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Improving Delivery of Seed and Soil Fertility Technologies in Ethiopia, Malawi, and Mozambique

Linking Research Outputs to Smallholder Farmers:
A Partnership Journey with International Fund for Agricultural Development

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Alliance for a Green Revolution in Africa

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Abbreviations & Acronyms

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ABMT	Advanced Business Management Training
ACE	Agricultural Commodity Exchange
ACT	Africa Conservation Tillage Network
ADD	National and Agriculture Development Division
ADP	Agro-Dealer Development Program
AGRA	Alliance for a Green Revolution in Africa
AIP	Affordable Inputs Program
ASWAP	Agricultural Sector Wide Approach
BINDZU	Bindzu Agrobusiness e Consultoria Lda
CA	Conservation Agriculture
CAA	Community Agribusiness Agents
CAE	Community Agribusiness Entrepreneurs
CBO	Community Based Organization CFGB: Canadian Food Grains Bank
CGIAR	Consortium of International Agricultural Research Centers
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
COE	Centre of Excellence
COVID-19	Coronavirus Disease of 2019
CSA	Climate Smart Agriculture
DA	Development Agent
DAES	Department of Agricultural Extension Services
DAP	Diammonium Phosphate
DARS	Department of Agricultural Research Services
DCD	Department of Crop Development
DLRC	Department of Land Resource Conservation
EATA	Ethiopia Agency for the Transformation of Agriculture
EGS	Early Generation Seed
EIAR	Ethiopian Institute of Agricultural Research - Kulumsa Agricultural Research Centre (formerly a GIZ- run Agricultural Training Centre for Mechanization)
EPA	Extension Planning Areas
ESNEC	Entrepreneurship of Chibuto
FAO	Food and Agriculture Organization
FDA	Fundo de Desenvolvimento Agrário
FFS	Farmer Field Schools
FRG	Farmer research groups
FTC	Farmer Training Centers
GAP	Good Agricultural Practices

GDP	Gross Domestic Product
GFM	Gender Model Families
GIZ	German Agency for International Cooperation
ha	Hectare
HH	Household
ICARDA	International Center for Agricultural Research in the Dry Areas
IDSST	Improved Delivery of Seed and Soil Fertility Technologies to Smallholder Farmers
IFAD	International Fund for Agricultural Development
IIAM	Instituto de Investigação Agrária de Moçambique:
INGO	International NGO
ISFM	Integrated Soil Fertility Management
IWUA	Irrigation Water Users Associations
K	Potassium
KULIMA	KULIMA Program Malawi
M&E	Monitoring and Evaluation
MAA	Market Access Alliance
MCC	Mennonite Central Committee Canada
MGDS	Malawi Growth and Development Strategy
MoA	Ministry of Agriculture
MoANR	Ministry of Agriculture and Natural Resources
MTT	Metric Ton
MUSECO	Multi-Seed Company
NAP	National Agriculture Policy
NARI	National Agricultural Research Institution
NGO	Non-Governmental Organization
NPK	Nitrogen, Phosphorus and Potassium
NPSB	Blended Fertilizer
OCSSCO	Oromia Saving and Credit Share Company
OMO	OMO Bank
SDAE	Servico Distrital de Actividades Economicas (Mozambican government extension services)
VBA	Village based adviser
RuSACCO	Rural Savings and Credit Cooperative

Foreword

Agriculture is central to the economies of sub-Saharan Africa (SSA), accounting for about 80% of livelihoods, and 70% of the incomes of the poorest countries. Its importance is also related to its contribution towards achieving the second goal of the Sustainable Development Goals, "zero hunger", by 2030. Overall, growth originating from agriculture has been two to four times more effective at reducing poverty than growth originating from other sectors. A study by the World Bank on *Ending Poverty and Hunger by 2030* shows some evidence that income gains from agricultural activities have been no more costly to achieve than income gains in other sectors. Despite a rapid growth in agriculture in the last decade compared to other regions, the performance in SSA is poor. Some countries are achieving average yields of about 2.5 tons per hectare, while in most countries yields range from 0.5 to 1.5 tons per hectare (World Bank, 2015). This is a result of agricultural systems that are characterized by low-input and low-technology use in production, reliance on rain-fed production, small and declining farm sizes, as well as underdeveloped infrastructure and markets. Studies have shown that 75% of agriculture growth is due to area expansion and only 25% growth comes from crop yield increases (AGRA, 2021).

It has been demonstrated that farmer uptake of improved seed, and the increased use of appropriate fertilizer is responsible for driving increased crop yields, achieving 80% higher yields for important food crops (SSG, 2020). It is, therefore, essential to support the use of improved seed varieties as well as timely and correct use of both organic and inorganic fertilizers coupled with good agronomic practices to achieve increased crop productivity.

Although African farmers are ready users of new technologies, they are constrained by under-developed or unsustainable technology delivery systems as well as a lack of awareness of the benefits of improved technologies and limited access to finance. In the absence of widespread adoption of improved agricultural technologies, average crop yields in Africa will remain well below average when compared to other regions.

In an effort to increase farmers' uptake of improved seed and soil health technologies, the Alliance for a Green Revolution in Africa (AGRA) and the International Fund for Agricultural Development (IFAD) formed a strategic partnership through a pilot project, *Improving Delivery of Seed and Soil Fertility Technologies (IDSST)*. The partnership sought to address the challenges of linking new crop varieties and improved soil fertility management research outputs to smallholder beneficiaries of IFAD-funded programs.

In addition to the promotion and dissemination of improved seed and soil fertility technologies, IDSST documented lessons and organized knowledge-sharing events to facilitate the scaling out and scaling up of lessons. This book of lessons is an effort to document and share knowledge on the IDSST partnership. This project has shown how partnership is critical to achieving greater impact for smallholder farmers by filling in gaps of resources, approaches, and competencies.

Thouraya Triki
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Sara Mbago-Bhunu
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Preface

African farmers have demonstrated that they are ready users of new technologies. The absence of sustainable delivery systems coupled with a lack of awareness of the benefits of these technologies, are among the main constraints to their wider adoption. Compared to other regions of the world, the slow uptake of improved agricultural technologies in Africa significantly limits average crop yields. In sub-Saharan Africa (SSA), the yields of the main cereal crops have stagnated at less than 25% of potentially attainable yields while the per capita food production has decreased over the last five decades (James Mutegi & Shamie Zingore, Closing Crop Yield Gaps in sub-Saharan Africa through Integrated Soil Fertility Management).

The Improved Delivery of Seed and Soil Fertility Technologies (IDSST), a partnership project that was co-funded by the International fund for Agricultural Development (IFAD) and the Alliance for a Green Revolution in Africa (AGRA), was commissioned on May 30, 2017, with a grant of US$2 million (US$1 million from IFAD and US$1 million co-financing from AGRA). The project goal was to generate improved and more resilient livelihoods for poor rural people in IFAD's existing portfolio in Ethiopia, Malawi, and Mozambique, by linking technologies generated by research to smallholder beneficiaries of IFAD-funded projects in the three countries.

In addition to promoting and disseminating improved seed and soil fertility technologies, IDSST also sought to generate, document, and disseminate lessons and knowledge from the implementation of sub-grants. This powerful method of sharing ideas for improving work is in line with IFAD's 2015 Policy on Grant Financing. In documenting the experiences, lessons, key success factors, and learning from the delivery of improved seed and soil fertility technologies in three countries, the book also highlights the technologies and lessons learned that can be adopted to promote shared learning through partnership.

The comprehensive documentation of the results of the sub-grants also provides an important resource for stakeholders and a reference for similar existing and future projects. The book consists of three chapters and includes recommendations for up-scaling initiatives and points as key policy issues for follow-up.

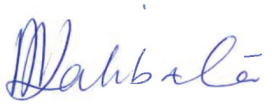
Chapter 1 details how the IDSST project was implemented in Ethiopia from 2019 to support the second phase of the Participatory Small Scale Irrigation Development Program (PASIDP II) through a partnership between Ethiopia's Ministry of Agriculture (MoA), IFAD and AGRA. The chapter covers three areas of intervention namely; capacity building of farmer training centers (FTCs) to promote integrated soil fertility management (ISFM) technologies; capacity building in the Ministry of Agriculture for conservation agriculture; and agribusiness technical support to PASDIP II target beneficiaries.

Chapter 2 documents the partnership and co-funding of the IDSST initiative in Malawi, and addresses the challenges of linking high quality seeds of improved crop varieties and other inputs to rural farmers. The chapter highlights how Malawi's Ministry of Agriculture and the IFAD funded Sustainable Agriculture Production Program (SAPP) worked with IDSST sub-grantees to develop a Public Private Partnership (PPP). The chapter documents the partnership engagement processes, achievements and lessons from implementing IDSST in Malawi for purposes of knowledge sharing, adoption, and scaling of the model to other countries and regions to build successful agricultural systems and deliver technologies to farmers through PPPs.

Lastly, Chapter 3 covers the support for the Pro-Poor Value Chain Development Project in Mozambique's Maputo and Limpopo Corridors (PROSUL) to disseminate quality, disease-free cassava cuttings sustainably. The chapter covers the three components of the sub-grants, namely, increased cassava production through increased capacity of other cassava seed value

chain actors, increased access to disease-free cassava planting materials, and building the capacity of extension systems in the Limpopo and Maputo areas to ensure increased cassava productivity through the use of improved inputs and access to markets. The chapter also looks at the contributions to improved food security and incomes among smallholder farming families through the development of business skills in the seed and processing value chains.

