

**Testing the GLDC Scaling Framework:  
Design, Performance, and Gaps**

**Working Paper**

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## **Abstract**

Accelerating the adoption of new technology – improved varieties and management practices – by smallholders remains a challenge for agricultural research and extension systems, particularly in sub-Saharan Africa. The objective of the CGIAR Grain Legumes and Dryland Cereals (GLDC) research program is to achieve adoption of these technologies at scale in the semi-arid environment. The program has developed a scaling framework which integrates nine components required for successful scaling of these technologies. We tested the utility of this framework using case studies of four large scaling projects. The framework was useful because it provided a systematic way to review the design of the projects and their scaling methods. This highlighted potential design flaws as well as opportunities for testing alternative scaling methods. The framework was less useful for evaluating project performance. Although poor performance may be the result of poor design it may also be the result of factors beyond the project's control. Rather than use the framework to adjudicate 'success' or 'failure' the framework is more useful as a springboard for systematic learning from project experience and ensuring that these lessons are incorporated in the design of future scaling projects. The case studies exposed some gaps in the framework. One is the need to situate the framework in its wider context, as the product of a theory of change based on the transition from subsistence to commercial agriculture. Another gap is insufficient attention to process, specifically partnerships and gender, which are both emphasised in the case study projects. The framework is a useful visualisation of the scaling process. To realise its full potential, however, the framework needs to be developed into a scaling toolkit. This toolkit would set the framework in context, explain the individual components in more detail, suggesting questions to ask about the content of each component, include cross-cutting processes like partnerships and gender, and give concrete examples of how the framework might be applied in practice to scaling projects.

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## 1. Introduction

The low adoption of new technology by smallholders is a challenge to agricultural research in Sub-Saharan Africa. The search for explanations has a long history (eg. Anderson, 1992). More recently, attention has focused on ‘the science of delivery’ or to removing the structural barriers that impede adoption at scale. The emphasis has shifted from the product to the customer. Research is no longer just about ‘getting the product right’ but about ‘getting the delivery right’. Delivery embraces everything that is critical for this process, including institutions and policies. Thus, the old and widely - debated problem of low adoption is now framed as a problem of social marketing, where adoption at scale is the result getting the right product to the right customer. The rise of ‘philanthro-capitalism’ (Brooks, 2013) or of new donors with a background in the private sector has been influential here, bringing not just funding but expertise in commercial R & D where the ‘scaling’ of innovation is an integral part of the research process. At long last, has ‘the science of delivery’ found the key to Africa’s elusive Green Revolution?

While there is no universally agreed definition of scaling, the definition proposed by the International Institute of Rural Reconstruction is widely cited: “Scaling up brings more quality benefits to more people over a wider geographical area, more quickly, more equitably, and more lastingly.” (IIRR, 2000). Two pathways for scaling agricultural innovations have been identified (Gundel et. al., 2001):

- Scaling-out, or horizontal scaling, by expanding the numbers (and diversity) of people sustainably benefiting from (and/or area covered by) an innovation, policy, or program; and
- Scaling-up, or vertical scaling, by influencing or strengthening policies, political processes, and/or institutions, with the aim of creating a more enabling environment for horizontal scaling.

This definition of scaling therefore takes a holistic view of the problem of low adoption that embraces constraints at the level of both the farm household and the wider enabling environment.

This framing of low adoption has recently been institutionalised by the Consortium for International Agricultural Research – a consortium of 15 research institutes – in its new research programs. Between 2012- 2017, seven CGIAR research programs were funded, of which six have now entered a second phase. These programs align research outputs directly with strategic development goals like poverty reduction, improved health, and sustainability. These research programs are expected to deliver new technology to millions of smallholder households. To reach these ambitious targets, the programs must rely on ‘scaling’ projects. Some projects are hybrids that combine both research and scaling components in a single project. Others are designed specifically as scaling projects to deliver new technology developed by earlier ‘research’ projects. The design and performance of these projects may offer insights into how to overcome the legacy of low adoption and achieve adoption at scale.

The research program on Grain Legumes and Dryland Cereals (GLDC) focuses on the cereal crops sorghum (*Sorghum bicolor*) and millets (*Pennisetum glaucum* and *Eleusine coracana*), and on six major grain legume crops – chickpea (*Cicer arietinum*), common bean (*Phaseolus vulgaris*), cowpea (*Vigna unguiculata*), groundnut (*Arachis hypogaea*), pigeonpea (*Cajanus cajan*) and soybean (*Glycine max*). (GLDC, 2017). Scaling new technology for these crops faces a specific set of challenges. One is on the supply side. They are grown in the semi-arid environment, where thin populations and poor infrastructure make smallholders harder to reach. Two challenges lie on the demand side. Many crops in this environment are open-pollinated and can therefore be recycled for several years without significant loss in yield,

which reduces demand for new seed. This limits the incentive for private seed companies to market the seed of improved varieties. Finally, commercialisation is limited. Smallholders may live far from markets, and the crops they sell may also be staple food crops that are needed for household food security. Market prices may be low, reducing the demand for new technology. Urbanisation and higher incomes reduce consumer demand for sorghum and millets compared to maize. Alternative uses that can increase demand may be limited or problematic in other ways. In combination, these supply and demand-side constraints make it particularly challenging to achieve adoption at scale.

