Hybrid Market Systems Development to Reinforce System Resilience and Climate Preparedness

RESULTS AND LESSONS LEARNED FROM PROMOTING SUSTAINABLE POTATO CULTIVATION IN UGANDA

April 2022

IFDC

OU

Hybrid Market Systems Development to Reinforce System Resilience and Climate Preparedness

Results and Lessons Learned from Promoting Sustainable Potato Cultivation In Uganda

P.O. Box 2040
Muscle Shoals, AL 35662

David Hirst, Harald Bekkers and Muneeb Zulfiqar

Table of Contents

Tables

Figures

Acronyms and Abbreviations

CATALIST	Catalyze Accelerated Agricultural Intensification for Social and Environmental Stability
CIP	International Potato Center
CSA	Climate-Smart Agriculture
DCED	Donor Committee for Enterprise Development
EKN	Embassy of the Kingdom of the Netherlands
FaaB	Farming as a Business
GAP	Good Agricultural Practice
IFDC	International Fertilizer Development Center
IITA	International Institute of Tropical Agriculture
ISB	Integrated Seed Business (from plantlets to basic seed and/or QDS)
KaZARDI	Kachwekano Zonal Agricultural Research and Development Institute
LSB	Local Seed Business (from basic seed to QDS)
M4P	Making Markets Work for the Poor
MSD	Market System Development
MSC	Microfinance Support Centre
NARO	National Agricultural Research Association
NGO	Non-Governmental Organization
QDS	Quality Declared Seed
REACH	Resilient Efficient Agribusiness Chains
SME	Small and Medium Enterprise
SSP	Spray Service Provider
VSLA	Village Savings and Loan Association

Hybrid Market Systems Development to Reinforce System Resilience and Climate Preparedness

Results and Lessons Learned from Promoting Sustainable Potato Cultivation In Uganda

1. Introduction: Why and When Go Hybrid?

The MSD Lifecycle: Systemic Development Can Deliver More than Growth

Market systems development (MSD) as a development methodology emerged early into the new millennium. A focus on enterprise development in the 1990s had given birth to business development services. However, soon it became apparent that enterprise growth was dependent on more than transacted business services, such as marketing and accounting. Integration into value chains and being embedded in a suitable business enabling environment mattered too. A more comprehensive picture of systemic development emerged (see Figure 1).

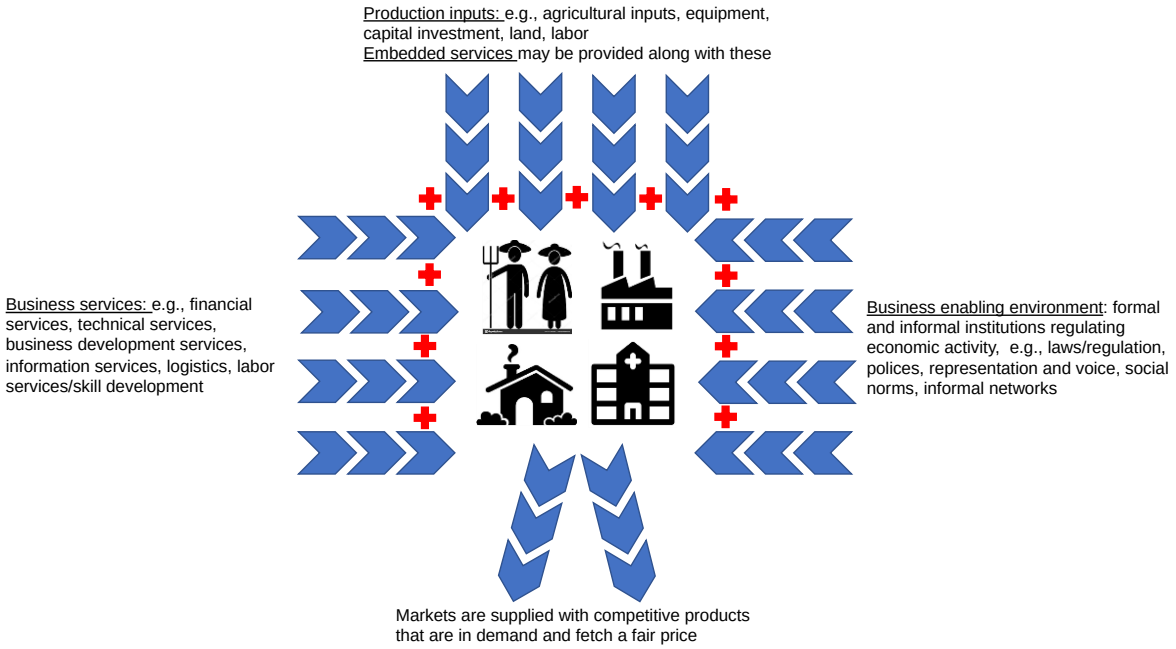

Figure 1. Framework for Systemic Development

What Figure 1 shows is a "productivity function" for systemic development: Competitive products and services are produced when producers, big and small, have access to the appropriate production inputs, services, rules, and regulations. This formula can be applied to every production process, whether it is agricultural, manufacturing, service delivery (e.g., healthcare, education), or

building affordable housing. To make something good and affordable, you need efficient access to the right "ingredients." The more the market system is able to provide this, the more productive one can become.

From Growth to Pro-Poor Growth

An initial focus on growth soon gave way to a focus on pro-poor growth, strongly influenced by the British focus on Making Markets Work for the Poor (M4P). A bit unexpectedly, the systems approach around small and medium enterprise (SME) development, which at least on paper looked most appropriate to develop urban SME clusters, celebrated its first large-scale success by including smallholder farmers in rural supply chains.[1] Thus, from the onset, there were indications that a systems approach could serve different development outcomes.

Becoming More Unorthodox in Shallow Markets

The next step was to apply the systems approach outside dynamic Asian economies to smaller, often less thriving economies, with a less mature private sector or public sector to leverage. As it turned out, a systems approach can be put to good use in thin or shallow markets, provided the mantra of "light-touch short-term facilitation" is appropriately adapted to the context in which it is implemented.

Many second-generation MSD projects may not go far enough in this regard, adhering to the M4P handbook to their own detriment. Others took adaptation seriously and were sometimes not considered sufficiently MSD oriented, but they made the systems approach work in unlikely places, such as the Pacific Island nations and post-conflict environments.[2] In such a challenging context, systemic development can be messy, with more ups and downs, longer implementation windows, and relatively more support and troubleshooting, but this does not make it less sustainable, systemic, or necessary.

[1] For instance, see the list of publication on Katalyst in the BEAM Exchange Evidence Map: beamexchange.org/search/?page=2&q=katalyst

[2] See the Messiness Series - In search of the sweet spot in implementing MSD programmes: beamexchange.org/resources/1040/