Despite the achievements generated by the project, all three countries suffered significantly from COVID-19. In an effort to contain the spread of the disease, the governments of Ethiopia, Malawi and Mozambique introduced several control measures, most of which restricted human movement, thus affecting grant activities and outcomes on the production and promotion of new seed varieties, as well as and the number of IFAD loan beneficiaries reached under the grant.



Dr. Agnes Kalibata
President, AGRA

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The Alliance for a Green Revolution in Africa (AGRA) would like to thank the International Fund for Agricultural Development (IFAD) for the financial support and the great partnership and collaboration that enabled the implementation of this project, "Improving Delivery of Seed and Soil Fertility Technologies (IDSST)" in Ethiopia, Malawi and Mozambique. We appreciate the support and contributions from IFAD technical teams, both in-country and regional, that provided feedback and guidance throughout the implementation process.

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We thank the external reviewers at the country level who provided insightful and constructive comments on the respective chapters of this report. Our gratitude is extended to all those who took part in the write-shops, validation, and review meetings and whose inputs and feedback enhanced the content of this publication.

We are particularly grateful to the external reviewers: Dr. Peter Hazell, Visiting Professor at Imperial College London and Dr. Steven Haggblabe, Professor Emeritus Michigan State University, who provided highly insightful and constructive comments on the content and structure of this publication.

The book would not have been completed with such quality without the editors with whom we worked tirelessly very closely, and the designer Conrad Mudibo, Ecomedia Limited.

Finally, this book is for all partners to share these lessons and positively impact small holder farmers.

Aggie Asiimwe Konde
Vice President, Program Innovation and Delivery, AGRA

Executive Summary

Agriculture is central to the economies of sub-Saharan Africa (SSA) and accounts for about 80% of livelihoods. Despite rapid growth over the last decade, agricultural productivity in SSA remains low, with cereal harvests averaging around one-third of the yields achievable with fertilizer applications (AGRA, 2019). Agricultural systems in SSA continue to be constrained by low-input and low-technology production, rainfed production, many small and declining farm sizes and underdeveloped infrastructure and markets (AGRA, 2021). Recent growth in agricultural production is attributed to the expansion of area under cropland rather than from crop yield improvements (AGRA, 2021).

It has been shown that farmer uptake of improved inputs and technologies can deliver increased crop yields, achieving up to 80% higher yields for staple food crops (SSG, 2020). Unfortunately, the absence of sustainable delivery systems and a lack of awareness of these technologies has hindered their wider adoption.

While IFAD investments to support these countries have enabled them make significant gains, sustainable access to inputs such as improved seeds and soil fertility technologies remained a challenge. At the same time, AGRA and its partners have invested in generating improved seed technologies and innovations that could benefit the IFAD supported loan programs to achieve higher impact.

In order to address this gap, IDSST country teams and project staff from IFAD-financed loan programs worked on strengthening the capacities of national agricultural research institutions (NARI), rural agro-dealers and smallholder farmers. The aim was to fill the identified gaps through small grants to enhance the outcomes of the IFAD-supported projects. In addition to the promotion and dissemination of improved seed and soil fertility technologies, the IDSST project worked on generating documentation and sharing knowledge to facilitate the scaling out and scaling up of lessons.

A participatory approach was followed to identify gaps with stakeholders and in designing the implementation program. The approach in each country was matched to need: IDSST project grants focused on deepening seed systems in Malawi, producing disease-free cassava cuttings through tissue culture in Mozambique and enhancing state capacity in conservation agriculture and integrated soil fertility management in Ethiopia.

Ethiopia

Crop production in Ethiopia is highly vulnerable to changes in climate such as drought, and productivity remains low. This has hampered the achievement of its full agricultural potential and is exacerbated by subsistence-oriented, low-output farming and suboptimal agronomic practices (ATA, 2020). Land degradation and soil fertility loss have been identified as a major constraint to Ethiopia's agricultural productivity.

In Ethiopia, the IDSST project supported the second phase of the Participatory Small Scale Irrigation Development Program (PASIDP II) through a partnership between Ethiopia's Ministry of Agriculture and Natural Resources (MoANR), IFAD, and AGRA. While the first phase of the Participatory Small Scale Irrigation Development Program (PASIDP I), focused on establishing small-scale irrigation projects through a loan program PASIDP II (2017-2024) had a wider mandate of reducing the country's vulnerability to adverse climate risks and drought, reducing rural poverty and food insecurity with a target of reaching 108,750 household beneficiaries in four regions.

The IDSST grant was implemented in Ethiopia through strategic partnerships with Self Help Africa (SHA), Agrimech Consulting and Technoserve. SHA rolled out soil fertility management technologies with a target of reaching 880 members of farmer research groups and 35,200 farmers through strengthened research-extension linkages. Agrimech Consulting was tasked to strengthen the capacity of MoANR staff involved in the implementation of PASIDP II and to advance conservation agriculture practice and climate resilient technologies through training while Technoserve delivered the agribusiness technical capacity development.

Some of the achievements of the IDSST project in Ethiopia are

- The development of standardized formats for training programs covering the four ISFM

technologies offered guidelines and reference materials for the Farmer Training Centers (FTCs) that have been translated into three Ethiopian languages and customized to address the demands of local communities.

- The 236 demonstration plots showcasing ISFM technologies and practices have given farmers access to information to boost crop production in a sustainable manner, allowing a hands-on-experience and enabling them test the different technologies during various stages of crop growth and to exchange knowledge.
- There was a yield increase of 19% and 78% for soya bean and haricot bean crop varieties respectively due to the use of biofertilizer over the conventional practices. In addition, by using blended fertilizers on improved teff of "boset" variety, some lead farmers reported a 142% increase in yield from the traditional 0.7T/ha to 1.8T/ha.
- Approximately 12,000 farmers stand to benefit from the deployment of soil texture kits and NPK soil test kits in the FTCs. Coupled with the training of government-employed Development Agents for soil mapping, soil atlas interpretation, fertilizer applications, as well as handling and analysis techniques with soil testing equipment, the ground has been laid for the sustained promotion and adoption of ISFM to address decline of soil fertility in Ethiopia.

Malawi

The 85% of the population that is active in agriculture in Malawi is mainly made up of smallholder farmers (4.5 million farm families) who also constitute the majority of the rural population and contribute 60% of the country's agriculture and 10% of export earnings (MGDS III, 2017-2022). Cultivating more than 2.5 million hectares (ha) of land collectively, they are central to the country's food production and poverty reduction efforts despite their small land holdings (0.5-0.8 ha per household). Yields from these fields are at 50% of attainable yields and despite efforts to improve the agriculture sector, 50.7% of the population in Malawi remains poor, earning less than USD 1.95 per day. Although maize and tobacco production have dominated smallholder farming. the collapse of the tobacco industry and fluctuating maize production have seen the Government of Malawi advocate for crop diversification and the adoption of high-quality, high-yield seed of improved varieties that mature early and are drought tolerant.

The IDSST grant in Malawi:

- Complemented efforts of the Ministry of Agriculture and the IFAD-funded Sustainable Agricultural Production Program (SAPP) to address the challenge of linking new crop varieties and improved soil fertility management technologies to smallholder beneficiaries. SAPP is a nine-year program (2012-2020). It was implemented in six districts across Malawi to contribute to poverty reduction and improved food security for 200,000 smallholder farmers. The specific development objective of SAPP was to achieve a viable and sustainable smallholder agricultural sector employing good agricultural practices (GAPs).
- Strengthened the seed system by enhancing the production of early generation seed and strengthening distribution channels by building the capacity of agro-dealers.
- Activities were implemented by the Department of Agriculture Research Services (DARS), a public research institution under the Ministry of Agriculture (MoA), private sector partner Multi-Seeds Company (MUSECO), a local seed company and Rural Market Trust (RUMARK), a local non-governmental organization.
- 231 seed out-growers (1,010 smallholders) were supported through community seed multiplying groups.
- Eighty percent of the smallholder farmers obtained seed on loan from MUSECO, while 30 MT of pre-basic seed, 358 kg basic seed and 170 MT certified seed were produced.
- The capacity of 86 agro-dealers (27 females and 59 males) was strengthened and having linked them with suppliers, this effectively reduced the distance that farmers travel to access inputs from 15km at the start of the project, to 10km at the end of the project.

Mozambique

Mozambique is among the ten largest producers of cassava in the world, producing an estimated 10 million tons per year. Along with maize, rice, beans and sweet potatoes, cassava is one of the most important staple foods and it is cultivated by more than 80% of farmers in rural Mozambique - mostly through small-scale, subsistence farming. The lack of clean planting material is recognized as a constraint on production, resulting in poor harvests. As farmers begin to understand the effects of low-quality planting materials on yields, this has created a high demand for disease-free planting materials in the cassava value chain.

