale, and a roadmap for implementation, the prospectus communicates both the promise and the feasibility of the innovation, building confidence among investors and strategic partners.

REFS took the necessary steps to integrate a scaling perspective into Feed the Future research and development investments at the level of specific innovations. The PLC approach, followed systematically, was facilitating effective hand-off of innovations to beneficiaries that were designed specifically for their needs. Deployment of this approach was a positive step to realistically and proactively minimize orphaned innovations.

The Bureau took the necessary steps to integrate a scaling perspective into Feed the Future research and development investments at the level of specific innovations. The PLC approach, followed systematically, was facilitating effective hand-off of innovations to beneficiaries that were designed specifically for their needs. Deployment of this approach was a positive step to realistically and proactively minimize orphaned innovations.

A more substantial challenge ahead for scaling practitioners is to find systematic approaches to the design and implementation of pilot activities from a scalability perspective. Such approaches must integrate testability, evaluation and feedback, redesign and adjustment, and re-evaluation with contextual indicators and benchmarks that inform progress and enable rapid decision making, within the institutional arrangements that are available. Successful pilot activities at this level typically involve changing systems.

Tracking Diffusion

REFS largely relied on Innovation Labs to report on downstream uptake of innovations, partly because of lack of resources and partly because of tracking complexity. Tracking the diffusion of innovations, especially by smallholder farmers, is challenging due to several factors. Farmers are often dispersed across remote areas, and adoption frequently occurs through informal or local distribution channels, leaving little formal data. Adoption patterns are heterogeneous, with farmers experimenting or partially adopting innovations, and uptake can fluctuate seasonally or due to resource constraints. Monitoring and evaluation capacity and resources are limited, and data collected by different actors are often inconsistent, making it difficult to generate reliable, comparable measures of adoption at scale. Together, these factors complicate efforts to assess the reach and impact of innovations intended for smallholder communities.

REFS' scaling team followed up with Innovation Labs about the status of innovations reported to have reached Phase 4 ("evidence of uptake"). New crop varieties' uptake, as opposed to other products or

practices, were tracked separately from other types of innovations, gathering information on if they passed National Performance Trials, cleared variety release committee regulators, were recorded in national or regional seed catalogs, and are being maintained, etc. Data was available for over 60 varieties. In most cases, REFS was unable to confirm farmers' use of these varieties without field inspections or DNA fingerprint analysis, but REFS could confirm their availability at National Agricultural Systems, a proxy for availability at the national level, though in uncertain qualities volumes.

Responses for other types of products or practices were uneven. Overall, most Labs did not track downstream adoption, either due to difficulty or lack of resources, as noted previously. Anecdotes came primarily from word-of-mouth. More than a few innovations reported as being in Phase 4 were actually in Phase 3, based on the indicator's definition of being "evidence of uptake", regarding "widespread uptake". For instance, when examined closely, some innovations were found to be still in the prototype stage and had not been rigorously field tested.

3.0 Synthesis & Way Forward

3.1 Integrated lessons from 2011–2020 and 2020–2024

Reaching populations at scale with new innovations relies, at its core, on human behavior. The more people there are who use an innovation the more new users there are likely to be. Scaling up studies are relevant for behavioral science and other social science disciplines, as well as economics and biological science. Through its work on scaling, USAID was in the vanguard of donors who were applying behavioral economic concepts to positively impact the lives of beneficiaries through their use of new technologies. Over more than a decade, REFS built a comprehensive scaling portfolio, advancing from conceptual frameworks to market-driven approaches.

Early efforts (2011–2020) highlighted that scaling is not automatic: innovations must be designed with scale in mind from the start, assessed for scalability during R&D, and aligned with appropriate delivery pathways. A **pathways-to-scale framework** and a **Product Life Cycle (PLC) approach** were developed to guide this process, fed by a database of Feed the Future-funded innovations. The PLC approach, followed systematically, was facilitating effective hand-off of innovations to beneficiaries that were designed specifically for their needs. Deployment of this approach was a positive step to realistically and proactively minimize orphaned innovations. Key lessons emphasize starting early with planning for scale, matching innovations to the right delivery model (private, public, or public-private partnerships), engaging appropriate partners, designing for inclusivity, adapting approaches to local contexts, and tracking real diffusion and impact beyond direct beneficiaries.