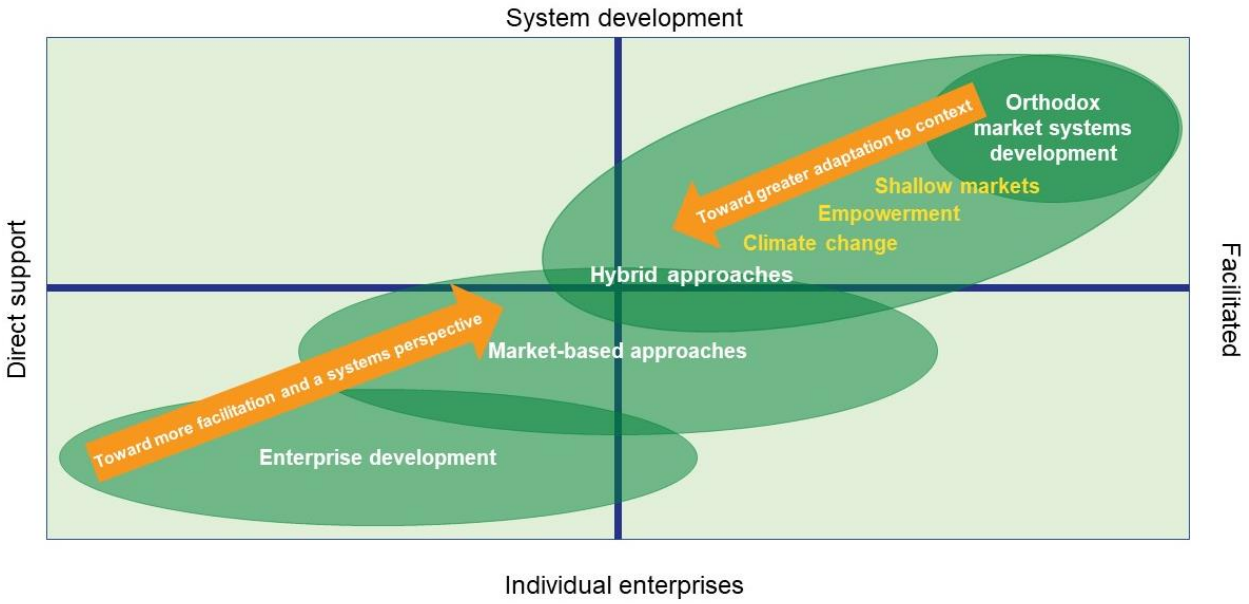

Figure 2. From Orthodox MSD to More Adaptive Systemic Approaches

Thus, a systems approach must be context-sensitive, respond to the development constraints it encounters, and build on the system actors present to address these. With adaptation, much is possible; without adaptation, MSD can turn into sterile repetition of jargon.

Further Adaptation to Drive Inclusion and Empowerment

Another test in adaptation was how to make the systems approach work in contexts in which the development constraints surpass what system actors' incentives and business models can cope with. For instance, in Papua New Guinea, can a systems approach address violence against women? Female-controlled economic activities can be empowering, but this can backfire if men feel left out. So how far can, for instance, a vegetable wholesaler can go in terms of supervising female vegetable producers and providing counseling to the female and male members of supplier households on shared benefits and joint decision-making? In Ethiopia, some women cannot access digital financial services, because their literacy levels are insufficient. How much can a financial service provider do in terms of educating potential female clients in order for them to learn how to operate a service that can improve their safety and provide access to new opportunities?

To deal with scenarios that are clearly more complex than targeting farmers at the base of the pyramid (BoP) and shrinking pack sizes to increase affordability to include and empower vulnerable groups and genders often overlooked or misunderstood, three different facilitation responses have been distinguished:

1. Include activities on the border of what is commercially sustainable in the cost-sharing agreements between facilitator and system actor. The financial service provider cannot provide primary education to new users. But a facilitator can cost-share an early, elaborate education effort to allow the financial service to learn how client education can be done in an economical manner (by learning what to focus on, developing effective, short modules, etc.). Thus, learning by doing may generate a way of working that is productive and cost-effective, and can be sustained within the business model.
2. When activities are well beyond what is commercially sustainable or the system actor lacks the capacity to fulfill complex or delicate tasks such as monitoring female well-being, the facilitator can consider developing supplementary interventions. For instance, the facilitator can engage a non-governmental organization (NGO) to monitor female well-being together with the vegetable wholesaler and in the process train their extension staff. This ensures that no harm is done in the short term and the vegetable wholesaler can take over in the long term or decide to retain a collaboration with the NGO in support of his business.[3]
3. When activities are well beyond what is commercially sustainable or the system actor lacks the capacity to fulfill complex or delicate tasks, and there is no other organization that can be contracted to supplement and support as described under point 2, the facilitator may opt to implement some activities themselves, essentially stepping out of the facilitator role. This is the least preferred option, as it risks reverting to unsustainable direct delivery models. However, if well implemented (see below), this can be a helpful option in shallow markets facing complex challenges with low-capacity systems actors. These can be social but also environmental in nature.

The Next Challenge: Climate Adaptation and System Resilience

Questions of methodological adaptation and supplementary activities to pave the way for commercially sustainable business models are even more important in the context of climate adaptation and system resilience.

Climate adaptation requires access to specific inputs and services and knowledge of good practices to deal with more extreme weather patterns. This puts pressure on farmers, the market system of suppliers around them, and indirectly, market system facilitators. Because of the increasing extremity, getting it half-right may no longer be good enough – the room for maneuver is reducing. Farmers need to be knowledgeable and require reliable access to all necessary appropriate inputs and services and supportive rules and regulations. The crop varieties need to be sufficiently tolerant or hardy. Farmers need to know how to grow them, may require access to protective or corrective measures (e.g., shading, irrigation) to shield crops from

[3] See three publications by the Market Development Facility, which refer to challenges and practices to develop business cases and address norms: beamexchange.org/resources/638/; beamexchange.org/resources/1142/; beamexchange.org/resources/1123/

the worst weather extremities, and may need to implement better post-harvest handling to ensure that a good harvest does not go to waste.

Thus, as climate pressure mounts, the plus (+) signs in the system diagram in Figure 1 are becoming more important. System resilience means that all necessary inputs and services can be accessed and that this access itself is resilient to shocks and stressors. In market systems early in their lifecycle, characterized by shallow markets and weak or missing system actors, there are likely to be many system gaps. The question is, then, which of the three options presented above would best fill these?

This case study describes how, confronted with such a scenario in potato cultivation in Uganda, the Resilient Efficient Agribusiness Chains (REACH) project, funded by the Embassy of the Kingdom of the Netherlands (EKN) and implemented by the International Fertilizer Development Center (IFDC), opted to go "hybrid." REACH's hybrid approach took shape over time, as it reflected on its MSD work and farmer training programs.

What is a Hybrid Approach?

A hybrid approach is not a bit of a systems approach and a bit of old-fashioned direct delivery going side by side. Going hybrid fits in the pattern described above: gradually and carefully adapting the MSD approach to diverse contexts and circumstances. Whereas direct delivery approaches have become more market-based, MSD has moved in the opposite direction: remaining systemic yet more adaptative and responsive to context (see Figure 2). The following are characteristics of a hybrid approach:

1. A hybrid approach is an MSD approach – it maintains a systems perspective. This implies that the market system has been analyzed; market demand, production constraints, inclusion and empowerment concerns, climate adaption concerns, and requirements for system resilience have been identified.
2. This analysis must be turned into a clear evidence-based vision for system change and strategy that defines how the system will work long-term without donor support, the constraints and concerns identified above, and opportunities for system actors to address these. This should include a reflection on whether or not supplementary intervention or direct delivery may be required in light of the constraints that need to be addressed and the expected lack of capacity of system actors in doing so. To avoid overuse of potentially less sustainable models, specific gaps should be well-defined and justified.
3. This strategy should be turned into an intervention portfolio. In support of commercially sustainable business models, supplementary interventions or direct delivery can be considered in line with the gaps identified.
4. The accumulated change of this intervention portfolio should result in an increasingly resilient system.

How to Read This Paper

This case study explores how REACH adopted a hybrid approach to potato cultivation in Uganda, already facing the strain from more extreme weather patterns.

Chapter 2 discusses the potato scenario in Uganda in more detail. Potato is a promising yet technically demanding crop in need of a resilient market system to support climate adaption. However, the market system for potato is just emerging. Farmers lack know-how and access to information and inputs that support good agricultural practices (GAPs). Markets actors are absent or getting established – their ability to influence farmers is limited for now.

Chapter 3 shows how REACH implemented a hybrid approach to address this scenario: establishing three pathways to systemic change, getting more market actors in play, and pairing this with farmer uplift to strengthen systemic outcomes.

Chapter 4 discusses the results and lessons learned. A market system is forming in which more market actors make relevant inputs and services available closer to farmers. Farmers are in a better position to understand the relevance of these and apply these for more productive and resilient potato farming.

2. Potato in Uganda: An Emerging Cash Crop in Need of a Resilient Market System

A Demanding Crop Relevant for Food and Nutrition Security

Potato is highly relevant for food and nutrition security. Yields can reach up to 8 metric tons (mt)/acre, more than any other staple crop. Potato is also rich in nutrients compared to other staple crops. While offering a ready form of carbohydrates, potatoes also contain important micronutrients and amino acids.[4]

Box 1. Potato Nutrition Facts from the International Potato Center (CIP)

- Potato is the **third most important food crop** in the world.
- Potato contains **more calories per hectare** than the major grains.
- Potato produces **more food per unit of water** than any other major crop.
- Potato contains half the daily requirement of **vitamin C and significant amounts of vitamin B, iron, potassium, and zinc**.