The three components of IDSST in Mozambique were increased cassava production through increased capacity of other cassava seed value chain actors, increased access to disease-free cassava planting materials, and building the capacity of extension systems in the Limpopo and Maputo areas to ensure increased cassava productivity through the use of improved inputs and access to markets. The IDSST grant addressed the production of high quality, disease-free cassava cuttings in Mozambique, as well as farmers' demand for clean planting material and increasing sustainable returns to smallholder farmers in the cassava value chain through capacity building.

The strategic partners worked together to conduct multiple trainings to enhance the capacity of public and private extension service providers to impact farmer groups, commercial and emergent small-scale farmers with the skills and knowledge for increased productivity, including the adoption of improved cassava varieties and integrated soil fertility management practices to increase crop productivity.

AGRA collaborated with IFAD Country Teams, Project Coordination Unit (PCU) and other stakeholders, to hold validation meetings and also conducted field visits to concretize the outcomes of the validation meetings. In-country inception meetings were also held with a focus on strengthening the capacity of the Mozambique Institute of Agricultural Research's (IIAM) laboratory facilities and green houses to ensure production of higher volume and health materials of cassava seedlings using tissue culture technologies. The inception meetings also deliberated the promotion of post-harvest and good agronomic practices for cassava and strengthening agribusiness linkages for cassava.

The IDSST grant also supported the Poor Value Chain Development Project (PROSUL), an undertaking of the government of Mozambique that aims to improve livelihoods and climate-smart resilience of smallholder farmers in the Maputo and Limpopo corridors through increased returns. The project area includes 19 selected districts in Gaza, Inhambane and Maputo Provinces.

The grant was used to address the demand for high quality disease-free cassava cuttings and to expand the value chain for cassava products to meet the government's goal of increasing returns to smallholder farmers and diversifying the market for cassava products in the value chain.

Below are some of the key highlights

- IDSST resulted in the training of 84 personnel, eight of whom are agriculture extension officers, 38 VBAS/CAES and 38 cassava processors. These trained personnel took part in the expansion of training of other farmers and processors in different PROSUL implementation regions.
- 50 cassava seed producers have been trained in the best practices of cassava seed production and assisted to develop business plans, and of the 50 producers, 30 have had their fields certified. Each producer has a capacity to produce about 80,000 seed cuttings enough to plant 8 ha of cassava. The area using certified seed is therefore projected to increase from 240 ha to 400 ha. IDSST led to a production of 172,000 cassava cuttings.
- PROCAVA, which is the successor project for PROSUL in Mozambique, is now promoting the new varieties developed by IDSST, Chinhembwe, Amarelinha, Umbeluzi-2, and Tapioca.

Lessons learned

The end of project evaluation however, concluded that the project was relevant and well-designed and had demonstrated that the IDSST interventions generally had positive results that fed into the overall project's goal of a more competitive cassava, maize and legumes value chain in Malawi, Mozambique, and Ethiopia respectively, thus creating a measure of impact around the following two key areas:

- Increased efficiency of government research and development functions that have successfully supported seed and ISFM technology development, release, and dissemination.
- Increased private sector actors' roles and capacity in developing and disseminating improved seed and fertilizer technologies.

Some of the lessons learned from implementation of the IDSST grant were:

- **Linkages with IFAD- funded projects**: Clear linkages of grant activities to ongoing IFAD-funded projects and frequent consultations and engagements between AGRA, IFAD and respective Government implementing partners were key to the success of the IDSST. However, future partnerships should call for earlier and timely engagements between grant recipients for co-creation based on the identified gaps. This would be preferable at design, validation or baseline stage.
- **Identification of preliminary interventions**: Validation of the projects preliminary intervention

areas enabled IDSST to identify the gaps in SAPP's targeting and ensured that appropriate agricultural technologies and GAPs were screened and adapted for each agro-ecology.

- V**illage-based approach and hub agro-dealer model**: The development of input delivery systems and use of AGRA's Village-based Advisor (VBA) extension approach led to the success of the grant in all three countries.
- Farmers' access to modern labor-saving technologies (e.g., mechanization of cassava production and processing) were responsible for the enhanced adoption and positive impacts.
- **Project timeframe and uptake of technologies**: Farmer adoption of new agricultural practices takes time to understand, evaluate and adopt. A lesson learned from all three countries is that the grant required at least three years of support for this to happen.
- **Market-led adoption of project interventions.** Farmers have seen a strong market demand for crops like soya bean and groundnuts, while agro-dealers see a large and growing market for farm inputs, seed, and fertilizer.
- **Investment in public-private producer partnerships (PPPP) works:** IDSST has confirmed the success and demonstrated the importance of the PPP model in delivery of seeds and soil health technologies to farmers by enabling DARS, a public institution to lead the production of breeder seeds and to directly partner with private seed companies, MUSECO and Global Seeds, which eased commercialization of legume varieties which were released by researchers a few years ago but could not be accessed by farmers. The sub-granting of private seed companies such as MUSECO in Malawi realized increased production and distribution of high quality pre-basic, basic seed and certified seed respectively to the farming communities in the districts where the project was implemented. Seed multipliers (farmers)' willingness to continue working with MUSECO also showed their confidence in partnering with the private sector.
- **The development of hub agro-dealers** was a critical step for continued sustainability of the agro-dealers. New agro-dealers would otherwise struggle to maintain their business, financing their inventory and in reaching smallholder farmers. The discounted prices enjoyed by the hub agro-dealers for bulk procurement are passed on to the retail agro-dealer keeping the retail prices competitive.

The IDSST grant was key to identifying and testing approaches to strengthen the seed system, increase access to soil fertility technologies in all countries. These improvements are visible across the national seed value chains and are the result of building the capacity of private seed suppliers, government research and regulatory agencies, and seed producers, especially in Malawi and Mozambique.

Recommendations

- **Recommendations for scale up:** There is a need to involve all partners in the process for the sake of sustainability, replication and scale up. There is further need for the Ministry of Agriculture to move towards scientific crop selection and to encourage the adoption of the tools developed under this grant for this purpose in all PASIDP interventions.
- **Training more start-up agro-dealers** is key to increasing access to quality seeds and inputs: The newly trained agro-dealers have been empowered to operate in remote underserved areas to enable them reach the smallholder farmers. If more start-up agro-dealers are trained, the distance between agro-dealers and farmers will reduce thus improving access to seed and other inputs.
- **Improving supply distribution** by linking with input suppliers: The linkages that were established between agro-dealers and input suppliers led to improved input supply distribution channels for smallholder farmers in the rural areas.
- **Village based agents create linkages, increase demand for agro-dealers:** Identification of and training for more village-based agents (VBAs) should be continued.
- **Gender:** There is a need to roll out the Gender Model Family approach to other areas and integrate it into the government system.
- **Learning-by-doing** is a powerful approach and delivered messages well, it promotes knowledge transfer and awareness raising. Demo plots and training in-field should be continued for more awareness creation which leads to the adoption of technologies.

- **Supporting and strengthening farmers groups** as they convert to associations or cooperatives is worth the investment. There is also a need to institutionalize the cooperative movement.
- **Project timeframes should consider the crop production cycle** to enable full-cycle hands-on learning for participants.
- **Processing and marketing capacity for some crops like Cassava or seeds should be strengthened** to allow an increase of the demand and to encourage farmers to invest and get a return on their investments. Access to packaging is a gap that remains unfilled in some value chains and hampers farmers' ability to get to market.
- **Establishing a platform of stakeholders involved in the value chains** can facilitate the discussions, work on opportunities and investments.

1 Improving the delivery of soil fertility technologies and supporting agribusinesses in Ethiopia

Agriculture is the major source of livelihood for over 79% of the Ethiopian population and employs the bulk of the labor force. It accounts for about 33% of the country's gross domestic product (GDP) with an annual growth rate of 4.3% – somewhat lower than that for industry (9.6%) and services (5.3%) (NBE, 2020). The crop sector contributes about 65% of the agricultural GDP. Although there has been a decline in agricultural contribution to GDP growth, the agricultural sector is still the main contributor to the country's foreign exchange earnings (80%).

Despite substantial improvements over the past year, crop production in Ethiopia is highly vulnerable to changes in climate such as drought, and productivity remains low. Consequently, full agricultural potential has not been realized due to subsistence-oriented, low-output farming and suboptimal agronomic practices (ATA, 2020).

The agricultural sector is underdeveloped and unable to support farmers with the required inputs and technologies to boost food production. Land degradation, manifested as soil fertility loss, has been identified as a major constraint to Ethiopia's agricultural productivity. Low levels of crop productivity can also be traced to the limited implementation capacity of Farmer Training Centers (FTCs) based at *kebele* level, the lowest administration unit in Ethiopia, set up in close proximity to farmers. The *kebele* is also the level at which frontline extension services are expected to be delivered by Development Agents (DAs). The FTCs are designed to serve as centers for information and knowledge sharing, training and demonstration of technologies and innovation. Other hindrances to the sustainable increase of agricultural production, productivity and incomes include farmers' lack of agribusiness skills for market-oriented farming.

IDSST in Ethiopia

In Ethiopia, the IDSST grant was implemented to support the second phase of the Participatory Small Scale Irrigation Development Program (PASIDP II) through a partnership between Ethiopia's Ministry of Agriculture and Natural Resources (MoANR), and IDSST.