The subsequent period (2020–2024) shifted emphasis toward **commercial scaling**, recognizing that sustained and sustainable adoption depends on viable business models, robust economic data, and effective delivery channels. Experience showed that innovations scale most effectively when business models are defined early in the PLC process, supported by standardized economic data, and connected to credible delivery channels such as agrodealers, cooperatives, BSPs, and digital platforms. Showcasing and brokering efforts demonstrated that generating market interest benefits from investor-ready prospectuses and matchmaking between innovators and commercial partners. Communication strategies—including tailored sell sheets and prospectuses—proved essential for visibility and credibility, while partnerships with organizations such as Seeds2B, AfSTA, and Peace Corps illustrated scalable models.

Taken together, the lessons underscore an evolution: from establishing **theoretical and systems-based foundations** to embedding **commercial and investor-oriented approaches** that are cognizant of the enabling environment. Going forward, successful scaling will require integrating these two streams—continuing to design for scale and inclusivity from the outset, while also institutionalizing business model planning, economic analysis, brokering functions, and communications. By doing so, scaling practitioners can ensure that research outputs move efficiently from research to market and achieve the widespread impact needed to strengthen food security, nutrition, resilience, income growth and other development outcomes.

A more substantial challenge ahead for scaling practitioners is to find systematic approaches to the design and implementation of pilot activities from a scalability perspective, for example by testing point-of-sale strategies with agrodealers. Such approaches must integrate testability, evaluation and feedback, redesign and adjustment, and re-evaluation with contextual indicators and benchmarks that inform progress and enable rapid decision making, within the institutional arrangements that are available. Successful pilot activities at this level typically involve changing systems.

Scaling Essentials for Practitioners

When moving an innovation from research to widespread adoption, keep these essentials in mind:

- **Start with Scale in Mind**
  - Plan for scaling from the earliest research stages.
  - Use clear criteria (importance, ease of use, business case, enabling environment).
- **Choose the Right Pathway**
  - Match the delivery model to the type of innovation:
    - *Private goods* → markets & profit incentives.
    - *Public goods* → government & donor support.
    - *Common goods* → public-private partnerships.
    - *Practices* → bundle with commercial products or services.
- **Engage the Right Partners**
  - Pair innovators with private-sector actors, governments, and NGOs.
  - Fill gaps with finance, training, demand creation, or regulation.
- **Design for Inclusion**
  - Ensure women, youth, and disadvantaged groups are among early adopters.
  - Tailor products, trial sizes, and service models to reach them.
- **Adapt and Ground Locally**
  - Use adaptive management and co-creation with local partners.
  - Align to incentives, culture, and market realities on the ground.
- **Track Real Diffusion and Impact**
  - Go beyond counting direct beneficiaries.
  - Monitor who adopts, how widely, and with what outcomes over time.

3.2 Cross-cutting priorities

REFS was accountable for inclusion of women, youth, and disadvantaged groups, a well-nourished population, environmental stewardship, and other priorities.[41] This required effective planning and monitoring of implementation and potential impacts of scaling on these cross-cutting priorities, and adjusting approaches as needed. REFS was also accountable for ensuring that scaling efforts supported not only widespread adoption but also equity, sustainability, and resilience. The following cross-cutting priorities represent essential areas of focus for scaling practitioners.

Diversity & Inclusion. The scaling trajectory of adopters represented by an S-curve advances from innovators to early adopters to early majority adopters, then late majority adopters and, finally, laggards. This process is not necessarily inclusive, nor does it promote diversity. Rather, the opposite outcome is a real possibility. The challenge for scaling practitioners is to ensure that disadvantaged groups are among the cohorts of early adopters. The populations targeted by FTF often lacked resources and were highly risk averse. Under such circumstances, deliberate inclusion strategies were necessary such as offering free trial sizes of new seed varieties with accompanying instructions, or seed capital for bootstrapping service providers of specific economic activities such as trained spraying service providers (often youths) to safely apply agricultural chemicals. Ultimately, inclusive scaling hinges on designing research for innovations that specifically respond to the unique demands of people facing social or economic exclusion. Target Product Profiles must address these disadvantaged demographic and market segments, so that research outputs are appropriate and reach them effectively.