Potato is also a demanding crop. Clean seed, application of appropriate Fertilizer and Crop Protection Products, and crop rotation are all important to obtain good yields and prevent soils from becoming contaminated with soil-borne pests and pathogens:

- Compared to other staples such as rice and maize, potato yields drop significantly and the risk of diseases skyrockets if a farmer decides to use small potatoes from last year's harvest – typically undersized due to the impacts of disease and genetic deterioration – as seed for next year's crop. Ideally, farmers invest in fresh seed every season or at least every two to three seasons.
- Application of fertilizer and fungicide are key to boosting yields and controlling late blight.
- Crop rotation is critical to controlling soil-borne pests and pathogens. Crop rotation done for at least one season with a non-solanum crop allows some natural regeneration of soils and reduces diseases, such as late blight.

Research conducted by the International Institute of Tropical Agriculture (IITA) in 2014 in Uganda revealed that yields of 7-8 mt/acre could be achieved. The most important factors for this were the use of clean seed as well as the correct fertilizer.[5]

However, most potato farmers obtain yields less than half of this, with the national average at just below 3 mt/acre. Furthermore, this has gradually reduced from 3.5 mt/acre in 1970.[6] The reasons for low potato yields are easy to identify:

[4] See European Food Information Council (EUFIC): eufic.org/en/healthy-living/article/the-goodness-in-potatoes
[5] IITA Agronomic Survey data 2015
[6] Research Report No. 14, Investment Opportunities and Challenges in the Irish Potato Value Chain in Uganda, PASIC Project Output 1: Evidence Generation-Activity # 1.2 Value Chain Studies

- The seed potato industry in Uganda is virtually nonexistent. It is estimated that approximately 24,000 mt of clean seed is required annually by farmers,[7] while in 2016 only 5% of this was met. Farmers have no choice but to plant degenerated seed.
- Appropriate application of inputs is expensive and access to capital to help prefinance a season is severely limited. REACH calculations suggest that total investments in clean seed, fertilizer and crop protection products, land preparation, and labor can reach approximately €600 per acre.
- Farmers often have insufficient access to land to practice crop rotation. The typical land size owned in the southwestern highlands is less than 0.5 acres and often fragmented. In the Elgon highlands in Eastern Uganda, land size is closer to 1 acre. At the same time, population densities in these highland areas are among the highest in Uganda. Some land may be available to rent, but with population pressure and high demand, this can amount to 30% of the cost of production. As such, crop rotation, although acknowledged by farmers as important to maintaining soil health, may be considered secondary to the economic lure of a profitable crop such as potato.

Thus, whereas the climatic conditions in Uganda are suitable for potato cultivation (more on that below) and the demand for potato is strong – locally, in the cities, and in export markets – the market system to sustain productive cultivation is not yet in place.

Strong "Horizontal" Expansion but Low Yields: IFDC Steps In

Despite this, production of potato has expanded in Uganda over the last 20 years. Farmers are investing in potato as a food security and cash crop. The most recent Annual Agricultural Survey conducted by the Uganda Bureau of Statistics in 2018 estimated the national production of ware potato to be 327,000 mt, from an estimated total planted area of 111,000 hectares (ha) across two seasons. This has more than doubled from 155,000 mt in 2005/06.[8]

This expansion has been largely smallholder farmer driven and was done with only fledging access to and utilization of key goods and services and limited investments from the private sector. To maintain the momentum toward expansion, a support inputs and services industry was needed to further develop this nascent market system.

IFDC commenced working in potato in Uganda in 2012. The first project funded by EKN, the Catalyze Accelerated Agricultural Intensification for Social and Environmental Stability-Uganda (CATALIST, 2012-2016), focused primarily on training farmers on GAPs. Also, modest but important beginnings were made for a more systemic approach. The project partnered with Kachwekano Zonal Agricultural Research and Development Institute (KaZARDI) on developing

[7] Uganda Bureau of Statistics, Annual Agricultural Survey 2018
[8] Research Report No. 14, Investment Opportunities and Challenges in the Irish Potato Value Chain in Uganda, PASIC Project Output 1: Evidence Generation-Activity # 1.2 Value Chain Studies

two important components of the local seed system: increased production capacity for the tissue culture laboratory, an essential first step in improving the availability of tissue culture plantlets; and the establishment of six screenhouses to support mini-tuber (early generation seed) production. CATALIST's successor, Resilient Efficient Agribusiness Chains (REACH; 2016-2021), adopted a hybrid approach (see below).

Climate Adaptation Increases the Demands on Farmers and the Market System

The stress on potato cultivation, and therefore the demand on the emerging market system around potato, is increasing. Since 2016, 50% of the agricultural seasons in highland areas have shown either above normal or slightly below normal average rainfall.[9] This can be attributed to the localized impact of climate change. Potato-growing areas are increasingly subject to uncertain rainfall, changing rainy seasons, and occurrence of extreme weather events such as flooding and occasional minor incidences of drought. These fluctuations – too much or below normal rain – impact farmer yields, given that over 90% of production is still rainfed.

Almost 60% of farmers in southwestern and eastern Uganda report that yields are not meeting their expectations due to harsh weather conditions.[10] While too little rain means that potato plants have insufficient water to grow adequately, too much rain can equally reduce yields due to higher incidences of disease, such as late blight. Unpredictable weather conditions have therefore increased potato farmers' vulnerability and require increasingly dynamic and integrated solutions.

For farmers to resist, absorb, and respond to climatic events requires integrated solutions. A smallholder farmer requires a combination of access to quality affordable inputs for potato production (seed, fertilizer, crop protection products) at the right time in order to be flexible to changes in conditions (prior to and at intervals during the agricultural season). Also, farmers must know how to apply these in an optimal and environmentally sustainable manner. Typically, some but not all parts of this package are missing; hence, farmers' yields are not meeting their expectations. But how can these pieces be brought together?

An Early Life Cycle Market System in Uganda Barely Able to Respond

Seed. Access to clean seeds is the backbone for potato cultivation, but there are reasons why a seed potato industry does not easily emerge on its own. Because of the bulk involved, seed potato multiplication is best done close to farmers, in the region, and thus relatively further away from many government institutions, banks, and laboratories producing clean planting material for multiplication. In the region, there may be few actors with the skills, resources, and network to establish a business that can make the connection between farmer demand and all of the production services needed to respond to this. Related to this, seed potato multiplication requires

[9] Uganda National Meteorological Authority, seasonal
[10] REACH Uganda final report, Toward an Inclusive Systemic Uplift of Smallholder Productivity and Resilience, 2016-2021

time and land, while the returns from investment are only realized in the medium to long term. Few can or want to wait so long. The 5% market coverage in 2016 quoted above mostly came through the public sector system under the National Agricultural Research Organization (NARO). In addition, a handful of private sector businesses in southwestern Uganda under CATALIST, operating on a suboptimal and informal basis, made some available.

Fertilizer. Clean seed needs to be combined with access to and utilization of the right fertilizer. Only 60%[11] of farmers were using any kind of fertilizer in 2016, and virtually none applied appropriate types and doses due to a lack of knowledge, access, or affordability. Getting the right product at the right time in the right place was not happening due to the limited last-mile delivery and advisory services to farmers.

Access to finance. Financial options to prefinance investments in potato were also limited at best. In 2016, only 16% of potato farmers were accessing loans.[12]

Knowledge of GAPs and business skills. At the project baseline, only 52% of potato farmers were practicing three out of 11 GAPs, and none were practicing six out of 11. Furthermore, the knowledge and practice of climate-smart approaches was low, particularly the use of correct fertilizer, soil and water conservation measures, and crop and income diversification. Even if farmers had some level of adoption of GAPs, knowledge and adoption of climate-smart agriculture (CSA) was limited and therefore would need to be addressed as part of the package.