The GLDC program has developed a conceptual framework for the scaling of GLDC technologies. The general objective of this report is to assess the utility of this framework by applying it to four of the GLDC program's largest scaling projects. The specific objectives are to:

1. Review the framework against the design and implementation of these projects;
2. Identify gaps in the scaling framework; and
3. Recommend changes to the framework to improve the design of scaling projects and the effectiveness of scaling in the GLDC program.

The primary focus of this report is not on the four projects or their success or failure in reaching the targets that they set for scaling new technology. Rather, the focus is on the scaling framework and whether it is a useful tool for identifying *what has to happen* for these targets to be met. Our main concern is not the relevance and utility of the projects but of the framework itself.

The report is organised as follows. Sections 2 and 3 present the scaling framework and describe data and methods. Sections 4 and 5 discuss the value of the framework for project design and performance. Section 6 identifies gaps. The final section summarises our conclusions and recommendations.

## **2. Conceptual Framework**

The literature dedicated to understanding the scaling of agricultural innovations in developing countries is vast (Feder et al., 1985; Sunding and Zilberman, 2001; de Janvry, Macours, and Sadoulet, 2016; Stevenson and Vlek 2018). Most of this literature focuses on the microeconomics of adoption, exploring decision-making, time horizons, and risk preferences at the household level (Foster and Rosenzweig, 2010; Suri, 2011; Magruder, 2017). Yet adoption or non-adoption may be due to factors that are beyond farmers' control. They are embedded in complex value chains that may deliver technologies that are unsuitable, or unaffordable, or without the necessary training, knowledge, and market linkages (Trienekens, 2011; Wiggins and Keats, 2013; Vroegindewey and Hodbod, 2018). In consequence, the scaling of agricultural innovations must address weaknesses along the entire value chain (Wigboldus et al., 2016).

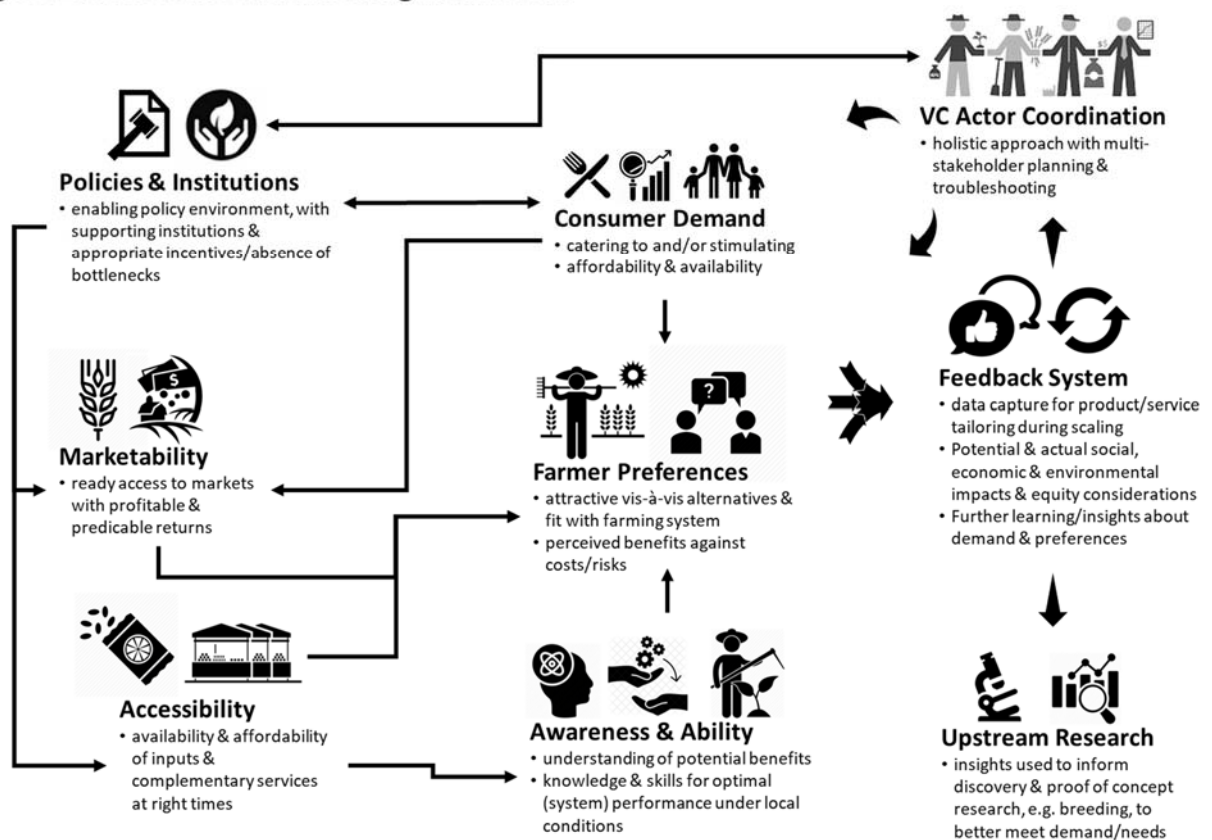
The CGIAR's scaling framework is structured around the value chain. In this framework, plant breeders develop improved varieties that are appropriate and demanded by farmers. Seed systems deliver quality seeds at accessible prices, while training and extension services equip farmers with the knowledge and skills they need to successfully cultivate these improved crop varieties and use improved management practices. techniques. To spur adoption, market opportunities exist that allow farmers to recoup upfront investments and bring additional benefits. Failure in any single link in the value chain may prevent successful adoption at scale. Thus, even if varieties with desirable traits exist and quality seeds are accessible, farmers will fail to adopt them if they are unaware of the benefits or lack the skills to cultivate them. Scaling

is therefore viewed as a series of ‘hurdles’ that must be cleared before farmers can even begin to weigh the on-farm benefits and feasibility of improved varieties (Shiferaw et. al., 2008).