When viewed through a programmatic lens, inclusive scaling is more realistically attainable and can be directly impacted by practitioners. Explicitly implementing pro-poor solutions through approaches targeting bottom-of-the-pyramid consumers with adaptive management and co-creation ensures that exposure to new innovations is expanded. Scaling practitioners should be proactive about engaging and drawing on the expertise of new voices and often excluded voices, both local and international.

New local partners*:* To maximize adoption of innovations, local partners must be prioritized; they have relationships and are most informed of local context, opportunities and constraints. Partnering with a host country government is also critical to identify public pathways to scale (and of course public and PPP pathways). Local governments especially understand the implications and nuances impacting cross border flows of goods and services. They also possess the capacity to apply and/or create incentives such as subsidies and extension services to ease the on-boarding and adoption of a new good or practice.

Scaling efforts must include **close coordination with the local actors** who understand country-specific market dynamics. Local enterprises and entrepreneurs possess market-systems savvy and can expedite new innovations through complex and sometimes difficult market channels. Local implementers can also play a critical role in providing technical assistance. Local implementers understand local systems and can provide a push and pull effect to encourage technology diffusion in challenging environments. They have an incredible reach capability, and local language and cultural understanding position them well to deliver technical assistance along the final mile.

[41] Op Cit. Global Food Security Strategy, pp. 44-62.

***Nutrition & Human Well-Being**:* Scaling also needs to strengthen food systems' contributions to nutrition and human health. Innovations should also be assessed for their potential to improve diets, reduce malnutrition, and support a well-nourished population.

***Environmental Stewardship & Climate Resilience**:* Sustainable scaling requires alignment with principles of environmental stewardship and explicit attention to **climate adaptation and resilience**. Innovations should help smallholders adapt to current and projected local climate variability, reduce resource degradation, and mitigate environmental risks. Climate-smart design and adoption strategies increase both sustainability, encourage systemic efficiencies, and farmer willingness to invest in new technologies.

***Policy & Enabling Environment**:* Government policy and regulation shape scaling outcomes. Supportive frameworks for trade, seed systems, subsidies, intellectual property, and standards can accelerate adoption, while weak or inconsistent policies create barriers. Close collaboration with host-country policymakers and regional bodies supports enabling environments to align with scaling objectives.

Digital Inclusion & Data Equity: Digital platforms, mobile technologies, and secure data systems are now central to scaling, offering cost-effective ways to disseminate knowledge, gather information, and track adoption. However, **digital exclusion**—caused by limited connectivity, affordability, or literacy—can reinforce inequalities. Ensuring equitable access, protecting data rights, and promoting user-centered digital solutions are critical for inclusive scaling.

***Learning, Evidence, and Accountability**:* Scaling requires continuous learning and adaptation. Monitoring must go beyond counting direct beneficiaries to capture **diffusion to greater populations and systems-level impact**. Ex-post evaluations, national level surveys and agriculture censuses, contribution analysis, and new methods such as DNA fingerprinting or mobile-enabled surveys can strengthen evidence. Embedding **feedback loops** and learning systems ensures accountability while helping practitioners adjust approaches in real time.

3.3 Recommendations for future scaling practice

Manage with scale in mind. Feed the Future built the capacity to guide R&D to increase the scalability of innovations for receptive markets and target beneficiaries. The PLC approach to research management engendered a systematic process that supported design with scale in mind.

To better support scaling, research partners should consider these ***lessons learned to prepare for scaling efforts**:*

- **Plan time, expertise, and budget** to develop communication and commercialization materials (business plans, economic analysis, and user value propositions) early in the R&D cycle.
- **Encourage research partners to engage potential users** through interviews, trials, and feedback collection throughout the development process.
- Use the **presence of a commercial partner** as an initial signal of viability but also to assess whether their model is scalable and sustainable:

- **If a commercial partner is active and scaling** focus on supporting them with research on demand, production, or marketing to help them expand.
- **If a partner owns the innovation but is not scaling** due diligence and matchmaking with new partners may be needed, but this takes time and effort.