Based on this, REACH focused on five key systemic bottlenecks that were restricting the development of the potato sector in Uganda:

1. The absence of a local seed industry for clean affordable local seed.
2. A very limited last-mile delivery system in fertilizer and crop protection products.
3. Lack of financial services to facilitate investment in GAPs.
4. The absence of motorable feeder roads in rural highland areas, limiting access to the market and services for potato farmers.
5. Limited knowledge of GAPs, particularly new developments/techniques in CSA for climate-proof potato production, and how this could be run as a strong business enterprise

The perception was that the nascent potato market system (virtually no seed multipliers, no last-mile distribution, etc.) did not have market actors able to lay the groundwork for point 5, and thus REACH decided to do this directly through provision of a farmer uplift training package via two sources: local partner NGOs and individual field extension workers who were embedded into the local communities. This hybrid approach was informed by a single vision and strategy. This vision and strategy is illustrated in Figure 3.

[11] REACH baseline study, December 2016
[12] REACH baseline study, December 2016

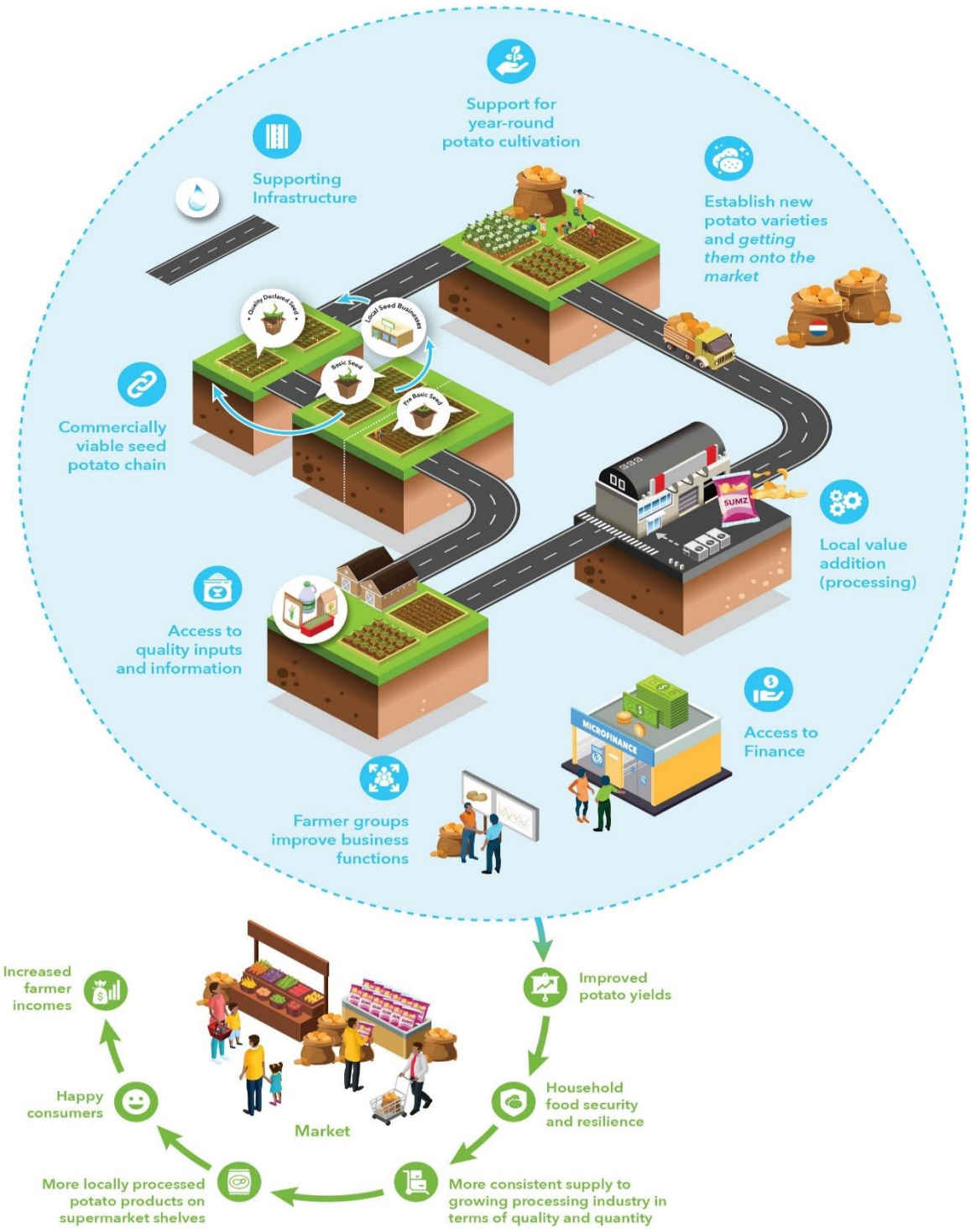

Figure 3. REACH Strategy for Developing the Potato Market System in Uganda

In addition to the three key pathways and farmer uplift efforts identified above, REACH also worked on a number of other key elements to make the potato market system stronger: introducing new potato varieties (to increase fresh stock, respond to demand for potato with specific characteristics); investing in potato processing and value addition (to create a local food industry able to compete with imports); strengthening the business enabling environment (particularly the absence of a seed potato inspection and certification guidelines).

This paper focuses on the three pathways, plus the investment in rural infrastructure, and farmer uplift identified above.

3. Go Hybrid in Action

Establishing a Local Commercial Seed Multiplication Industry

The first pathway to systemic change involved establishing the entire supply for seed potato multiplication, from laboratories importing varieties and using tissue culture to create clean planting material, to regional Integrated Seed Businesses (ISBs) multiplying this into basic seed (tubers), to last-mile Local Seed Businesses (LSBs) conducting the last multiplication round(s) and selling quality declared seed (QDS) to farmers. Because seed potato is very difficult to distinguish from degenerated small potato, it is important that the seed chain is short and farmers can trace the product. Figure 4 explains the seed potato supply chain.

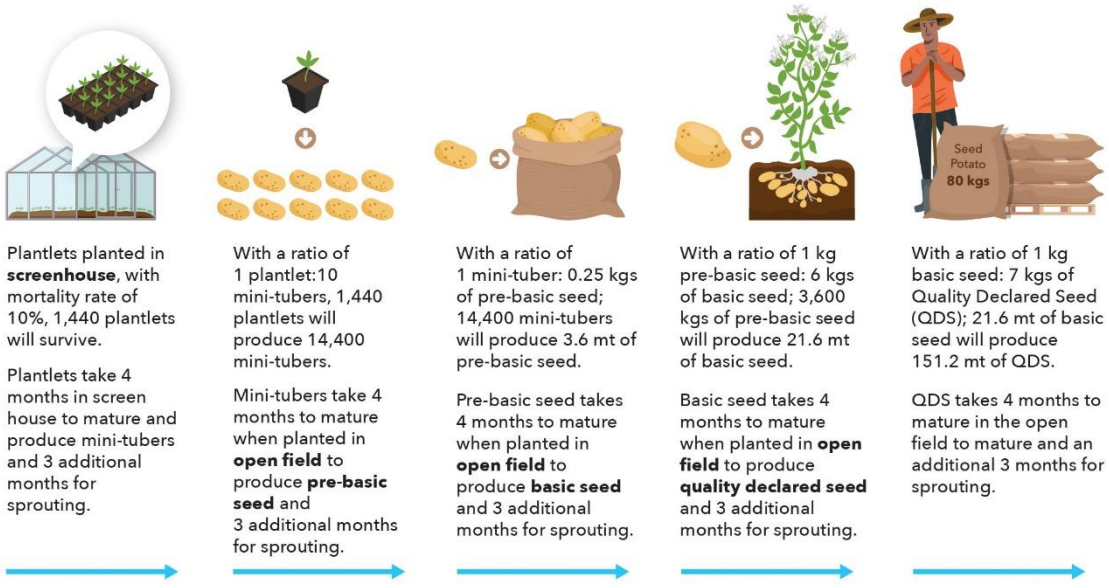

Figure 4. Seed Potato Supply Chain

Building off of and incorporating lessons learned from previous seed-based interventions in Uganda (including CATALIST), REACH sought to develop a wholly commercial strategy for seed potato at scale. These lessons were:

- Until 2015, interventions by CATALIST and other program had brought positive, but piecemeal, benefits to farmers and the market system. Efforts had been focused on producing limited quantities of seed either in government facilities or by farmer groups. The question of how to establish capacity for multiplication at scale along the chain, presented in Figure 4, was largely ignored. A proper supply system for seed multiplication did not emerge.
- Related to this, popularization of seed potato as a community good, rather than a commercial product, inhibited entrepreneurs from investing in commercial production.