Agricultural Research for Development (AR4D) provides an alternative conceptual framework where scaling is the final phase in a continuum of innovation, starting with ‘discovery’, then ‘testing’, before ‘piloting’ new technology under real-world conditions (Bernhardt 2016). Yet successful scaling is rarely this straightforward (Wigboldus et al.,2016). Substantive modifications often take place during the scaling phase, as new technology is modified to fit a specific environment or farmers’ circumstances (Coe et al. 2014). Moreover, impacts may be reduced if scaling saturates local markets or result in negative externalities such as the depletion of groundwater. Finally, treatment effects documented in more tightly controlled pilots often diminish during the scaling phase, because of less intensive support by extension services or less strict adherence to innovation protocols (Singal, Higgins, & Waljee, 2014). Dissatisfaction with the linear treatment of scaling has led to calls for a more iterative and adaptive approach (e.g. Linn 2012; Fatubi et al. 2015; Hughes et al., 2018), as well as the better integration of context-based research into the scaling process itself (Coe et al., 2014). Many also advocate the incorporation of a monitoring, evaluation, and learning (MEL) component to support adaptive management and the refinement of scaling strategies and even of the innovations themselves.

Figure 1 [need to re-label Figure from 4 to 1] presents a modified Innovation Scaling Framework, which combines both the value chain and non-linear approaches. This framework comprises nine elements, each of which is likely to influence the success of any scaling effort program, albeit to differing degrees depending on the context.

**Figure 1: AR4D Innovation Scaling Framework**



Supportive **policies and institutions** are critical for successful scaling. Farmers may be deterred from adopting agricultural technologies as a result of price regulation, cumbersome regulatory requirements, unequitable subsidy regimes, and monopolies in processing and trading (Tunde et al, 2018). Policy analysis and engagement with policy actors—coupled with capacity development—is therefore often critical for successful scaling (Westermann et al., 2018). Similarly, effective **coordination among value chain actors** is important, particularly when challenges are complex and require cooperation among stakeholder groups (Orr, 2018). Indeed, there is a burgeoning interest in the role of multi-stakeholder collaboration in strengthening agricultural value chains, e.g. via innovation platforms (Devaux, Torero, & Horton, 2018).

Although Wigboldus et al. (2016) correctly highlight the limitations of focusing exclusively on the farm level, nevertheless **farmer preferences** remain critical. Innovations must have a decisive advantage over existing technology. They must also fit within the overall farming system (Birner et al., 2009) and be consistent with the farmer’s risk preferences (Koundouri, Nauges, & Tzouvelekas, 2006). Farmer preference are shaped by several factors, including **awareness** of the innovation and its potential benefits and the **ability** to apply the innovation effectively (Campenhout, 2019; de Janvry, Sadoulet, & Rao, 2016). These in turn are correlated with **accessibility** to extension and information delivery services, participation in relevant social networks (Meijer et al., 2015), as well as access to the material inputs such as seed or inorganic fertilizer associated with the innovation (Melesse, 2018). Successful scaling is often determined by the **marketability** of a crop, which is linked to **consumer demand**. Farmers are generally unwilling to invest in an innovation unless they foresee a financial return (Wiggins and Keats, 2013; Verkaart et al. 2019) or at least some value for domestic consumption. Finally, successful scaling is more likely to result from adaptive management supported by a timely **feedback system**, which includes **upstream research** to enhance the scaling process.

### 3. Data and methods

Our evaluation of this conceptual framework is based on four projects in the GLDC research program (Table 1). All four were ‘flagship’ scaling projects with large budgets that were expected to reach between 400,000 – 4 million households. Two projects (HOPE and TL III) were research projects with sizeable scaling components, whereas AVDC and MISST focused on scaling existing technology. Between them the four projects covered seven major crops commonly grown in semi-arid environments, including two dryland cereals (sorghum and millets) and five grain legumes (groundnuts, chickpea, cowpea, pigeonpea, soybean and common bean) as well as root crops (Irish potato, sweet potato) and the value chains for livestock and milk. Two projects (HOPE and TL III) were regional in scope and covered both East and West Africa, while two covered just one country (Kenya and Malawi). Their duration ranged from three (AVCD) to five years (HOPE). Funding came from both private philanthropy (BMGF) and the public-sector (USAID).

The common objective of all four scaling projects was to improve the delivery of certified seed. HOPE 2 and MISST targeted a specific volume of seed per country or per crop (ICRISAT, 2014; FTF-Malawi, 2019). TL III sought to supply “at least 20% of the seed required on a national basis for each crop” (ICRISAT, 2013). The AVCD project focused on commercialisation (“increase the value and volume of the products in each value chain by 15%”) but included seed targets for all its crops (ILRI, 2015).