In PASIDP II, IDSST is strengthening capacities for the promotion and dissemination of improved seed and soil fertility management technologies and the generation, documentation and sharing of knowledge.

IDSST has provided support to the PASIDP II project regions of Amhara, Tigray, Oromia and SNNPR to support the strengthening of the capacity of both project and Ministry of Agriculture staff involved in the implementation of the project.

Prior to implementation, IDSST held validation meetings and also conducted field visits to concretize the outcomes of the validation meetings. In-country inception meetings were also held. Consensus from these processes was that the gaps to be addressed in Ethiopia were:

1. Build the capacities of NARIs on conservation agriculture.
2. Pilot the adoption of new seed and soil fertility improving technologies (including new blends).

In the delivery of the IDSST, the following strategic partner institutions were engaged:

1. Self Help Africa (SHA), a development charity with an expertise in small-scale farming and growing family-farm businesses.
2. Agrimech Consulting, a local private company.

In addition to these partners for the project implementation, AGRA gave a separate grant to support the Market Access component which appears to be critical. TechnoServe, an international

nonprofit that promotes business solutions to poverty in the developing world by linking people to information, capital and markets has been identified as implementing partner.

The Participatory Small Scale Irrigation Development Program, PASIDP II

IFAD supported the Ethiopia Growth and Transformation Plan I (2008-2015), the first phase of the Participatory Small Scale Irrigation Development Program (PASIDP I), a loan program on irrigation with the aim of establishing small-scale irrigation projects. This was succeeded by PASIDP II (2017-2024), that has a wider mandate of reducing the country's vulnerability to adverse climate risks and drought, reducing rural poverty and food insecurity. PASIDP targets 108,750 household beneficiaries through the development of 15,000 hectares of small-scale irrigation schemes as well as support linkages to markets and services so that smallholder farmers can increase their productivity, competitiveness and incomes.

The gaps identified in the design of the project included the need for:

- Enhanced linkages between research, input supplies and extension services
- Strengthening of marketing of output
- Expansion of capacity building of community based and led institutions (e.g., Irrigation Water Users Associations, Cooperatives, Farmer Training Centers, Watershed Management Teams).

Program components

Capacity building of Farmer Training Centers to promote ISFM

This component seeks to effectively disseminate skills and knowledge of ISFM technologies through the network of Farmer Training Centers (FTCs), with a particular focus on the application of blended fertilizers, lime, bio-fertilizers and conservation agriculture (CA) techniques to beneficiaries in PASIDP target regions. It aims to strengthen the effectiveness of FTCs and raising their capacity to provide appropriate agricultural extension services to increase farmers' production and productivity with particular focus on ISFM technology and practices.

- *Rapid assessment of agricultural practices*
To inform implementation, a rapid assessment of agricultural technologies and practices in 40 districts of Oromia, Tigray, Amhara and SNNP was undertaken at the start of the project. The assessment focused on soil health and fertility, local practices and technologies, and was carried out by SHA in collaboration with PASIDP and local level government partners, including FTCs and woreda level agriculture and natural resource offices.
- *Developing modules and manuals for training of farmer:* This sub-component aims to provide standardized formats and reference materials for use by the FTCs. Training manuals, posters and other materials developed cover the four ISFM technologies; blended fertilizers, bio-fertilizers, lime application and CA techniques.
- *Strengthening extension support for ISFM:* The sub-component seeks to cascade ISFM technologies through FTCs, trained Development Agents (DAs) and peer to peer learning among farmers to reach a wider audience of farmers at the grassroots with the necessary knowledge and skills to apply ISFM techniques in their normal farming practices. The cascaded training uses hands-on demonstrations to share lessons on CA, proper use of recommended blended fertilizers, use of bio-fertilizers and acid soil treatment using lime application practices and are facilitated by training of trainers ToT training participants from the respective woredas.
- *Demonstrating ISFM technologies and practices:* Under this sub-component demonstration plots are set up to give farmers hands-on experience and to pilot the adoption of the ISFM technologies and practices. The demonstrations also enable farmers to see the isolated impact of CA, bio-fertilizers, use of blended fertilizer, and agro-lime application on soils affected by acid. Along with the fertility improving practices, other good agricultural practices, such as improved seed, Berken Maresha (improved tillage), row planting, timely sowing and weeding are also taught and demonstrated, and farmers can exchange knowledge among themselves.

Capacity building of MoANR for conservation agriculture

This component aims to strengthen the capacity of MoANR staff involved in the implementation of PASIDP II Project to enable them to advance conservation agriculture (CA) practice and climate smart/resilient technologies (CSA).

Consolidating CA-CSA practice for sustainable farming: The development of standard training modules and manuals focusing on participatory approaches and practical solutions of conservation agriculture and resilient agriculture practices was addressed under this component.

Enhancing the capacity of MoANR to advance CA-CSA: This component aims to strengthen the capacity of MoANR staff and relevant stakeholders involved in implementing PASIDP II with specific practical solutions of conservation agriculture and resilient technologies/practices.

Agribusiness technical support to PASIDP II target beneficiaries.

Access to ISFM technologies and services: The aim of this sub-component is to build capacity and consolidate the role of private agro-dealers in the input supply market with a view to ensuring a sustainable and efficient supply of soil fertility technologies. The training of agro-dealers is geared towards establishing agro-dealer groups, providing technical and business management training and linking agro-dealers with agricultural input providers.

Training Development Agents on soil testing kit usage, soil mapping and atlas interpretation: The component seeks to mitigate nutrient depletion of the soil, to promote soil test-based recommendations that are used to inform the application of blended fertilizers. The project deploys soil texture kits at FTCs and also introduces mobile soil test kits, the first of their kind in the country, to support spot decisions for tailor-made fertilizer recommendations. ToT training is also provided.

Knowledge exchange: This sub-component aims to promote peer to peer support and knowledge sharing about ISFM technologies among stakeholders both within and outside the project target areas allowing participants to share successes and challenges of the different farming technologies and techniques they have adopted from inception of the project.

Piloting the adoption of new seed and soil fertility improving technologies

Land degradation is identified as a major constraint to Ethiopia's agricultural production and productivity. High levels of acidity (affecting 40% of Ethiopia), significantly depleted organic matter due to the removal of crop biomass for fuel, depleted macro- and micronutrients as well as depletion of soil physical properties and salinity (IFPRI, 2010) are all contributors. These factors, among others, have resulted in low crop productivity such that the national average for cereals and pulses is 2.86 T/ha and 1.9 T/ha respectively (CSA, 2020). The economic loss attributed to widespread soil fertility constraints, including loss in crop production, productivity and GDP is also enormous.

For instance, nutrient loss for nitrogen and phosphorus due to biomass energy consumption of dung and crop residues which would otherwise have been added to the soil is equivalent to the total commercial fertilizer use in Ethiopia (MoARD, 2010). Research further indicates that 2% to 3% of agricultural gross domestic product is lost as a result of soil degradation (World Bank, 2007). Soil is the basis for most crop production and supplies essential nutrients to crops. Therefore, a decline in soil fertility in Ethiopia affects crop productivity.

To address these issues, a holistic approach such as integrated soil fertility management (ISFM) that combines various soil fertility management techniques is required. Accordingly, a capacity building activity to equip extension agents and farmers for effective and enhanced uptake and utilization of the ISFM technologies and practices was initiated.

Implementation Framework of the IDSST Grant

Strengthening agricultural extension to deliver ISFM

Ethiopia's agricultural extension system is heavily dependent on Farmer Training Centers (FTCs) and trained Development Agents (DAs) who provide extension support to farmers. According to Ethiopia's Agricultural Extension Strategy (MoANR, 2017), FTCs are expected to serve as hubs for knowledge, information sharing and promoting best practices. FTCs were set up in each rural *kebele*, the smallest administrative in the country. Each FTC is staffed with at least three DAs (also referred to as extension agents)

and there are nearly 15,000 such centers throughout the country. Despite the huge responsibility placed on them, their level of functionality varies greatly. Most FTCs established over the past decade do not work at full potential and are unable to provide the expected services to farmers. Several bottlenecks have been identified as constraints to the FTCs' effectiveness. It is acknowledged that most DAs do not have sufficient technical knowledge and skills to provide hands-on training and demand-driven advisory services to farmers, while the training that is delivered is poorly resourced and organized and is not season-based or agro-ecology oriented (MoANR, 2017). The IDSST grant was designed to address the above challenges through capacity building for FTCs in the four regions targeted by PASIDP II (Amhara, Oromia, the Southern Nations and Nationalities People's Region, SNNP and Tigray).

IDSST was implemented in Ethiopia through one grant and one consultancy to support PASIDP II and address challenges identified:

i. A sub-grant to Self Help Africa (SHA) to roll out soil fertility management focusing on strengthening research-extension linkages through capacity building of Farmer Training Centers (FTC) to promote soil fertility technologies and blended fertilizers in PASIDP regions. Through this grant, the target was to reach 880 members of farmer research groups (FRGs), and 35,200 farmers within the PASIDP II project catchment area with ISFM technology and practices.

ii A consultancy was awarded to Agrimech Consulting, a private company engaged to strengthen the capacity of MoANR staff involved in the implementation of PASIDP II Project and to advance CA practice and climate resilient technologies through the development of training modules and manuals as well as training to promote specific practical solutions with conservation agriculture and enhancement of resilient technologies/practices.