- Technological solutions piloted, such screenhouses to raise plantlets and diffused light stores for storing seed potato, proved successful but were not commercially scaled up.

Based on national demand, the estimated seed potato production shortfall, and the lessons learned from tested technological solutions, it was feasible for REACH to envision how a commercially sustainable seed potato supply chain should look.

1. A handful of public and private tissue culture laboratories are required, in which clean germplasm is used to produce plantlets for further multiplication. Importing seed potato is expensive due the bulk involved. These laboratories can keep potato varieties in stock and produce plantlets on demand. Two commercial laboratories and one public laboratory at NARO (which had received some support from CATALIST) existed in Uganda. The latter turned out to be a relevant player in supporting a commercial supply chain but faced supply constraints. The commercial players had limited experience interacting with farmers.
2. REACH estimated that a total of 45 screenhouse units (based on average production capacity) spread across four major potato-growing regions would be needed to meet the estimated demand of 24,000 mt of seed potato. They would create demand for more than 172,000 plantlets from tissue culture laboratories per year.
3. Approximately 90 LSBs, acting as multiplication agents, would be required to produce QDS and sell this to farmers.

The advantage of this system is that local seed companies, often emerging from local lead farmers or lead-farmer groups, can produce clean seed near farming communities. Because seed potato is bulky and distinguishing between clean seed and degenerated seed is difficult, short, localized supply chains are preferred. In this manner, a tight-knit, locally relevant clean seed production and distribution system can be established.

REACH would not be able to lift this whole infrastructure off the ground given the time and resources required. The aim was to make a decent start in the southwestern and the eastern highlands, get the innovation established, and then see how market dynamics (crowding in) and/or further donor investment would drive scaling up.

REACH partnered with eight ISBs to ramp up the production of certified seed potato. ISBs were identified and selected through a screening process based on several key criteria, including basic technical know-how, business acumen, location, and capacity to cost-share between 30% and 50% of the investments, which included a screenhouse, a diffused light store, and a rainwater harvesting system.

It should be noted that agro-finance to support these investments is not readily available in the market and expensive, given the high interest rate of 25%. ISBs may only become profitable after three years and are therefore unattractive to financial institutions already reluctant to invest

in anything related to agriculture due to the perceived risk. As such, REACH's 30-50% subsidy on a total investment of around €15,000 was considered justifiable, given the informal and local nature of the seed potato multiplication enterprises.

These eight ISBs have sufficient capacity to meet 26% of national demand by 2023. At a regional level, by 2023 the five partners in southwestern Uganda will be able to supply 37% of local demand and the three partners in eastern Uganda 27% of local demand.[13] Table 1 shows the seed production per partner (actual values through 2021, projections for the next two years).

Table 1. REACH-Supported Seed Potato Production

Partner	2019	2020	2021	2022 (projection)	2023 (projection)	Subtotal (mt)
	Basic Seed (mt)	Basic Seed (mt)	Basic Seed (mt)	Basic Seed (mt)	Basic Seed (mt)	
CKB	122.42	58.75	76.06	77.09	77.09	411.41
KFRC	92.84	15.89	39.36	67.72	67.72	283.53
MAZIBA	0	0	0	95.96	95.96	191.92
MUYAMBI	0	0	0	102.96	89.23	192.19
BITAMBA	0	0	0	50.16	102.2	152.36
WELISHE	0	0	0	42.9	42.9	85.8
MIFA	0	0	0	52.8	52.8	105.6
CHEMONGES	0	0	0	29.04	58.08	87.12
Annual Total Basic	**215.26**	**74.64**	**115.42**	**518.63**	**585.98**	**1,509.93**
QDS Volume	**1,506.82**	**522.48**	**807.94**	**3,630.41**	**4,101.86**	**10,569.51**
# of farmers seed demand served	**1,884**	**653**	**1,010**	**4,538**	**5,127**	**13,211.89**

Establishing Last-Mile Distribution of and Services for Fertilizer and Crop Protection Products

A second pathway for systemic change involved establishing last-mile agrochemical availability and services. In Uganda, in the main towns, agro-stockists (regional wholesalers) are present, but the distribution system into the districts is patchy. Access to local retailers and service providers

[13] These figures only include the three ISBs supported under the project in eastern Uganda. In eastern Uganda, four other ISBs were supported under the GIZ PNSP project also implemented by IFDC, which increases the percentage of the local market covered in the Elgon sub-region.

who are knowledgeable about correct fertilizer application and disease control measures are virtually nonexistent. Improving this was done through two (business) models:

1. Establishing a distribution chain for crop-specific fertilizer for potato.
2. Establishing spray service providers (SSPs) and promoting the safe and correct use of crop protection products.

In partnership with Grainpulse Limited, access to crop-specific fertilizer was promoted. Specific fertilizer blends should lead to efficient fertilizer use. Blends were based on soil analysis and the specific nutrient needs of potato.

While blended products had recently entered the market, their outreach in rural markets had been limited. Through the partnership, 30 district- and sub-county-level stockists were selected and trained on product knowledge of crop-specific fertilizers, and 42 demonstrations were established to compare the performance of Grainpulse Limited's crop-specific fertilizer with the generic ones on the market.

In addition, REACH supported the establishment of SSP networks to promote better access to and correct use of crop protection spray services at the community level. SSPs can provide frontline advice on correct application of crop protection products, which are essential in potato to manage pests and diseases in a manner that is environmentally sound. The project trained 137 SSPs (84 youth) on correct use and safe handling of crop protection products, business skills, and financial literacy, and they were able to form associations in two potato producing districts.

Both models can be expanded significantly to widen the emerging systemic change pathway.

Deepening Financial Inclusion, Establishing Agro-Financing

The third pathway for systemic change focused on deepening financial inclusion (somewhat existent) and making products available for agro-financing (virtually nonexistent).

The project cast a wide net for financial institutions operating in potato-growing areas in anticipation of forming partnerships that would reach isolated potato growers with affordable and timely financing. Although several potential partners were identified, most discussion did not reach the stage of partnership development due to the financial institutions' lack of interest in taking on farmer risk in remote rural areas. The institutions often expected that REACH would cover their risks, such as farmer engagement, resources for staff, and guarantee of loans. However, the project was not willing to subsidize the institutions for reasons of market distortion.

In the end, the project did establish a partnership with Microfinance Support Centre (MSC), which was interested in expanding their lending base with a competitive group loan product that offered reasonable cost incentives to farmers. MSC already had a farmer group loan product but had difficulties in their farmer engagement with it. At a 1% interest rate per month, the MSC

loan is more affordable to farmers than a commercial bank rate of at least 2% per month, and it is suitable for potato farmers. However, the model also has limitations. Despite the inclusion of more loan officers, the outreach of institutions such as MSC is still limited.

A different approach needed to be tried.

With banks still having a limited footprint in the rural agricultural landscape, village savings and loan associations (VSLAs) had to form the foundation to further financial inclusion. A total of 589 VSLAs were established with potato groups, and 9,381 members were trained on financial literacy and business skills. The business skills component was included in recognition of the need to plan and optimize the use of resources available through the groups and focused on leadership and governance, business planning, marketing and networking, and budgeting for a farm business. Through VSLAs, a savings culture was promoted and farmers gained the opportunity to access small loans (at a maximum of approximately €100; while enough to fund an entire crop, it provided a stepping stone).

In addition, REACH supported VSLAs' access to loans, through linkage to microfinance institutions or banks. VSLAs offer a sound entry point for financial institutions looking to reduce risk by targeting farmers who are already knowledgeable on the basics of savings and loans with higher value credit options. Several banks and microfinance institutions were able to participate in the VSLA and financial literacy training program by taking farmers through the basics of loan packages in their portfolios.