- Where no commercial partner exists, support the development of a **localized business plan** before attempting to broker partnerships:
  - **If no partner exists yet** the innovation will need a solid business case, demand estimate, and clear value proposition before brokering is worthwhile. Commercial partners require business and economic case-specific data pertaining to each innovation that would be relevant for producers, distributors, service providers, and others who may want to pursue commercialization.

Develop a viable business model. The PLC emphasized early planning for scaling pathways through the development of a business model—including planning for licensing, pricing, distribution, and value chain alignment —right from the earliest research stage. The chosen business model determines the distribution channel and affects uptake.

The ultimate aim is to design a sustainable, scalable, and profitable business model that meets customer needs and ensures long-term success for the innovation. Innovators should consider:

1. Problem to be solved and potential market size (is the problem important?)
2. Competitive landscape (what current solutions are there?)
3. Monetization and pricing (can potential solutions be produced competitively?)
4. Distribution strategy and partnerships (how can potential users be reached?)
5. Scaling costs and funding
6. Regulatory barriers
7. Organizational capacity and talent
8. Role of data in refining the model

Economic analysis of innovations: Economic analysis is essential to understanding the viability and scalability of an innovation and must address the concerns of investors. Most investors prefer to back businesses that can scale a technology, rather than scaling it themselves. Economic analysis should include the following data and detailed estimates of:

- Market size
- Fixed and variable production costs
- Revenue potential
- Suggested selling price
- Profitability and scalability of the business model
- Breakeven point
- Expected return on investment

These factors vary by location but must be thoroughly itemized.

Delivery channels selection and strategic engagement: Some important channels that REFS explored for commercializing and scaling innovations included:

- Agrodealers and input suppliers
- Business service providers (BSPs) offering mechanization or processing services
- Farmer cooperatives and associations
- Fabricators who manufacture or assemble equipment locally
- Digital platforms that provide product access or technical information
- Demonstration events, trade shows, or field days
- Distributors and licensees managing regional supply chains

Efforts to scale through these channels demonstrated that effective marketing channels in agriculture must not only ensure physical distribution, but also build awareness, trust, affordability, and after-sales support—especially in rural and underserved areas. Selecting the right channel is critical for scaling innovations and attracting investor interest, as it directly influences market reach and adoption rates.

Digital innovation portals support adoption. Portals like the TAAT Clearinghouse present clear cost-benefit information and maintain consistent standards across cataloged technologies. While each portal may have slightly different requirements, many request similar types of data—such as initial cost, operational cost, ROI, and economic benefits. *Standardized templates* would help innovators consistently provide this essential information.

Plan and budget for communication strategies. Prospectuses and sell sheets present essential information about the innovation for investors, market actor adopters, and users. Budgeting for these materials, and building dissemination plans into timelines, aligned with product life cycle stages, can better equip research partners and scaling practitioners to engage stakeholders and attract investment at the right time. By institutionalizing these communication practices, the practitioners can improve the visibility, credibility, and uptake potential of innovations emerging from its research portfolio.

Appendix One: Two Examples of Scaling Program Successes

The following two examples highlight what successful scaling programs might look like in practice. These are not perfect examples, but they do highlight the complexity and challenge associated with scaling up programs, especially when tied to five-year time horizons. Scale is very often a lagging indicator and impact may not be observable until several years after the end of an activity. It's important to plan for logical leading indicators to determine what success looks like, and plan for ex-post studies after project conclusion where relevant.

AgResults Nigeria Aflasafe Challenge Project[42]

The AgResults initiative is a $152 million multi-donor program that used Pay-for-Results (PfR) mechanisms to incentivize the private sector to overcome market barriers and achieve defined development goals in exchange for monetary rewards.

The Nigeria Aflasafe Challenge Project (2013–2019) aimed to encourage private sector investment in the adoption and distribution of Aflasafe, a biocontrol product that reduces aflatoxins in grains and groundnuts. At the program's outset, there was limited awareness of aflatoxins' health risks and little access for smallholder farmers to markets that demanded aflatoxin-treated (AT) crops.