AGRA also leveraged this project and supported a market component which helped PASIDP beneficiaries in crop selection and marketing their product. Even though this was not part of the IDSST project, it has complemented it very well, led to awareness and changes in the production and marketing products and has shown good lessons for IFAD-loan programs.

Promoting Improved Soil Fertility Technologies

Self Help Africa implemented the initiative, *Promoting Improved Soil Fertility Technologies* by building capacity of the Farmer Training Centers in PASIDP target regions. The 15-month initiative sought to effectively disseminate skills and knowledge of ISFM technologies, with a particular focus on the application of blended fertilizers, lime, bio-fertilizers and CA techniques to target beneficiaries.

The project commenced with a rapid assessment of agricultural technologies and practices in 40 districts of Oromia, Tigray, Amhara and SNNP. The assessment, which focused on soil health and fertility, local practices, and technologies, was carried out by SHA in collaboration with PASIDP and local level government partners, including FTCs, and *woreda* (district) Agriculture and Natural Resource offices. The assessment revealed land degradation as the prime factor causing depletion of nutrients and organic matter in the soil while lack of awareness due to low levels of coordination among partners in the inputs value chain was found to constrain the ability of farmers to access and practice ISFM technology. Another issue revealed by the assessment was the fact that although farmers were aware that blended fertilizer was good, most of them continued to apply it at below the recommended rate due to lack of awareness, lack of timely availability and high fertilizer cost. The assessment confirmed the need for demonstration of ISFM technologies and practices at both FTCs and on model farmers' fields in order to provide opportunities for farmers to learn how to boost crop production in a sustainable manner and improve their livelihoods.

Developing training manuals to uplift capacity of farmers

Ahead of the capacity building activities, training manuals were developed to provide a standardized format for the training programs and as reference materials for the FTCs. The training manuals covered four ISFM technologies; blended fertilizers, bio-fertilizers, lime application, and CA techniques. Soil and agricultural extension experts from the MoA were invited to review and validate the manuals. Once finalized, the manuals were customized to suit various local conditions including translation into the three local languages (Amharic, Tigrigna and Afnan Oromo) to fit the specific demands of local communities in

each region and use of pictures and illustrations from the target communities. At the end of the process, 4,100 posters, 2,880 brochures and 72 roll-up banners had been printed and distributed to DAs, FTCs and to farmers during farmers' field days at FTCs. The materials were used to support the farmers' training program at village level.

An additional 10,000 posters were also printed, laminated, and distributed to individual farmers to pass on key extension messages about ISFM technologies as a means of advancing the program in the face of COVID-19 restrictions that banned public gatherings. Priority was given to farmers who could read and write, followed by households that had school going children who were able to support parents in reading the distributed materials. The extension agents were the main clients for the materials and used the manuals to train and demonstrate ISFM technologies and practices. In addition to the manuals, the Ethiopian Soil Information System (EthioSIS) fertilizer recommendation maps were developed, printed and distributed.

Building the capacity of Development Agents and lead farmers

The baseline rapid assessment identified the lack of skills and knowledge within grassroot development units, such as FTCs, as one of the factors hampering the ability to provide context specific ISFM support to farmers. In light of this limitation, a training of trainers (ToT) program for DAs and lead farmers was conducted. The training aimed to cascade ISFM technologies through DAs as well as peer to peer learning to reach a wider audience of farmers at the grassroots with the necessary knowledge and skills to apply ISFM techniques in their normal farming practices. The cascaded training used hands-on demonstrations to share lessons on CA, proper use of recommended blended fertilizers, use of bio-fertilizers and acid soil treatment using lime application practices and were facilitated by ToT training participants from the respective *woredas*. Other areas of training included crop technologies for improving crop production, agronomic practices such as use of improved seeds, *Berken Maresha* (improved tiller), row planting, timely sowing, and weeding. During the training, an emphasis was placed on soil fertility as the overarching problem hindering crop productivity. In order to enhance the training, live demonstrations at the FTCs coupled with diagrams and picture illustrations using different media were used to show practical application of the technologies.

The assessment pointed to a need to establish demonstration farms for ISFM technologies and practices where farmers would be able to access information as and when they needed it. The establishment of the demonstration farms was done by developing multiple 10 x 10 square meter demonstration plots at the FTCs as well as at select model farmers' fields. An exception was in the SNNP region where larger demonstration plots, measuring 25 x 25 square meters were established. These plots were set up to give farmers a hands-on-experience and to pilot the adoption of the ISFM technologies and practices. They also enabled farmers to exchange knowledge and see the isolated impact of CA, bio-fertilizers, use of blended fertilizer, and agro-lime application on soils affected by acid. Along with the fertility improving practices, other good agricultural practices, such as improved seed, *Berken Maresha* (improved tillage), row planting, timely sowing and weeding were also taught and demonstrated. In total, 236 demonstration plots were established.

To mitigate nutrient depletion of the soil, soil texture kits were deployed at FTCs to promote test-based recommendations for soil that would inform the application of blended fertilizers. The project also introduced mobile soil test kits, the first of their kind in the country, to support spot decisions for tailor-made fertilizer recommendations. At another level, ToT training was provided for 36 agricultural officers to equip them with the skills for the soil-test kits for soil analysis. Other related topics taught during the training were the EthioSIS soil fertilizer recommendation map and soil status interpretation. The ToT participants cascaded the training to 86 *woreda* level experts and 76 DAs during a practical session covering testing of soil pH, nitrogen, phosphorus, and potassium (NPK) fertilizer and soil texture analysis. DAs are now able to carry out instant soil tests while in the field and to determine the status of soil fertility to enable them to tailor-make appropriate fertilizer recommendations in collaboration with soil fertility experts. Although it is too early to evaluate the value of the soil analysis kit results as an alternative to standard soil laboratory tests, participants who handled the soil testing equipment and learnt analysis techniques expressed their satisfaction and indicated that it provided a quick fix to some of the soil problems experienced by the farmers in their areas.

To give the farmers hands-on experience and pilot the adoption of ISFM technologies and practices, the project established 236 demonstration plots in

the four targeted regions of Amhara, SNNPR, Tigray and Oromia. The technologies promoted include the use of lime, blended fertilizers (NPSB, NPSZn, and urea), bio-fertilizers and CA based on the agro-ecological requirements of the project sites. In this regard, the demonstration of the ISFM technologies and practices created awareness for further adoption of the technologies and practices by the wider farming community that are keen to boost crop production in a sustainable manner and ultimately improve their livelihoods. Along with these soil fertility-improving practices, other related good agricultural practices, such as the use of improved seed, *Berken Maresha* (improved tiller), row planting, timely sowing and weeding were also demonstrated. Based on the physical observation of the new practices and available data gathered from the demonstration sites, the introduced technologies have enabled farmers to improve a remarkable yield advantage over the local practices. For instance, there is a yield increase of 19% and 78% for soya bean and haricot bean crop varieties respectively due to the use of biofertilizer over the conventional practices.

While agro-dealers play an important role in ensuring that farmers have access to some essential agricultural inputs that contribute to boosting agricultural productivity, they often receive little attention. Until very recently, agricultural input supply activities to smallholder farmers in Ethiopia were provided by the government, farmers' cooperatives, and unions. The involvement of the private sector is a recent phenomenon. Most agricultural inputs are provided to farmers as part of extension services and packaged at the supply end; they include fertilizers, improved seeds, pesticides, and farm equipment. Unfortunately, more often than not, they are of poor quality and often fail to address the needs of small-scale farmers. As the number of private agro-industries rises, so too does the demand for quality farm inputs. However, the sector is still constrained by inadequate supply from producers, limited access to technical knowledge, poor business skills of agro-dealers, financial constraints, high transportation costs and poor storage facilities.

It is against this background that a three-day capacity building training for agro-dealers was held with the intention of consolidating the role of private agro-dealers in the input supply market with a view to ensuring a sustainable and efficient supply of soil fertility technologies. The training was also geared towards establishing agro-dealer groups, providing technical and business management training, and linking agro-dealers with agricultural input providers. By agreement prior to the training, the agro-dealers were selected from legally registered groups that were already in existence with a track record in addressing input supply gaps using a private agro-dealership model. The training was attended by 39 agro-dealers in Amhara, Oromia, and SNNP regional states and 21 government officers from the zonal administration and *woredas* and was meant to further consolidate the link between agro-dealers and government authorities mandated with the role of agricultural input supply coordination. In addition to equipping agro-dealers with business and management skills to improve their participation in sustainable input supply activities, market-linkage creation and operations among suppliers and farmers, the training also created awareness of the role of agro-dealers.