Infrastructure

As a highland crop, potato is usually grown in remote areas that have poor infrastructure as a result of heavy rain and erosion. Through partnerships with the public sector, 52 kilometers of rural feeder roads were rehabilitated or constructed. Prior to the interventions, these roads were either completely impassable or partially impassable in the rainy seasons. These strategic infrastructure interventions were jointly identified and implemented with District Local Governments in four highland districts. The total investment was €1,243,404, of which the District Local Governments and partners covered €383,111 and the project covered €860,293.

Farmer Uplift in Support of Systemic Change Pathways

While these systemic change pathways took shape, some broader than others, it was clear that all local market actors that became involved would have limited capacity to engage intensely with farmers to change their practices. The agricultural laboratories were too small to reach out to many farmers – they had just enough capacity to support their clients. ISBs were generally knowledgeable but quite busy building up their new businesses. LSBs were small too. SSPs could have played a bigger role if their numbers were bigger, but also this network had to be built up. The capacity of input companies to engage farmers was relatively better, but still modest compared to the need. They were foremost busy building up their distribution networks.

Microfinance institutions lacked the agribusiness know-how to play a meaningful role here. So who can help farmers connect, make use of the system emerging around them, and grow a demanding, expensive crop in an efficient, productive manner?

Potato represents an early lifecycle market system with a limited number of players, many of whom are startups, that may not be able to provide a full package of value-added services, such as training, demonstration, and technology promotion. Furthermore, with the increasing challenge of climate change, potato farmers need to be able to respond to increasing shocks or setbacks in a timely manner and require a helping hand to develop their knowledge and skills on how to better maximize the use of these services. Hence, farmer uplift was factored into the design as the pre-market component of REACH.

Enhancing farmer uplift would be hugely beneficial, provided that it is done in partnership with carefully selected farmer groups, uses catalytic co-investment and mentoring, and is aligned closely with market outreach interventions (REACH, End-of-Project Impact Assessment, January 2021).

The training program was rolled out to over 887 potato farmer groups, consisting of 16,877 individual farmers. In potato, over 13,000 potato farmers were trained in CSA and over 11,000 farmers in GAPs and farming as a business (FaaB). Over 9,000 farmers also received training in financial literary business skills (as part of VSLA support). Table 2 shows the number of farmers trained by topic.

Table 2. Number of Potato Farmers Trained by Topic

Topic	2017	2018	2019	Cumulative
FaaB	5,913	3,059	2,825	11,797
GAPs	4,857	3,630	2,825	11,312
Income Diversification	3,297	6,594	2,825	12,716
Access to Finance	0	6,619	2,762	9,381
Joint Decision-Making	2,526	8,665	5,041	16,232
CSA	3826	6641	2,825	13,292
Ancillary Crops	0	3,406	6,743	10,149

The training program integrated GAPs, FaaB, CSA, income diversification, and gender into the same curriculum, which was split into several modules involving a contact session every week for eight to 10 weeks. Financial literacy and business skills training was conducted for the same groups in the subsequent season to avoid an overload of trainings. The following potato GAPs were promoted (see Table 3).

Table 3. Potato GAPs Promoted by REACH

GAP	Explanation
Site selection	- Select a site that has not been under potato production or potato-related crops for a period of at least two seasons for ware potato or three seasons for seed potato production. - This is to prevent planting seed in an already bacterial wilt-infected soil and to have relatively fertile land.
Land preparation	- Plow deep across the slope or along the contours to minimize soil erosion. - Perform the first plowing at least a month before onset of rains/planting to allow proper decomposition of organic matter. - Perform the second plowing two weeks before planting to ensure a fine and friable soil before planting for proper crop emergence and root and tuber development.
Line planting	- Make lines, or furrows, across the slope at a spacing of 75 cm x 30 cm for ware potato or 60 cm x 30 cm for seed potato planting. Line planting ensures optimum seed rate and plant population per unit area. It also makes proceeding field operations, such as weeding, earthing up, and spraying, easier.
Fertilizer application	- Consider soil testing to understand soil nutrient deficiencies. - General recommendation: Apply 120-200 kg of NPK 17:17:17 per acre at the time of planting in furrows.
Making large mounds	- Form large mounds/ridges at planting, weeding, and earthing up to properly cover the planted seed tuber, retain soil moisture, reduce pest infestation of the tubers, enable proper root development and tuber enlargement, and control water runoff, hence facilitating proper infiltration and reducing soil erosion.
Weed management	- Perform first weeding and earthing-up two weeks after crop emergence and second weeding and earthing up two weeks after first weeding. Weeds compete with potato for nutrients; weeds also provide a conducive environment for disease development.
Pest and disease management	- Proper pest and disease identification and management particularly late blight, bacterial wilt, and viral diseases and pests such as potato tuber moth and aphids.
Harvesting	- Provides farmers an understanding of the maturity/harvest date, so as to harvest mature potato for a better market and storage.
Post-harvest handling	- Sort, grade, and remove infected or damaged tubers and weigh immediately after harvesting in the field. - Use appropriate storage facilities, e.g., diffused light store for seed potato and ambient store and dark aerated rooms for ware potato. - Control storage pests, such as potato tuber moth, using appropriate pesticides and repellants, e.g. Malathion and African marigold. - Inspect the store regularly to remove diseased or damaged tubers.

In the face of a changing climate, the adoption of the above nine GAPs may only take a farmer so far. Farmers must be increasingly able to better adapt their farming practices and manage climatic shocks and setbacks where possible. Therefore, in addition to critical GAPs, the CSA training program was designed around three pillars: productivity improvement, adaptation, and mitigation of climate change. The key productivity approaches were conducted in conjunction with the GAPs training, with an emphasis on soil and water conservation, making use of weather data, use of quality/clean seed, and balanced fertilizer use, while the adaptation techniques comprised crop and enterprise diversification and access to finance, as previously discussed. Under mitigation, the project emphasized techniques that reduce greenhouse gas emissions, such

as smart fertilizer usage and good soil management. Table 4 shows the CSA practices promoted and the adoption rate.

Table 4. CSA Practices Promoted by REACH and Adoption Rate

Climate-Smart Agriculture Practice	Description	2017	Endline
Access to credit	Credit access mechanisms allow farmers to make investments and can be used for loans to help farmers recover financially in case of negative climate events.	22%	47%
Income diversification	Devise other sources of income besides potato production.	26%	77%
Crop diversification	Plant other ancillary crops besides potato for extra income and food security.	48%	99%
Know the weather forecast	Knowing the long-term and short-term weather forecast helps to prepare for the season and adjust the seasonal calendar when necessary.	56%	61%
Plant on time	Early planting results in better use of rainfall, and plants capture nutrients that may be washed from the soil. Should rains stop early, the earliest planted potato will have an advantage.	60%	89%
Plant well-sprouted seed	Well-sprouted seed results in faster establishment, shielding the soil from erosion, and makes better use of early rains.	88%	90%
Plant early-maturing varieties	Varieties that mature in as little as 90 days are more disease-resistant and respond better to fertilizers. Faster canopy coverage from these varieties helps keep the soil in place when rainfall is heavy.	57%	59%
Use glyphosate herbicides	Using herbicides reduces the number of plowings from three to two. The organic residue from dying weeds improves the soil, resulting in a better potato seed bed and better capture of water when rains begin in earnest	10%	47%
Use the correct fertilizers	The right fertilizers for potato should include N, P, and K, as well as other nutrients that may be deficient. The right fertilizer will cause the canopy to close faster and protect the soil.	29%	40%
Use water catchment	Water catchments (trenches) can be developed to capture runoff water for irrigation in times of water scarcity.	11%	63%
Make mounds along the slope contour	Large mounds control erosion and capture more rainfall.	32%	42%

REACH Integrated Theory of Change for Potato

Figure 5 shows how systemic efforts and farmer uplift come together in the REACH integrated theory of change for potato. This theory of change contains the aggregate realized and project impact of REACH's work in potato.