**Table 1. Case study projects for evaluation of scaling framework**

Name	Target population	Seed scaling targets	Duration	Geographies	Crops	Lead Agency	Budget (USD)	Donor
Harnessing Opportunities for Productivity Enhancement (HOPE) of Sorghum and Millets in Sub-Saharan Africa (Phase 2)	4,000,000 households	Increase supply certified seed by 12,000t/yr; 300,000 Small Seed Packs; 30,000 ISSFM minikits	2016-2020	East Africa: Ethiopia, Tanzania West Africa: Niger, Nigeria, Niger, Mali, Burkina Faso	Sorghum Pearl millet Finger millet	ICRISAT	15 m.	Bill & Melinda Gates Foundation
Tropical Legumes III (TL III): Improving Livelihoods for Smallholder Farmers: enhanced Grain Legume Productivity and Production in Sub-Saharan Africa and south Asia	500,000 households	Supply 20% of certified seed required for target crops	2015-2019	West Africa: Burkina Faso, Ghana, Mali, Nigeria, East Africa: Ethiopia, Tanzania and Uganda India: Uttar Pradesh (chickpea)	Common bean, cowpea, chickpea, groundnut	ICRISAT	25 m.	Bill & Melinda Gates Foundation
Accelerated Value Chain Development (AVCD) Program for Kenya	444,000 households	Increase volume and value of market sales by 15%	2016-2019	Kenya (17 counties)	Value chains for livestock/ fodder, dairy, sweet potato, Irish potato, sorghum, groundnuts, pigeonpea	ILRI, ICRISAT, CIP	25 m.	Feed the Future-United States Agency for International Development
Malawi Improved Seed Systems and Technologies Project (MISST)	220,000 households	14,500 tons of seed	2014-2019	Malawi (7 districts, later increased to 10)	Maize, sweet potato, pigeonpea, groundnuts, soybean, biological control	ICRISAT, CIP	18.6 m.	Feed the Future-United States Agency for International Development

Sources: ICRISAT (2013), ICRISAT (2014), ILRI (2015), Akinwale et. al. (2016).

Information on project design and performance was obtained from relevant project documents. For TL III, information was obtained from the project proposal (ICRISAT, 2013) and publications (Varshney, 2019; Rubyogo et. al., 2019). Information for HOPE 2 was obtained from the project proposal (ICRISAT, 2014). Since both TL III and HOPE 2 have not yet ended, project completion reports were not yet available. For the AVCD project, both the project proposal (ILRI, 2016) and the last annual report were available (FTF-Kenya, 2018). For MISST, information was available from the project completion report (FTF-Malawi, 2019) and from reporting on soybean (Akinwale et. al., 2016). In addition, information on lessons learned was gleaned from skype interviews with selected project personnel, including Principal Investigators, project managers, and research scientists.

#### 4. The Scaling Framework and Project Design

Table 2 maps the scaling framework against the design and scaling methods of the four projects. The contents are not intended to be exhaustive but to summarise the main features. The results show that the scaling framework captures the approach to scaling used by the four projects. Most scaling activities can be fitted into one of the nine components of the framework. The advantage of the scaling framework is that, by combining separate components on one page, it gives planners a clearer picture of the overall project and the methods that will be used to address each component of the scaling process. This is not to claim that the framework includes everything required for scaling, but that it is sufficiently comprehensive to be a useful planning tool for scaling projects.

**Table 2. GLDC scaling framework and design of case study projects**

Scaling Framework	Case Study Projects			
	HOPE	TL III	AVCD	MISST
Farmer preferences	Farmer Participatory Varietal Selection (FPVS) National crop strategies	Farmer Participatory Varietal Selection (FPVS) National crop strategies	Farmer Participatory Varietal Selection (FPVS) for potato and sweet potato	Farmer evaluation at field days
Awareness and Ability	Seed Fairs Field Days Video Printed information in local languages	Seed Fairs Field Days/demonstration plots Information packs Printed information in local languages	Private extension agents Field Days/demonstration plots	Demonstration plots Field Days
Access to technology	Quality Declared Seed (QDS) Small Seed Packs (SSP) ISSFM Minikits Seed roadmaps	Small Seed Packs (SSP) 'Seed delivery platforms' Bilateral seed projects (eg. AGRA-PASS) Seed roadmaps	Small Seed Packs (SSP) Smallholder seed producers and private seed companies Community seed banks	Small seed packs (SSP) Seed producer groups, small seed companies
Policies and institutions	Quality Declared Seed (QDS) Capacity building of NARS breeding programs	Private seed companies Capacity building of NARS breeding programs	Evidence for policy Barriers to livestock trade and market development	Revolving fund for early generation (breeder & basic) seed
Marketability	Training courses and manuals for seed production and marketing		Innovation platforms Marketing associations/ organisations Dairy business hubs	
Consumer demand	Incorporate 'consumer trait preferences' in breeding program	Incorporate short cooking time into breeding program	TV programs for consumers of SmartFoods Photovoice	
Value Chain Coordination	Partnerships with NARS, NGOs and seed companies	Research for development partnerships Joint planning of seed needs	Business support to producer organisations and private seed companies Market information through local radio Collective marketing Brokering bulk sales	Facilitated sale of seed to farmers' associations and cooperatives

Upstream research	Advanced genomics to shorten the breeding cycle Genome Wide Assessment Studies (GWAS)	Advanced genomics to shorten the breeding cycle		
Feedback systems	MLE Plan and MLE specialist Breeding Program Assessment Tool (BPAT)	MLE Plan and MLE specialist Breeding Program Assessment Tool (BPAT)	Results Based Monitoring	

Sources: ICRISAT (2013), ICRISAT (2014), ILRI (2015), Akinwale et. al. (2016).