To address this, the program introduced a prize competition that rewarded maize aggregators for purchasing AT maize from smallholders. This incentive was intended to stimulate demand, encourage compliance with government standards, and expand premium market opportunities for farmers.

Over time, the program fostered stronger linkages between aggregators and smallholders, leading to the emergence of a premium—though still niche—market among exporters, food processors, and animal feed producers.

Despite these achievements, full market sustainability was not realized. Adoption of Aflasafe remained driven primarily by short-term economic incentives rather than long-term awareness of health benefits. Moreover, the enabling environment in Nigeria lacked the policy and institutional support needed to sustain the AT maize market beyond the life of the program. [43]

USAID/Mozambique Feed the Future Agricultural Innovations Project (INOVA)

The INOVA program was a 5-year, $20.9 million program implemented in Mozambique with the goal of increasing equitable growth and incomes in the agricultural sector. To do this, the program sought to facilitate behavior change in the input distribution networks, improve market linkages and supply chain management, and bolster market support functions such as digital networks, marketing, and logistics.

The program's use of adaptive management approaches were key elements contributing to its success. INOVA mastered the difficult balance of "one foot on the brake while having the other on the

[42] Abt Associates, Evaluation Final Report, Nigeria AflaSafe Challenge Project, pg. 41-43 - though the program did experience some success and was intentional about planning for scale, question remains as to the sustainability of its impact, particularly in regards to farmer awareness of aflatoxins and long term availability and affordability of the AflaSafe product. The premium market for aflatoxin free maize continued to be a niche market, and more work remains to see sustained and expanded demand for AT/AC maize.

[43] Abt Associates, Brief 3: Nigeria AflaSafe Challenge Project Evaluation Findings, November 2020

accelerator"[44] to effectively plan to scale through learning to intervene simultaneously at multiple points in the agriculture market system to discover the best levers for achieving its goals. The program developed an adaptive management system approach they called "Probe, Measure, Respond" through which its practitioners could facilitate pro-poor market outcomes.

INOVA worked with the local private sector to develop business cases that focused on partners' incentives but also provided information on potential social returns. One of the businesses INOVA worked with, Casa do Agricultor, established an inputs distribution system that led to increased sales and decreased costs, as well as providing 17,000 farmers with access to improved seed for increased productivity and quality.[45]

These details show strong potential for scale of a model like INOVA's.

[44] Scale Up Sourcebook

[45] Feed the Future INOVA Business Cases, MarketShare Associates: https://marketshareassociates.com/feedthefuture-inova-business-cases

Appendix 2: Feed the Future Indicators Relevant to the Scaling Agenda

The kinds of data and information that were systematically captured covering innovations and their use in Feed the Future are provided below:

A number of indicators capture some information on technology innovations.

EG.3.2-7 Number of technologies, practices, and approaches under various phases of research, development, and uptake as a result of USG assistance captures the progression of new or significantly improved technologies, practices, and approaches through four phases of research and development (R&D) to the demonstrated uptake by public or private sector stakeholders.

EG.3.2-24 Number of individuals in the agriculture system who have applied improved management practices or technologies with USG assistance and *EG.3.2-25 Number of hectares under improved management practices or technologies with USG assistance* report on the number of producers (and others) who apply improved management practices or innovations, and the hectares on which they were applied. Disaggregates including sex, age, commodity, and technology type make this a particularly challenging indicator to collect and report on, and it did not capture what specific innovations producers may be applying, so while the numbers of producers who are applying a technology related to crop genetics and maize is collected, the variety of maize that was being planted couldn't be determined.

At the ZOI level, *EG.3.2-a Percent of producers who have applied targeted improved management practices or technologies* captured those farmers who have applied those innovations promoted by the missions in their ZOIs. Missions were encouraged to choose four to five of the practices they were promoting and tailor their ZOI population-based survey to capture information on the specific technologies, but the survey wasn't able to gather information on the great number of technologies that REFS invested in.