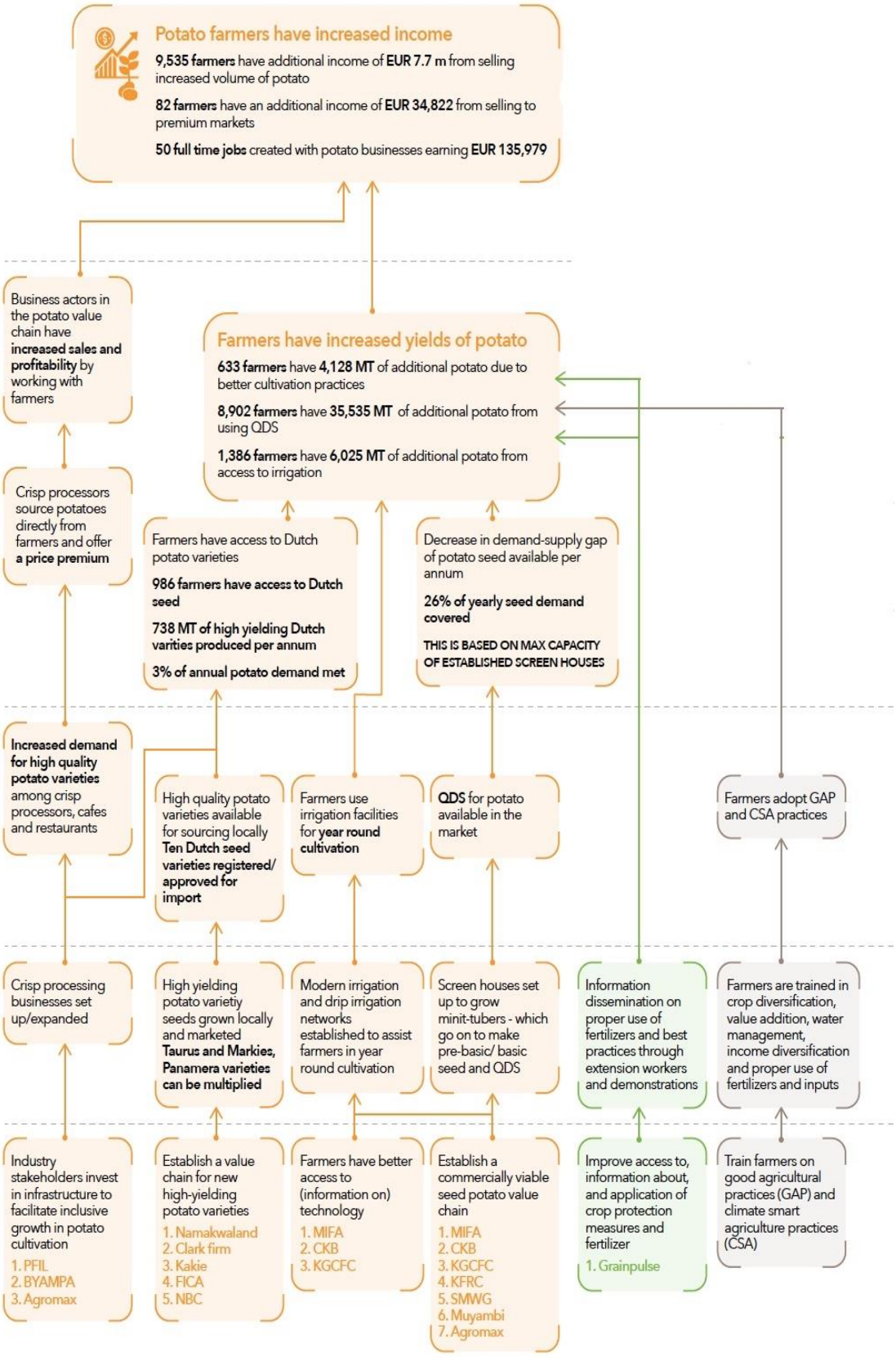

Figure 5. REACH Integrated Theory of Change for Potato

4. Hybrid Results and Lessons Learned

An Emerging Seed Potato Industry

Whereas in 2016 only 5% of seed demand was met, mostly through public sources, REACH investments are changing this scenario. From 2016 to 2021, REACH supported an additional eight ISBs and two LSBs to increase seed supply. All eight ISBs have completed their investments in screenhouses and diffused light stores and, where applicable, access to water. As a result, the eight ISBs now have a combined production capacity of 586 mt of basic seed per annum, which after multiplication by LSBs will serve the complete seed needs of 5,127 farmers per year. This equates to 26% of the estimated national demand per annum.[14] **On the diffusion of innovation curve, REACH has been able to reach the early majority stage. In other words, the volume of clean seeds being produced has reached a critical mass that makes it likely that the practice of using it is here to stay.**

The supply of tissue culture plantlets, however, has not kept up with the expansion of ISBs as only 45% of the plantlet demand has been met so far by 2021. REACH partnered with Agromax (a private tissue culture lab) to increase the supply of plantlets as demanded by the increasing number of ISBs. However, the plantlet supply continues to be dominated by the NARO KaZARDI. Discussions with screenhouse owners revealed several reasons behind this: its proximity in southwest Uganda to 60% of the ISBs, competitive pricing structure, and after-sales technical assistance offered to purchasers of tissue culture plantlets. Production of rooted apical cuttings by ISB operators (although 30% less productive than plantlets) has enabled the rapid bulking of planting materials for screenhouses, helping to overcome some of the supply chain shortages. In 2021, Agromax indicated that they were ready to fully engage with the sector again for providing plantlets to existing ISBs as well as technical backstopping and support for setting up successful ISBs.

Last-Mile Fertilizer and Crop Protection Products

30 agro-input stockists were supported to enable easier access to the potato-specific fertilizer product for the farmers. These stockists purchased and stocked over 349 mt of potato-specific fertilizer blends and have observed repeat purchases of the fertilizer by farmers. At the same time, market penetration has remained a challenge. Farmers are still unfamiliar with the blended products and are unconvinced about their efficacy versus the generic brands on the market.

The general use of fertilizer has increased over the course of the project: 95% of farmers are now using fertilizer, compared to 60% in 2016 (baseline year). There is opportunity for Grainpulse Limited (or other new players in the market, such as Yara) to capitalize on the growing demand.

[14] 586 mt of basic seed x 7 = 4,102 mt QDS x 1.5 (based on a farmer using clean seed every three seasons)/23,900, which is the total national demand per annum = 26%.

To further systemic change, more partnerships and more intensive efforts at demonstration and knowledge transfer would be required to increase appropriate fertilizer application.

As individuals SSPs are making a small profit, although business is insufficient to provide a livelihood on its own. Average net income for SSPs per season is €125. In other sectors business opportunities have increased for SSPs that are part of an active association, although this has not been established in the potato growing areas yet.

Financial Deepening

Over the two years of the partnership with REACH, MSC was able to sensitize 62 farmer groups on their loan products and disburse loans to 210 farmers amounting to €80,235.13. The positive aspect of the model from a smallholder farmer standpoint is that repayment is based on the maturity period of the crop. This is useful for a farmer unsure of the timing and quantity of rainfall during the season. Encouragingly, the loan repayment percentage by farmers has been good at 95%. The loans have been used make larger investments in productive assets, such as land and agro-inputs.

At the same time, the scale of MSC's footprint in reaching farmers has been limited, which is why the project had to try the alternative route of VSLAs.

Through the VSLA approach, financial inclusion improved. VSLAs offer a sound entry point for financial institutions looking to reduce risk by targeting farmers who are already knowledgeable on the basics of savings and loans with higher value credit options. One-quarter of VSLAs proceeded to open up savings accounts with microfinance institutions or savings and credit cooperative organizations, and in 2021, 31% of farmers had access to loans from financial institutions, compared to 16% in 2016.

Although these are not massive strides, the improvement shows the value of a VSLA and also the options it opens up. Using VSLA as a stepping stone to more formal financing mechanisms is advantageous to farmers, as the average size of loans is larger and can cover farm productions costs. The average loan size for potato farmers was approximately €370. The loans were primarily used by farmers to rent land for agriculture or to purchase agricultural inputs, such as fertilizers, pesticides, and herbicides. To put this in context, the production of potato (with full seed replenishment)[15] per season is €600 per acre – a substantial investment.