The framework identifies several possible gaps in the design of these four scaling projects. In some cases, components in the scaling framework are missing. Three examples of missing components are **Marketability**, **Policies and Institutions**, and **Upstream research**. The framework defines **Marketability** as the “*ready access to markets with profitable and predictable returns*” (Figure 1). This component is fundamental for scaling new technology designed for commercial markets. Yet it was deliberately omitted from the TL III project on the grounds that “*research on markets, policy and seed regulation ... are being adequately covered by other initiatives or that sufficient information is now available*” (ICRISAT, 2013, p. 13). Similarly, the framework defines **Policies and Institutions** as “*an enabling environment with supporting institutions and appropriate incentives/absence of bottlenecks*” (Figure 1). Yet only one project (AVCD) explicitly addresses policies that threaten adoption at scale. In this case, these policies are internal barriers to trade in livestock, including taxes, movement certificates, and veterinary certificates that limit the movement of livestock between different counties in Kenya. The project targets the removal of six key trade barriers to scaling (ILRI, 2016, pp. 43-44). Policy engagement around seed systems is complicated by the fluid nature of government policy – making, with some Seed Acts not yet implemented (IFPRI, 2018). Influencing policy requires specialist expertise and time. This may explain the reluctance of these projects to invest resources in this component of the scaling framework. **Upstream research** does not feature prominently in the design of all four projects. The framework defines this component as “*insights used to inform discovery & proof of concept research*” (Figure 1). This component is associated with research projects. The discoveries of the TL III breeding program fill an entire issue of *Plant Breeding* (Varshney, 2019). **Upstream research** might seem irrelevant for scaling projects that promote existing technology, but there is much still to discover about the effectiveness of different scaling methods. We return to this subject later in this section.

Of course, these gaps identified by the scaling framework may not be genuine gaps if they are addressed by other programs or projects. Individual projects may not have to address all nine components of the scaling framework in relation to market development. Both HOPE 2 and TL III were part of a continuum of older projects. TL III succeeded two earlier phases lasting seven years (2007-2014), while HOPE 2 followed one earlier phase of five years (2010-2016). This meant they could build on a legacy of previous research. Similarly, scaling in the AVDC project was complemented by other USAID-funded projects on policy, livestock marketing, and value chain development (ILRI, 2016, pp. 2-3). However, the scaling framework can be used to identify these complementarities at the design stage to avoid gaps appearing during implementation.

The scaling framework can also help identify scaling components that deserve greater attention. Among these we may single out **Feedback Systems**. All four projects included ‘learning’ as part of their M & E systems. In practice, however, for large projects burdened with multiple milestones, the tyranny of the logical framework means that only lip-service is paid to

learning, with the result that learning becomes the ‘invisible output’.<sup>1</sup> Some case-study projects did make a conscious effort to learn. The proposal documents for HOPE and TL III include sections and appendices that list learning; there are also examples of project publications that synthesise lessons (Monyo and Varshney, 2016). But learning is often left to the discretion of the project manager.<sup>2</sup> Learning needs to be made more systematic. Table 2 shows no evidence that specific learning outputs were identified at the design stage of these scaling projects, or how these lessons will be used to change the design of the project during implementation.

Another use of the scaling framework at the design stage is to direct attention on the methods themselves. Table 2 shows an impressive range of scaling methods. However, a closer look suggests room for improvement. The **Awareness and Ability** component shows the use of new communication methods. Alongside traditional standbys like demonstration plots there are TV programs, video and DVD and the use of local radio for market information. **Upstream Research** employs new tools to shorten breeding cycles. But the methods in **Consumer Demand** (“catering to and/or stimulating affordability and availability”) focus on consumer trait preferences. Agricultural economists are skilled in providing this information through baseline surveys or choice experiments. But national programs require other kinds of information to set breeding priorities, such as the size of the market, the various market segments, and the trait preferences of these segments. Yes, economists can map value chains and estimate elasticities of demand. But they are not market researchers. And it is the tools of market research, like the segmenting-targeting-positioning approach, that breeding programs need to develop “customer profiles” that match their products with the needs of their customers (Orr et al., 2018). Breeding programs need methods like these to understand **Consumer Demand**.

Scaling projects are fertile ground for testing scaling methods. There is a large literature on this subject. Examples that spring to mind include the post-mortem on the Training and Visit (T & V) extension system (Feder et. al., 2006), the continuing debate over the effectiveness of Farmer Field Schools (van der Berg and Jiggins, 2007; Feder et al., 2008; Friis-Hansen and Duveskog, 2012) and a recent study on the effectiveness of Farmer Business Schools (Chilemba and Ragasa, 2019). Less common are studies that directly compare the effectiveness of two scaling methods. However, some methods are more effective than others, particularly where new technology is knowledge-based (Bentley et. al., 2007; Riker-Gilbert et. al., 2007). A recent review of scaling projects in Malawi found little assessment of scaling up methods, and recommended “qualitative assessments of the methods used for scaling up and share the experiences through a formalized process, rethinking projects to be more amenable to longer term targets, thus enabling more analysis of methods within projects” (IFPRI, 2018). The scaling framework can help projects at the design stage to identify opportunities to assess the effectiveness of scaling methods.

Using the framework to map different scaling methods can also identify opportunities for learning from other projects. Some scaling methods in Table 2 are novel. Reality TV shows like Shamba Shape-Up already attract a wide audience across Swahili-speaking East Africa (Clarkson et. al., 2018). The AVCD project developed TV programs with celebrity chefs to showcase the nutritional benefits of sorghum and millets to viewers in Kenya. The shows

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<sup>1</sup> Phase 1 of the HOPE project had more than 1,000 milestones, which meant that annual planning meetings were dominated by monitoring progress against milestones rather than reflecting on what we were learning and the implications of these lessons for the project’s Theory of Change. Even this was tame compared with the AVCD project in Kenya, funded by USAID’s Feed the Future Program, which required monitoring reports every two weeks (M. Siambi, pers. comm.)