Details for all technologies, practices, and approaches from EG.3.2-7 are collected annually for the Research Rack Up database through a separate survey instrument, submitted by IPs of centrally funded research mechanisms. As of 2020, over 1000 entries were submitted. This survey instrument didn't capture extensive information on where innovations had been disseminated and how. The respondents were those who developed, adapted, and tested innovations. The extent to which they partnered with private or public sector entities to engage in the dissemination of technologies varied, and information on technologies handed over to other partners was not collected.

IPs were able to track application and use of their innovations to some extent. This tended to be time-consuming, expensive and difficult to carry out after awards that have funded the innovation have concluded so it's not widespread.

REFS commissioned a number of studies to examine the continuum from innovation development, adaptation, handoff and dissemination, including the Research Output Dissemination Study[46] and others referenced here, but there has been no comprehensive quantitative analysis examining who is using FTF-funded innovations and where.

[46] https://pdf.usaid.gov/pdf_docs/PA00WQDS.pdf

Appendix 3: Definitions of Common Terms for Scaling Up[47]

Adoption: a process involving an individual that includes the series of stages one undergoes from first hearing about a product to finally accepting or using it; also, the moment at which the decision maker acts to make the spread of the technology happen.

Bass Diffusion Model (BDM): describes the process of how new products get adopted in a population. The model classifies adopters as innovators or imitators where the speed and timing of adoption depends on their degree of innovativeness and the degree of imitation among adopters.

Bundling: Bundling strategies are associated with the concept of selling products or services with correlated demand levels in order to manage revenues and costs. With respect to scaling, bundling strategies involve selling products or services jointly with better information and practices to optimize returns on each element of the bundle, rather than selling or extending them individually, and marketing them at a price different from the sum of their individual prices. The objective of bundling for scale is to take advantage of demand-pull forces. An example of a bundle is a farm package that includes seeds and fertilizer with planting instructions. Adopters do not always consume an entire bundle of technologies but may selectively choose certain elements of a bundle.

Commercialization: the diffusion pathway by which a value chain is sufficiently resourced and organized to bring an innovation or product to a market (typically a mass market).

Communication channels: means by which messages are spread, including via mass media, interpersonal channels and electronic communications.

Diffusion: the process by which an innovation penetrates markets over time within a group driven by social influences, which include all interdependencies among consumers that affect various market players – with or without their explicit knowledge (Peres et al, 2009).

Diffusion modeling: the process of understanding the spread of innovations throughout their life cycle.

Innovation: any thought, behavior or thing that is new because it is qualitatively different from existing forms (Jones, 1967).

Institutionalization: incorporation of the program into the routines of an organization or broader policy and legislation.

Maturity: the period from a product's adoption slow down until sales begin a steady decline.

Peak sales: the point at which sales of a product reach their highest rate before plateauing or declining.

Rate of adoption: the relative speed with which members of a social system adopt an innovation. It is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation.

[47] The CGIAR Science Leaders have a "Scaling Glossary" published on its website at https://cgspace.cgiar.org/bitstream/handle/10568/110632/scaling_brief_04.pdf?sequence=3&isAllowed=y

S-curve (aka logistic curve): innovations typically diffuse over time in a pattern that resembles an S-shaped curve, indicating that an innovation goes through a period of slow, gradual growth before experiencing a period of relatively dramatic and rapid growth.

Saddle: a sudden, sustained and deep drop in sales of a new product after a period of rapid growth following takeoff, followed by a gradual recovery to the former peak.

Scale: having a significant impact on its goals at the population level. The FTF definition adds "in the target ZOI in each country."

Slowdown: the point of transition from the growth stage to the maturity stage of the product life cycle. The slowdown signals the beginning of a period of level, slowly increasing or temporarily decreasing product category sales.

Social system: the combination of external influences (mass media, organizational or governmental mandates) and internal influences (strong and weak social relationships, distance from opinion leaders). There are many roles in a social system, and their combination represents the total influences on a potential adopter.

Sustainability: the degree to which an innovation or program of change is continued after initial resources are expended.

Take-off point (aka critical mass or tipping point): the time at which a rapid increase in sales occurs that distinguishes the cutoff point between the introduction and growth stage of the product life cycle.