Infrastructure

Over 116,188 community members in four highland districts (including 13,000 trained potato farmers) were able to benefit from improved access to market and services. Potato prices improved by more than 30% as a result of better access to market and less deterioration in

[15] Seed is approximately 40% of the cost of production; however, it only requires replenishing every three seasons therefore this level of investment is not required every season.

quality, where poor-quality roads would often require produce to be transported on foot. Farmers along these roads have also reported improved access to agro-inputs for crop production.

More Awareness of Good Agricultural and Climate-Smart Practices

Overall, in 2021, 76% of farmers practiced six out of 11 CSA practices, compared to 48% at the start of the farmer uplift program in 2017.

Some of the main changes are:

- **Use of clean seed**: By 2021, based on REACH's impact assessment, farmer productivity had increased from 3.13 mt/acre to 4.35 mt/acre (a 39% increase) after farmers began using QDS and had been trained on GAPs. The overall increase in potato is related to a combination of quality planting material and better application of GAPs.
- **Fertilizer**: While the amounts and mixes still vary, fertilizers are far more likely to be applied by farmers trained by REACH than those who were not trained (100% compared to 65%). Also, untrained farmers tend to use improper amounts to varying degrees and mix several fertilizers. For trained farmers, there was an 11% improvement in correct use of fertilizer, from 29% to 40% of farmers; while this is still low, it shows that more farmers are switching to an NPK-based fertilizer, the most appropriate and efficient fertilizer for potato available on the market.
- **Disease control**: Farmers that were not trained by REACH had to invest twice as much in pesticides and had a higher incidence of diseases and pests compared to trained farmers. Trained potato farmers were more efficient
- **Crop diversification**: At the end of the project, 98% of the trained farmers were engaged in crop diversification activities compared to 74% in the baseline year. Trained farmers were more likely to practice crop diversification than untrained farmers. Trained farmers purposely diversified crops to improve food security, the quality of their soils though crop rotation, and as a backup source of income in case of crop failure. The training provided by the REACH project significantly benefited households' effectiveness in the use of changed cropping practices in improving income.[16] These are encouraging signs in the face of climate change, not only from the point of view of having fallback incomes and food sources, but also for removing pest and diseases and improving the longer-term health of soils.
- **Soil management, water conservation**: Of farmers participating in the project, 63% were using water catchments (trenches) to capture runoff water and for irrigation in times of water scarcity, compared to the baseline of 11%. This shows that such low-cost techniques can be relatively easily applied to retain soil moisture levels for farmers during drier weather periods.

[16] Vulnerability and resilience to shocks of potato and rice farmers in Uganda. 2020. "An impact assessment of the International Fertilizer Development Center's (IFDC) REACH-Uganda project," Menno Veen, MSC Thesis.

As a result of the above practices, and the improved yields, potato farmers' revenue per acre more than doubled from €575 in 2016 to over €1,200 in 2021. In terms of net income, there was a similar increase for potato farmers from €383 to €689 acre. This considerable increase of 80% can be attributed to the higher yield and the higher price that farmers have attained for better quality potato.

Lessons Learned

1. ***To make systemic development and farmer uplift work in tandem, it is important that both sets of activities are integrated into one market system strategy.***

A hybrid approach requires clear vision of how a system should work sustainably, inclusively, and with sufficient resilience. In this medium-term vision, getting change going by offering a short-term stimulus on both supply and demand sides can be justified and necessary. Making potato cultivation in Uganda sustainable and resilient will take considerable effort. While the market system is forming and market actors find their bearings, a market facilitator can help not only in terms of investment in new sustainable and resilient business models (hence investments in irrigation, access to more seed potato varieties) but also in preparing their clients for the inputs, services, and practices needed to maintain productive potato cultivation.

A shared vision and strategy (and a shared results measurement system) ensure that there is coordination between activities that can reinforce each other, as mentioned above, but can also undermine each other if not well coordinated. Coordination relates to:

- What market actors can currently do and when and where as well as what they should be able to do in the future.
- How a project can help market actors step up and step in where they are not ready yet. This can include direct delivery of some activities, but also how they are involved if not in a leading capacity.
- How the market actor takes over when ready to do so.

This vision of how it should work should be clear at the level of the individual market actor partner and at the system level to ensure building up system resilience (what inputs, services, and business enabling environment is needed, through which business models and public service delivery, with which features, and how many of each to ensure scale, inclusion, and resilience).

Direct delivery is an emergency measure. In extreme cases (e.g., climate change pressure, poor market systems), a project can fall back on this, but it needs to be cautious about the role it takes on and needs to determine how it can step out again as quickly, as possible.

In REACH, the realization that market facilitation and direct (training) delivery demand a shared vision and strategy emerged in time and, with it, the coordination between both set of activities.

2. ***Systemic development (facilitation) and training programs for farmer uplift are very different development disciplines.***

Market facilitation and direct delivery are very different development disciplines often executed by practitioners who do not share the same outlook. Those who focus on technical practices tend to focus more on scientific expert recommendations and want farmers to adhere to these. A focus on the well-being of farmers can lead to suspicion about how markets treat farmers. Market facilitators tend to focus more on the solutions emerging from within the system (at the expense of expert opinion, which in itself can be a good thing), but may underestimate how much needs to change to make practices sustainable and resilient.

This diversity in outlook underlines the importance of a shared vision and strategy. However, to ensure there is one team at work in support of that shared vision and strategy, it is also important that teams are in the same location and under the same leadership and jointly analyze the constraints faced and results achieved. This avoids parallel realities and helps ensure the balance needed for climate adaptation.

REACH reconfigured its team to reinforce a single vision and strategy: more team members were brought under the same roof to facilitate joint discussion and learning.

3. ***Even when market actors are still establishing themselves, the project includes them in activities to prepare for their future system role.***

REACH ensured that, where possible, farmer training programs were integrated with partnerships. In ISBs such as Mengya Integrated Farmers Association (MIFA), the training of its farmer groups was done in conjunction with the association's leadership. Similarly, with New Bukumbi Coffee (NBC) a series of farmers trainings were conducted for the 120 farmers from the cooperative on production of new seed varieties, together with the production and extension team of the company. However, in some cases this was not always feasible due to the limited personnel capacity of the partner, or the opportunity was missed as the group training was conducted prior to the partnership intervention being built around it. The involvement of partners in the uplift activities should be integrated into the design of these partnerships from the start.

4. ***Training programs deliver quick outputs in terms of farmers trained, while systemic development takes longer to deliver outcomes (higher level, more sustainable). That difference needs to be carefully explained to avoid comparing apples and oranges.***

Farmer training programs often communicate the number of farmers trained. These numbers can be fairly easily reported shortly after a project commences activities. Market facilitation programs often report on the farmers benefiting from the investment in the market actors' business models and new products and services. This timeline is much longer, as first investments need to be made, then farmers reached, and the effect of the utilization of new products and services measured. At the same time, the outcome of the measurement is more

meaningful: it demands proof of farmers being better (instead of assuming that an activity or access to a product makes them better, as is often the case with training).

To ensure coherent results reporting, in which the contributions of different activities are assessed with comparable rigor and thus can be meaningful compared, a hybrid approach requires a shared approach to results measurement, in line with the Donor Committee for Enterprise Development (DCED) Standard for Results Measurement.

REACH continued to operate two results measurement systems, but ideally would have integrated both farmer training and market facilitation into one system.

5. ***Climate adaptation interventions may not always be sufficient; preparedness and risk reduction need to be considered in the full menu of CSA options. Getting the right products and information to farmers in a timely manner can be done through a hybrid approach.***

Adopting several CSA practices clearly puts farmers in a better position to be able to adapt, yet more than half of potato farmers still perceive that they have lower than expected yields due to adverse weather conditions. For potato farmers to prosper in the face of climate change, they may need invest more up front in their preparedness rather than just adopt a handful of practices. Potato farmers may need to consider other investments, such as crop insurance, soil testing, better storage facilities, and more robust potato seed varieties in the future in their CSA menu of options. These may be further costs that farmers have to absorb, but it will also serve to reduce risks from erratic rainfall. At the same time, the full range of these products and services need to be readily available to farmers. This reinforces the importance of a systemic (hybrid) approach in which farmers are fully informed, fully engaged, are willing and can interact with a more functional market system, with the right products and information around this to sustain productivity under more challenging conditions.