Intra-and interregional field visits were organized to promote knowledge sharing about ISFM technologies among stakeholders both within and outside the project target areas. In 2020, six intraregional exchange visits, attended by 99 participants, including farmers, DAs and *woreda* staff were organized across the three regions of Amhara, Oromia, and SNNPR. The field visits were used to promote peer to peer support, allowing participants to share successes and challenges of the different farming technologies and techniques they had adopted from inception of the project in 2019. During the field visits, early adopters of the ISFM technologies being advanced by the project shared positive experiences about the impact of the technologies on land productivity. The soil fertility improvement technologies adopted by farmers over the course of the project life were bio-fertilizers and the application of blended fertilizer technology. Farmers indicated a preference for bio-fertilizer but singled out access to mulching materials for CA and farm labor as some of the critical challenges to the adoption of ISFM technologies. The strong link between ISFM technologies and increased soil productivity was noted (although data has not been collected to confirm the evidence) and the demand to try out the bio-fertilizers is seen to be on the rise. A considerable number of farmers established bio-fertilizer trials on their own initiative as a result of participating in previous field days. The project has been building the capacity of FTCs by providing training and technical assistance to enhance the dissemination and uptake of ISFM technologies and practices, with particular focus on the application of blended fertilizers, lime, bio-fertilizers, and CA techniques to improve agricultural productivity to target beneficiaries.

Promoting blended fertilizer usage

Soil is the foundational medium for plant growth supplying the necessary nutrients while providing spaces to hold air and water. Soil fertility is the condition of soil with respect to its ability to provide essential plant nutrients needed to sustain normal plant growth and optimize crop productivity. However, improper use of this natural resource, such as unsustainable agricultural practices, leads to soil infertility. Under such conditions, it is necessary to apply fertilizers to the soil to enhance the soil quality. Smallholder farmers have long been exposed to the use of inorganic fertilizers as a way of increasing crop productivity. The application of inorganic fertilizers was based on blanket recommendations for the country and relied on two types of fertilizers – urea and diammonium phosphate (DAP) – for the supply of nitrogen and phosphorus. This method did not take into consideration the differences in soil types in the different areas and led to nutrient mining as a result of sub-optimal fertilizer use. The result was depressed yields from crops that failed to obtain the soil nutrients they required for growth. The Ethiopian government recently developed a soil fertility status map along with corresponding recommendations for fertilizer type and promoted balanced fertilizers that contain additional micronutrients zinc (Zn) and boron (B) and macro nutrients sulfur (S) and potassium (K) in blend form. The use of blended fertilizers has been identified as one way to address the problem of soil fertility depletion that has led to low yields and low productivity. This means that although the different types of blended fertilizers containing different plant nutrients are currently supplied and utilized, most farmers still use lower amounts of the blended fertilizers. Another challenge is the use of blended fertilizers without application rates, ignoring the need for soil testing to ameliorate site specific deficiencies and determine specific crop nutrient needs. To deal with this problem, SHA developed training manuals and other communication materials in three local languages and trained DAs and farmers on the appropriate use of blended fertilizer. SHA also established demonstration plots. In addition, 108 EthioSIS maps were printed and distributed with the permission of the Ministry of Agriculture. DAs were trained to interpret and use the soil maps. The project also procured and deployed 44 LaMotte Rapid Soil Testing Equipment kits which include the soil NPK kit, soil texture kit and the pH/TDS/SALT tracer. Farmers are now able to use blended fertilizers based on the national average recommended rates for target crops such as wheat, tef, maize and barley that were identified during the project. The introduction of rapid soil test kits and associated training enabled participants to understand the principle behind the use of different blended fertilizers and to motivate them to check the soil situation in their mandate areas and to communicate with agricultural research centers to determine the right amount of each nutrient that their soils require. The project evaluation assessment indicated that by using blended fertilizers on improved teff of "boset" variety, some lead farmers reported a 142% increase in yield from the traditional 0.7T/ha to 1.8T/ha.

Promoting the use of bio-fertilizers

The increased cost of chemical fertilizers and added knowledge about their hazardous effects on soil health have increased the need for bio-fertilizers, given the important role they play in improving soil fertility and crop production through the supply of easily usable nutrients for host plants. Pulse crops develop symbiotic relationships with soil microbes/symbiotic bacteria, such as soil Rhizobium bacteria (rhizobia) within the nodules on their root system that can convert the atmospheric nitrogen into a form the plant is able to use for growth. In return, the plants provide nutrients required by the rhizobia. In this way, pulse legumes fix atmospheric nitrogen into the soil. The residues and exudates from the pulse crops add to the nitrogen of the soil to be used by subsequent non-leguminous crops, such as cereals. Hence, the inclusion of pulses in multiple cropping systems, such as intercropping or in simple crop rotations is considered important for the integrated management of soil nutrients and for moving towards conservation and organic agriculture. Other than their importance in maintaining soil fertility, pulse crops are a good source of protein, and generate income for farmers. Pulses enhance smallholder farmers' food security and nutrition besides boosting incomes. Pulses must be well nodulated for maximum atmospheric nitrogen fixation and rotational benefits. When the amounts of effective rhizobia in the soil are inadequate there is a need to inoculate the pulse, crop seed with appropriate strains of rhizobia during planting to ensure good levels of nodulation. Thus, it is recommended to inoculate pulse crops at planting. In current practice, farmers do not apply fertilizers

in legume crop production, while the application of inoculant to pulse seed is also a recent occurrence in the country. Consequently, there is low productivity of grain legumes, at about 1.9 metric tons per hectare and 9.54% (about 3.01 million tons) of the grain production is drawn from the pulse crops (CSA, 2020).

The ISFM project implemented by SHA introduced the use of bio-fertilizers as a way of addressing soil fertility depletion problems. Bio-fertilizer usage was promoted in pulse crops. Faba beans, field peas, haricot beans, grass peas, soya beans and mung beans make up the majority of pulse crops grown in Ethiopia. In this regard, 93 on-farm demonstrations were conducted, both at FTCs and in farmers' fields, to demonstrate the effects of the bio-fertilizers response on different pulse crops. On one side, crops were planted using farmers' conventional practices, without fertilizers, while on the other side bio-fertilizers were applied based on the national average recommended rate.

Taming soil acidity through lime application

Soil acidity is a major constraint to crop production and productivity in Ethiopia. According to EthioSIS (2014), more than 40% of agricultural land in Ethiopia is affected by soil acidity. As the problem of soil acidity expands, crop productivity is reduced, and more farmers switch to produce economically less important crops such as lubin 'Gibto' and wild oats 'Sinar' that are more tolerant to soil acidity. An assessment conducted prior to the implementation of the project found a widespread problem of acidity in the program areas that has contributed to low yields. To address soil health and fertility, IDSST employed ISFM intervention through the application of lime in acidic soil environments. Lime was applied to acidic soils at the FTCs and on model demonstration farms. The application of lime to the soil, or by adding basic materials to neutralize the soil acidity were methods used to raise soil pH levels. Since lime dissolves slowly, and in order to activate the lime reaction and facilitate mixing with the soil, the application of agro-lime to acidic soils was done ahead of planting time – at least two months before the crops were planted, to allow for the chemical reaction after incorporation into the soil. To appraise farmers on the new technology, DAs and selected model farmers were trained in the application of lime on selected crops including wheat, malt barley and teff. Besides creating awareness among farmers, the results of the demonstration showed enhanced yields after the application of lime leading to high demand for lime.

Capacity building for the Ministry of Agriculture in conservation agriculture

While conservation agriculture (CA) has proved to be potentially crucial to the improvement of crop yields and the sustainability of farming, efforts to package and promote it in Ethiopia over the past three decades have proved futile with low adoption levels. The Ethiopian Ministry of Agriculture, Natural Resource and Food Security organized a CA mainstreaming workshop in December 2018 in Adama City, Ethiopia. Over 50 participants from different offices of the Federal Ministry of Agriculture (MoA), (including staff from Extension, Crop Development, Food Security, Soil Fertility Improvement, Mechanization and Gender units), regional MoA officers from Oromia, SNNPR, Amhara and Benishangul-Gumuz; regional agricultural heads and zonal experts, researchers from CIMMYT and the Ethiopian Institute of Agricultural Research (Melkassa and Bako research centers), cooperative society representatives, civil society representatives such as the Mennonite Central Committee Canada (MCC), Canadian Foodgrains Bank (CFGB), Terpeza Development Association (TDA) and other CA implementing organizations in the country, took part in the workshop. The objective of the workshop was to incorporate CA, as an alternative extension package, into the identified high adoption potential areas of Ethiopia to ensure food security and conserve the environment. The key areas of discussion were applicability of CA across different agro-ecologies, subsistence and commercial farming and CA, input availability for CA, livestock feed improvement, alternative energy source, capacity building and stakeholder engagement. Participants understood the benefits of CA both at farm level (enhancing productivity) and at community level (restoring landscapes, improving food security, and conserving the natural resource base). Overall, participants agreed to incorporate CA in the extension packages. Extension agents endorsed CA as a technology package within the extension system to be implemented in suitable areas of the country.

Despite the development of guidelines for CA practice by the Ministry of Agriculture, a field survey in the PASIDP II regions by the Agrimech Consultancy team showed minimal adoption of CA practice. The Ministry lacked practical guidelines for CA adoption built upon the *How* of applying CA practice. Extension agents were doing their best to establish small demonstration

plots for farmers based on two of the three principles of CA, namely permanent soil cover and crop rotation. They lacked the tools to implement the third principle of minimum soil disturbance. Although the new CA guidelines reduced the number of passes of the *'Berken Maresha'* improved tiller from 6 to 8 down to 3 to 4 passes, yet this was still not good enough. Extension officers, who were good at telling the *What* and the *Why* of CA, reported major shortages in full-knowledge and practice of applying CA to include the *How*, especially in two primary areas - lack of the simplest of mechanization and the challenge of managing crop-livestock integration. Their focus on small experimental plots needed an urgent boost to rethinking CA in terms of managing landscapes and value chains. Their CA knowledge was quickly found limited in a world challenged by climate change, hence the new broader thinking and practice in terms of knowledge, attitude, and practice progression to climate smart agriculture (CSA).