<sup>2</sup> In Phase 1 of the HOPE project, for example, one of the authors submitted a list of lessons learned from market development which challenged some of the project’s assumptions. The response from the Project Manager was that it was “too late”.

reached a weekly audience of 800,000 viewers (ICRISAT, 2019, p. 43). Other innovative tools included Photovoice, in which village women are taught to photograph all the food the household eats over 24 hours, and the results used for training them in improved nutrition (ICRISAT, 2018). These methods have a wide range of applications.

## 5. The Scaling Framework and Project Performance

The scaling framework can also be applied retrospectively to explain project performance. However, this is trickier. Scaling projects may fail because of poor design: a key component of the scaling framework was missing. But they may also fail because the design was not properly implemented or because of events that could not be anticipated at the design stage (for example, a sudden reversal in government policy). These confounding factors limit the value of the scaling framework as a rear-view mirror to explain why some projects succeeded while others failed.

Success is usually measured against the original targets set out in the project design. Over three phases lasting 12 years (2007-2019) the TL III project delivered 500,000 t of certified seeds (Varshey, 2019). However, because of rapid growth in the area planted to legumes, the original target of meeting 20% of seed requirements was not met (C. Ojiewo, pers. comm.). No final figures were available for HOPE phase 2, which ends in 2020. The AVCD project exceeded its target to increase incremental sales by 17 % (USAID, 2018). The MISST project met about 80 % of its production targets for early generation and certified seed (FTF-Malawi, 2019). In general, these projects were successful in meeting their targets for seed production.

Performance did not therefore reveal major design flaws. However, implementation did reveal weaknesses in some assumptions. The scaling framework includes a component on **VC Actor Coordination**, defined as a “holistic approach with multi-stakeholder planning and troubleshooting” (Figure 1). Although this component was not missing from the TL III project, it proved difficult to implement. The project used a public-private partnership model of seed delivery in which national breeding programs and statutory bodies produced foundation seed for private seed companies and farmer groups. The initial funding for foundation seed came from project funds but, to make production sustainable, the income from the sale of foundation seed was supposed to be re-invested in a revolving fund that financed production in subsequent years. In practice, the income went into a government account in the central bank and was used for other purposes, so the fund failed to revolve (Chris Ojiewo, pers. comm.). This was outside the project’s control.

Similarly, the project design envisaged production and delivery of certified seed through private seed companies, which were start-ups funded by grants from the Program for Africa’s Seed Systems (PASS) project (ICRISAT, 2013, p. 15). However, these start-ups proved unable or unwilling to become fully-fledged seed companies. They complained of unfair competition from national breeding programs, some of which set up their own companies to produce certified seed. They also faced regulatory hurdles. In theory, seed regulations have been harmonised to allow the free movement of registered varieties and certified seed within African regions (Rohrbach et. al., 2003). In practice, this is frustrating and time-consuming for small seed companies. Private companies also want proprietary branding of the products they sell, but because improved varieties are public goods this requires licensing agreements and royalty payments to national breeding programs. Small seed companies have needed specialist help from Syngenta’s Seeds2B platform to navigate these bureaucratic hurdles (Syngenta Foundation, 2019). Finally, the expectation of further grants made some companies reluctant to invest their own resources. As a result, most of the certified seed in the TL III project has been produced and delivered not by private seed companies but by the informal sector (C. Ojiewo, pers. comm.). Tanzania saw a dramatic increase, from just 10 farmer organisations and community seed producers in 2007 to 470 in 2017 (Rubygo et. al., 2019).

Running a private seed company requires funds to buy seed and management skills. In the case of the ACVD project, ICRISAT found that changing community seed banks into private seed companies was a step too far – they were more effective as out-growers, supplying certified seed to companies for distribution and sale (Moses Siambi, pers. comm.).

These experiences suggest the need to move away from a binary view of project performance – “success” or “failure” – and use the scaling framework more as tool for learning. The framework can be used to systematically review each component and determine what did and did not work, and why. Individual components in the framework can be unpacked and analysed to identify lessons that can improve the design of future scaling projects. However, learning does not have to wait until the end of the project. The scaling framework can also be used as a monitoring tool within the lifetime of the project to help set the agenda for the **Upstream Research** component. Implementation problems may uncover mistaken assumptions about **VC Actor Coordination** or other components of the framework that require more fundamental research. The scaling framework can be used to help projects become “learning organisations” that are not afraid to make mistakes provided that they are also willing to learn from them.

## 6. Gaps in the Scaling Framework

*“Framework: a structure into which contents can be put, a skeleton”  
(Shorter Oxford Dictionary)*

A framework is not a model, or a narrative which explains how scaling works. Rather, the GLDC scaling framework is the product of a model which sees agricultural development as a transition from subsistence to commercial agriculture. Any discussion of the scaling framework needs to be set within this wider context.