Agrimech Consultancy worked to address a basic and foundational need to develop a CA-CSA Capacity Building Manual. The team saw this as a first solution and aid to a longer journey towards CA-CSA practice. Existing manuals, like the Extension Agent on the ground were strong on the *What* and *Why*, but not on the *How* of CA practice. The CA-CSA Manual to be developed would therefore not only define the ways of mechanizing CA farming in Ethiopia. It would also guide farmers and their supporters on how to work together at landscape level and to feed value chains that were market linked. The manual needed to guide institutional establishments, the requisite public-private partnerships, as well as the monitoring and evaluation (M&E) applications that would measure progress in the CA-CSA journey. It is the lack of these ingredients, the piece-meal approach to CA adoption and the lack of attention to the holistic CSA approach that were holding CA in Ethiopia at low-adoption and even non-existent levels.

The Agrimech Consultancy team was assigned the task of strengthening the capacity of the project and MoANR staff involved in the implementation of PASIDP II project on CA and climate resilient technologies by:

- Understanding the status of CA and the extent to which undertakings have been climate smart: Understanding the needs and peculiarities of the four regions and characterizing the biophysical and socio-economic factors that would enhance the uptake of CA and soil fertility management in the Ethiopian context:
    - Detailing the capacity needs assessment of farmer research groups and MoANR staff implementing PASIDIP II, Farmer Training Centers and Development Agents (DAs).
    - Identifying, characterizing, and selecting specific practical solutions of CA and resilient technologies and practices.
    - Developing a training manual (modules for practical CSA implementation)
    - Testing an agreed set of technologies and practices and laying the ground for their scale-up.
    - Developing a roadmap, monitoring and assessment and knowledge management scheme

(See Annex I & II for CA-CSA movement proposals and MoANR assessment respectively).

Financial management, analysis, training, and coaching through AGRA's grant to TNS

Farmers and their associations need to set fair prices that allow them to negotiate with buyers with confidence and at the same time achieve a reasonable margin of profits. For this reason, the financial analyses of selected irrigation crops are computed to help farmer associations and individual farmers consider production costs. The analyses necessitate an understanding of certain essential data to arrive at final sale values, including the estimation of crop prices versus smallholder output costs, such as supplies, irrigation scheme payments, and family labor forecasts, among other factors. The results are then checked and approved by cooperatives and members at the farmer association level. At the individual farmer level, the farmer decides based on the reported data. The TNS PASIDP team provided financial analysis training for 12 farmer cooperatives. They also trained and mentored 39 DAs and PASIDP focal persons, who cascaded training to 461 households. Individual farmers and cooperatives that were trained on financial analysis have strengthened their bargaining ability and are now able to achieve a fair margin that does not vary based on customer buying appetite. The training was carried out in all the four regions.

In addition, the project provided farmer cooperatives with the techniques to update their business plans by assessing key market signals such as the type of crops, input demand, potential buyers, suppliers market demand, volumes, and price. The support

has helped farmer institutions to improve their capacity to aggregate agricultural products. Other than the cooperatives, PASIDP partner staff were given orientation on business plan development and review techniques resulting in an increase in job efficiency and morale.

To assist individual families, measure and comprehend their unit output costs, the project supported the review of 1,223 household farm budgets in Amhara region comprising three irrigation scheme communities. Farmers that adopted the farm budgets/business plans became more aware of price setting, bargaining, and getting to market faster than farmers who did not use the tool. They were able to market their commodity to wholesalers, retailers, cooperatives, unions and other organizations. Cooperatives in SNNPR adopted aggregate marketing and marketed their produce to wholesalers using their revised business strategy, and price negotiation experiences to validate sellers' and buyers' insights.

Establishing and strengthening access and relationships with market actors

Establishing relationships between cooperatives, buyers improve sales

Since aggregate marketing is one of the best strategies to help farmers achieve economies of scale, TNS assisted farmer organizations, mostly cooperatives with agribusiness technical support in order to begin aggregate selling of their irrigation products. The total aggregate marketing by 14 cooperatives was 392 tons of different types of crops produced, at a total sale cost of USD 173,046 by cooperatives, translating to a total of USD 10,197 net profit for the cooperatives. Despite the fact that cooperatives' overall sales have improved, there is still a lack of production consistency, a limited volume of product, and poor product quality. TNS recommends addressing these challenges by supporting the implementation of strong agricultural development plans to facilitate contractual agreement models between IWUA and cooperatives to meet buyer's quality requirements. An increase in the synergy between IWUA and cooperatives, primary cooperatives and unions, wholesalers, traders, and other supply chain participants was observed as a result of the relationships. Farmer organization capacity also improved in various areas of marketing with up-to-date market information, business plans and farm budgeting which provided insights for IWUA and to the decision- making processes of cooperative leaders by increasing their confidence. Of the 14 cooperatives in the target group, 13 began aggregate selling for the first time. They also improved their record-keeping, financial management, financial forecasting, monitoring, and decision-making abilities and started negotiating contracts with prospective off-takers. The improvement in farmer organizations' institutional capacity attracts participants and new members, which results in increased share capital and the production quantity of 11 cooperatives.

Relationship between cooperatives and input suppliers established

The project helped in evaluating and filtering potential input suppliers to ensure that they met input provision requirements such as accessibility, consistency, and mode of delivery. TNS facilitated input linkages for 1,001 farmers, enabling them to obtain the irrigation inputs. TNS also linked the cooperatives with possible input supplier unions and agro-dealers, such as Arfan Kalo Union, Semien Wegagen, and Addis Farm in Oromia, Amhara, and SNNPR, respectively, as well as Damota, Licha and Shone unions in SNNPR. In total, USD 10,391 was mobilized for input purchasing and distribution by cooperatives. In addition, 39 Development Agents and 55 IWUA and cooperative leaders received orientation on techniques of input demand collection and planning. The project has led to an increase in irrigation agriculture input demand, particularly for seeds because there is an increase in the cultivation of irrigated land in most irrigation schemes. Awareness has been created leading to increased application of irrigation input requirements.

Identifying financing partners, supporting cooperatives to access loans

Eleven cooperatives were supported with follow-up on prior loan use, loan redemption, loan proposal, and business development. However, establishing direct financial links with loan suppliers such as banks and MFIs remained elusive to cooperatives making it difficult to meet loan providers' conditions. As a result, TNS staff engaged loan providers, explaining to them why irrigation production was a less risky, and a more profitable investment compared to other types of agriculture with greater investment opportunities. TNS assisted surrounding unions to include primary cooperatives as members in order to facilitate credit access and indicated ways to strengthen the capacity of RuSACCOs. Three cooperatives became members of

the unions and received a total loan amount of USD 66,912. TNS is also in negotiations for a USD 440,207 loan from Abay Bank to Jember Union.

By providing advisory and technical support, TNS created partnerships with different institutions such as the government, private sector, buyers, IWUAs, cooperatives and MFIs. As a result of the partnerships, input suppliers were linked with cooperatives, and the cooperatives with the farmers. Buyers were also linked with the cooperatives. The various implementing partners used the TNS systems to scale-up in their areas of operation. Financial linkage modalities have been stabilized and MOUs drafted between FIs and farmer organizations. The unions are now able to access loans from SACCO unions, banks, and microfinance institutions. The linkages created between HHs, cooperatives, unions and buyers has led to increased volumes of aggregation marketing.

Gender Model Families

An analysis of the Small Scale and Micro Irrigation Support Project (SMIS) sample districts revealed that the lack of decision-making power and independence has denied many women information and skills on irrigated agriculture. Women and men were found to be motivated differently to invest in labor and other resources in an irrigated crop production. During crop selection, both men and women expressed different interests and needs. In most cases, men were more interested in growing high value crops which require more energy and labor to generate more income. Women on the other hand, selected crops with short season, were early maturing, required less labor and time and could be easily managed.

The gender analysis also found out that it was mainly men who decided on the type of crops to be planted based on their income generation priorities. Women on the other hand, considered both their need for income and feeding their families. In some cases, although men discussed the issue with their wives, the final decision lay with the men, which had a reverse impact on the women's interest in feeding their families.

In order to address the gender inequalities, there is a need to identify and employ multiple approaches that will help men and women understand the gender inequalities reflected in their day-to-day lives and cause them to act on sharing in decision making, resources, labor, and benefits. This requires the introduction of a Gender Model Family (GMF) approach, as an extension approach, that is important to provide creative and workable solutions that enable husband and wife with their children to work towards realizing gender equality. A gender model family training manual was developed for district and community level small-scale and micro irrigation practitioners as part of the irrigation extension approach.

Key lessons and recommendations

Linkages

There is still a great need to strengthen linkages between producers, suppliers, agro-dealers, and farmers in order to solve the challenge of inadequate supplies of bio-fertilizers.