Several components of the scaling framework are relevant here. **Feedback systems** in public-sector breeding programs will “adopt operational and structural improvements that closely mirror efficient private sector breeding programs”, including the same management systems (Breeding Program Assessment Tools) as commercial seed companies (ICRISAT, 2013, pp. 7, 23). – **Marketability** – access to markets – is seen as a precondition for scaling as smallholder agriculture is commercialised. The uptake of new technology is driven by **Consumer Demand**, as smallholders respond to rising demand from growing urban populations and new industrial uses. Symptomatic in this regard is the re-branding of sorghum and millets from “poor man’s crops” for hungry subsistence farmers to nutrient-rich Smart Foods targeted at health-conscious middle-class consumers (ICRISAT, 2019). The design of the GLDC program and the four scaling projects reflect this model. The AVCD project speaks of “a total shift in mind-set in terms of how farming is viewed – from subsistence to farming as a business” (ILRI, 2016, p. 2).

The GLDC scaling framework seeks to operationalise this narrative, not to challenge it. Nevertheless, the framework should treat these assumptions as hypotheses, and thus test the narrative that lies behind the framework itself. This model of agricultural transformation assumes that subsistence farmers are commercial farmers in embryo. However, not all subsistence farmers have the same potential to ‘step up’ and commercialise. Some will continue ‘hanging-in’ to subsistence agriculture while others will have no choice except to ‘step out’ of agriculture altogether (DFID, 2015). The assumption that adoption at scale is driven by market demand is questionable, since resource-poor farmers may prioritise home consumption. Thus, pastoralists “prioritise milk production and herd growth over livestock sales” (ILRI, 2016, p. 11, citing Little et. al., 2014). Scaling strategies based on the assumption

that adoption is driven by market demand can tie themselves in logical knots.<sup>3</sup> Similarly, blaming low uptake of improved varieties on the lack of financial incentives for private seed companies overlooks the role of farmer-to-farmer diffusion. In Malawi, the unknown variety Nthawajuni has spread so rapidly in the last 10 years that it now occupies 80 % of the area planted to pigeonpea. Being aware of this narrative and its limitations can help practitioners avoid the trap of using the framework as a blueprint, but rather use it to determine for which contexts – which farmers and which commodities – these assumptions are valid. Again, this reinforces the value of the scaling framework as a way of learning, this time not about scaling methods but about the process of scaling itself.

One obvious gap in the scaling framework is the absence of any mention of social inclusion. **Farmer Preferences** can mean farmers in general, while the definition of preferences as “attractive vis a vis alternatives [and] perceived benefits against cost/risks” does not specify to whom the new technology is attractive or acknowledge that costs/risks may vary for different types of farmer. These distinctions are left implicit. This shorthand device may be legitimate where projects are careful to specify their target group as resource-poor farmers, but it is more problematic for gender equity.

In its present form, the scaling framework effectively renders women invisible. Yet gender equity is particularly relevant for the GLDC program, for two reasons. First, dryland cereals and grain legumes are widely regarded as ‘women’s crops’. Consequently, if improved varieties are to be adopted at scale they must take account of women’s trait preferences. The TL III project recognises that successful scaling depends on “empowering women take greater advantage of new technology” (ICRISAT, 2016, pp. 8,12). Second, commercialisation may disempower women if men take control of the income from market sales. As dairying is commercialised, for example, “there is a risk for women to lose control ... as men have the means (transport, identity card) to put their names on the supply card of formal milk collection centres thus giving them control over dairy income” (ILRI, 2016, p. 74). Coupled with the fact that a larger share of extra milk production is sold, commercialisation may have a negative impact on household nutrition (ILRI, 2016, p. 75). As a result, women with dairy cows may prefer not to adopt new technology that leaves them worse off than before (Lenjiso et. al., 2016). While the lack of explicit attention to women in the framework is not deliberate, it is a serious gap.

Another component of scaling that is not mentioned explicitly in the scaling framework is partnerships. They are not ignored, but they are subsumed in **VC Actor Coordination**, which includes “multi-stakeholder planning and troubleshooting” (Figure 1).<sup>4</sup> But partnerships cannot be confined to a single component. They are also essential for **Policy & Institutions** (“supporting institutions”), **Accessibility** (“availability of inputs and complementary services”), **Awareness and Ability** (“knowledge and skills for optimal performance”), and for **Upstream Research** using advanced genomics. Indeed, partnerships are the glue that keeps all seven components of the scaling framework together. No glue, no framework.

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<sup>3</sup> For example, USAID’s Malawi country strategy admits that “A main barrier [to market sales] is that smallholder farmers often do not view farming as a business, but as a means for survival” yet in the next breath declares that its strategy will “help farmers conduct business plans and make sound production choices that yield greater profits” (USAID, 2019).

<sup>4</sup> The ValueLinks framework defines a “value chain actor” as one who takes ownership of the product that is handled in the chain between production and final consumption, which makes seed supply an “input provider” to the value chain rather than an actor in the value chain (Springer-Heinze, 2017).

Scaling new technology for smallholder farmers requires a specific type of partnership which entails cooperation between the public and private sectors. Since the focus of the four projects was on seed delivery, the component **VC Actor Coordination** refers primarily to the value chain for certified seed. Two kinds of partnership are relevant for seed delivery. One links national breeding programs to commercial breeding companies, while the second links them to seed delivery by private companies and agro-dealers. Both types of partnership were found in the four case study projects. **Upstream Research** in TL III and HOPE 2 worked with advanced research institutes in developed countries to develop improved varieties of GLDC crops using new genomic tools (eg Varshney, 2019). However, the main objective of these projects was to improve the **Accessibility** of certified seed through partnerships with national research programs, private seed companies, and farmer groups. The TL III project involved partnerships with no fewer than 235 seed production and delivery agencies (ICRISAT, 2013, p. 15).

Public-private partnerships to multiply and deliver certified seed are based on mutual self-interest. National breeding programs have multiple channels to market their products and ensure that seed stays available. Private companies can reduce their start-up costs by using foundation seed from national programs. Farmer seed producer groups can earn income by providing “last-mile” delivery to remote areas not served by agro-dealers. Typically, the public sector provides foundation seed to private seed companies, private seed companies supply basic seed to local seed producers, and local producers then supply certified seed to growers (Rubyogo et. al., 2019). But there are many variations on this basic model. No two countries have the same seed system. Although public-private partnerships can transform seed systems, however, they can also be difficult to manage. As we have seen, the TL III project experienced difficulties with start-up seed companies for grain legumes. Similarly, some national breeding programs have resisted working with commercial seed companies on the grounds that their mandate is to work with smallholders (Dominik Klauser, pers. comm.). Successful partnerships must first overcome these differences in agendas, organisational culture, knowledge and skills.

Given the importance of partnerships and gender for scaling, the question is whether the framework should give them greater emphasis. Since they are relevant for more than one component, the solution may be to treat them as a cross-cutting issue. They are not a component of scaling, but they are part of the process. This is the solution adopted by the GLDC Research Program and by the four projects. However, these process elements are missing from the current scaling framework.

As it stands, the scaling framework is a useful visualisation of a complex process. But it remains a framework – “a skeleton” – rather than a tool. Tools come with a manual or a set of instructions. The utility of the scaling framework could be enhanced by presenting the framework as the centrepiece of an expanded toolkit, which provided the user with more information.

What would a scaling toolkit look like? The visualisation of scaling would stay the same. But the toolkit would contain significant new elements. First, the toolkit would set the framework in context, as a product of the GLDC program’s theory of change, where scaling is viewed as part of a wider process of commercialisation. The strengths and limitations of this model should be outlined. Next, the toolkit would include a glossary of the nine components in the framework. At present, the task of unpacking these components is largely left to the user. The glossary would spell out what needs to be considered for each component. A short check – list would prompt users to answer key questions. For example, the glossary for **Farmer Preferences** would ask users about the target group (s), women’s preferences, and whether the product was used primarily for sale or home consumption. Similarly, the glossary for

**Consumer Demand** would ask users about the size of the market segment, the consumer profile, and which product attributes match the needs of consumers. The checklist could also include cross-cutting issues, such as the opportunity to test key assumptions in the framework, to compare the effectiveness of scaling methods, and about partnerships. The glossary would be used at the design stage to ensure that critical issues for each component were not overlooked and that the design included opportunities for learning about scaling approaches and methods. The toolkits developed by the Gender and Plant Breeding Initiative are a possible model here (RTB, 2019). They include not just visualisation but instructions on how to use the tools correctly and effectively. Finally, the toolkit would include examples of how to use the scaling framework, based on the experience of real-world scaling projects or pointing out gaps in knowledge.

## 7. Conclusion and Recommendations

The scaling framework was designed to capture the chief components of a complex process. This design was based on a review of the literature on scaling. This report tested the design against the practical experience of four scaling projects in the GLDC research program. How useful was the framework for understanding the design and performance of these projects? Did these real-world examples expose gaps in the framework and, if so, how might the framework be improved?

We conclude that the GLDC scaling framework captured the main components of four scaling projects. The framework was most useful at the design stage, identifying which components were and were not addressed, the scaling methods used, and the scope for testing alternative methods. Arguably, the framework was less useful for evaluating project performance. Poor performance may be the result of poor design or missing out a component of the scaling framework. Here the framework can help identify what went wrong and improve design in the future. However, poor performance may also result from confounding factors outside the control of the project and the scope of the framework. In assessing performance, the framework is less useful as a blueprint to grade projects in terms of 'success' or 'failure' than as an opportunity for learning. Used in this spirit, the framework can identify useful lessons for future scaling projects.

Testing the framework against these four projects also exposed some gaps and limitations. We conclude with some recommendations to improve the usefulness of the framework for the design of future scaling projects and the effectiveness of the GLDC program in scaling new technology.

1. **Transform the scaling framework into a tool.** A scaling framework toolkit would be based on the existing visualization but also provide users with information on context, a checklist of contents for the seven components, and examples of how to apply the framework to scaling projects.
2. **Address gender and partnerships.** These two important processes are either missing or receive insufficient emphasis in the visualization. Yet they are critical for the scaling of GLDC crops which rely on partnerships to overcome market failures in the supply of certified seed, and on women who are often responsible for these crops. These processes are best addressed as cross-cutting issues rather than as separate components in the visualization.
3. **Contextualise the scaling framework.** The GLDC scaling framework embodies a specific model of the agricultural transformation, conceptualized as a transition from

subsistence to commercial agriculture. Making this context explicit would clarify some assumptions in the framework and open the door to testing these assumptions through the experience of scaling projects.

4. **Use the framework to learn about scaling methods.** Mapping scaling methods against the seven components can help identify opportunities to compare the effectiveness of alternative methods or suggest the need for new methods of scaling. Designing research into these methods can add value to scaling projects.

In sum, the scaling framework is already useful at several stages of the GLDC program. However, it has the potential to become something more. As part of a fully – developed toolkit, the framework can provide a practical guide to the realities of scaling with a relevance beyond the GLDC program.

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