Promotion of soil fertility technologies: Farmers require further training on the proper handling and application of bio-fertilizer for each crop, and access to appropriate quantities of bio-fertilizers shapes how farmers implement ISFM. For example, since a 125-gram container of bio-fertilizer recommended for coverage of a 0.25-hectare farm cannot be saved for future use once opened, farmers whose fields are less than 0.25-hectare field must therefore share the dose with other farmers. Since bio-fertilizers are not available for most farmers' needs, the linkages between producers, suppliers, agro-dealers, and farmers must be strengthened.

Based on farmers' experiences with the use of other forms of organic fertilizers the use of vermi-compost is well suited for promotion. As farmers embrace blended fertilizer technology, they face the challenge of inefficient transportation leading to poor distribution, which ultimately leads to late arrival of the fertilizers. Farmers also grapple with low, erratic supplies and the high cost of fertilizers. Similar challenges are experienced with the improved seeds. On-farm demonstrations were found to be the most effective mode for training delivery and should be the preferred forum for training. Once farmers realize the importance of fertilizer application and see practical demonstrations of how it can enhance vigorous plant growth and improved yields, there is a need to ensure the availability of fertilizers at the right time and in the right quantities and quality for the sustainability of the project.

Selecting crops to facilitate market access is critical: The market component, which provided technical assistance on irrigation crop selection on a continuous basis, has shown how important it is for assessing and aligning selected crops with market demand while also addressing input challenges to allow farmers get

a return on their investments. Despite the success of linkages, it is better to focus on production and productivity, improving agronomic practice such as cropping calendar, cluster farming producing marketable and high value crops. It is also important that institutionalization be carried out on the entire process from the target beneficiaries, and private sector in order to create institutional linkages for input-output marketing as well as financial access.

Recommendations for scale up: There is need to involve all partners in the process for the sake of sustainability, replication and scale up. There is further need for the MoA to move towards scientific crop selection and to encourage the adoption of the tools developed under this grant for this purpose in all PASIDP interventions.

Training more start-up agro-dealers is key to increasing access to quality seeds and inputs: The newly trained agro-dealers have been empowered to operate in remote underserved areas to enable them to reach the smallholder farmers. If more start-up agro-dealers are trained, the distance between agro-dealers and farmers will reduce thus improving access to seed and other inputs.

Storage facilities: There is a need for farmer organizations to own physical facilities for storage. Since the consortium approach was the best approach for PASIDP, there is a need to establish and demonstrate a consortium approach within the process. Agribusiness is a huge business and has diverse segments which need special focus such as soil fertility, seed multiplication (which require quarantine services), agronomy practice calendar, post-harvest handling, farmers' physical buildings, financial service delivery and marketing and capacity building.

Gender: Some of the lessons that were picked up from the implementation of the GMFs include the need to directly engage regional staff for GMF beneficiaries. Engaging couples in the training also helps to improve technology uptake. Empowerment of the households to identify, prioritize and solve their own problems and needs resulted in a more cohesive family. There is a need to roll out the Gender Model Family approach to other areas and integrate it into the government system. Lessons picked up from the implementation of the GMFs include the need to directly engage regional staff for GMF beneficiaries and to engage couples in the training as this helps to improve technology uptake. Mobilization of village savings groups on a voluntary basis, and creation of mutual trust among inter and intra-GMF members will foster sustainability.

Conclusion

The IDSST grant in Ethiopia has paved the way for opportunities for innovation and successful scale-up by IFAD's loan programs. The capacity building and refresher courses for smallholder farmers, farmer organizations, extension workers, and laboratory technologists have led to improved capacity. However, access to soil fertility technologies to improve productivity as well as the recognition of market-oriented interventions including micro-processing and efficient off-takers are also critical incentives for boosting production.

The end of project evaluation confirmed the relevance of the IDSST grant to the agricultural needs of the four regions targeted by the project in Ethiopia. The design of IDSST interventions supported identification of the best suited soil fertility management technologies available for Amhara, Oromia and the Southern Nations, Nationalities and Peoples' Region (SNNPR) and processes to scale them for maximum impact among project beneficiaries.

The development of standardized formats for training programs covering the four ISFM technologies offer guidelines and reference materials for the Farmer Training Centers (FTCs) and have been translated into three Ethiopian languages and customized to address the demands of local communities. The training-of-trainers conducted for DAs and lead farmers will support the cascading ISFM technologies down to farmers at *woreda* level and has also equipped the DAs and lead farmers with the knowledge and skills to apply in their normal farming practices. The farms that established ISFM technologies and practices have given farmers access to information to boost crop production in a sustainable manner, giving them hands-on-experience and enabling them test different technologies during different stages of crop growth and to exchange knowledge.

Also highlighted in the evaluation report, approximately 12,000 farmers stand to benefit from the deployment of soil texture kits and NPK soil test kits in the FTCs. Coupled with the training of government-employed Development Agents for soil mapping, soil atlas interpretation, fertilizer applications, as well as handling and analysis techniques with soil testing equipment, the ground has been laid for the sustained promotion and adoption of ISFM to address decline of soil fertility in Ethiopia.

The process was not without challenges and restrictions imposed by the government to curb the spread of

COVID-19 had a significant impact on grant activities. For example, the deployment of 44-LaMotte mobile soil test kits for farmers had to be deferred due to travel restrictions and training of farmers on use of the kits did not take place due to restrictions on public gatherings. The inability to hold public gatherings delayed many project activities; community mobilization and training sessions, soil mapping, soil atlas interpretation, fertilizer application and soil testing equipment handling and analysis techniques by extension officers were all paused until gatherings were allowed again. This was also the case for the establishment of demonstration plots for ISFM technologies and the delivery of affordable agricultural inputs which had significant impact on farmers' productivity. A planned workshop to launch the training manuals was put on hold as were physical validation workshops and field-based validation training for the manuals.

2 Building a sustainable seed system and supporting delivery of soil fertility technologies in Malawi

Agriculture contributes 30% of Malawi's gross domestic product (GDP) and provides a livelihood for 85% of the population. The 85% of the population that is active in agriculture comprises mainly smallholder farmers (4.5 million farm families) who constitute the majority of the rural population and contribute 60% of the country's agriculture and 10% of export earnings (MGDS III, 2017-2022). Smallholder farmers cultivate more than 2.5 million hectares (ha) in Malawi and are central to food production as well as poverty reduction despite owning fields that measure approximately 0.5 to 0.8 ha per household.

Yields of most crops that smallholder farmers grow are at 50% of the actual attainable yields and translate to decreased per capita food production. Some of the problems that have led to low productivity in the agricultural sector include the use of inappropriate fertilizers, poor access to high quality seeds of improved and locally adapted varieties, poor extension services, poor market access and financial constraints.

Despite efforts by the government and other stakeholders to improve the agriculture sector, 50.7% of the population in Malawi remains poor, earning less than USD 1.95 per day while 24.5% are ultra-poor, earning USD 1.00 per day or less.

Maize and tobacco production dominate smallholder farming for food and cash, respectively. With the collapse of the tobacco industry and fluctuating maize production, there is a pressing need to diversify both production, and farmer incomes. It is against this background that the government of Malawi has been advocating for diversification such as legumes, and the use of high-quality seed of improved varieties, preferably those that mature early and are drought tolerant.

Investments in a private sector-driven model for seed production and sale to smallholder farmers has likewise proven effective across several African countries. Seeds and their delivery systems play a critical role in agriculture transformation. The higher-yielding, climate-resilient crop varieties as well as a reliable model for seed delivery essentially re-writes the narrative for attaining food security in Africa and achieving Sustainable Development Goal #2 to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" by 2030 (SSG, 2020).

IDSST in Malawi

IDSST project in Malawi has complemented the IFAD-funded Sustainable Agricultural Production Program (SAPP) to address the challenge of linking new crop varieties and improved soil fertility management research outputs to smallholder beneficiaries.

Preliminary intervention areas which were identified during grant development with IFAD for SAPP were validated. IDSST held in-country at inception and validation meetings. IDSST also held field visits to concretize the outcomes of the validation meetings prior to the project inception meeting. Both validation and inception meetings confirmed the following key findings as gaps that the project should focus on:

- Creating a sustainable seed system to improve availability and uptake of high-quality early generation seed (EGS) and certified legume seeds for the farming communities.
- Creating mass awareness amongst smallholder farmers, private traders, agriculture front line staff and NGOs on the importance of using high quality seed of the improved varieties and appropriate agronomic practices.
- Supporting the development of geo-referenced information system (GIS) for fertilizer recommendations.

IDSST engaged the following strategic partner institutions:

1. Department of Agriculture Research Services (DARS), a public institution under the Ministry of Agriculture (MoA),
2. Multi-Seeds Company (MUSECO), an indigenous seed company in Malawi and,
3. Rural Market Development Trust (RUMARK), a local NGO in the agriculture sector.

The three partners collaborated to demonstrate how both a grant and loan could address identified gaps, through the involvement of the private sector. In the course of the project, another partner, Global Seeds, collaborated with the partners to support the community seed multiplication groups and awareness creation activities.

The project targeted all six SAPP impact districts - Balaka, Blantyre, Chiradzulu, Chitipa, Lilongwe and Nkhotakota. However, due to resource constraints, it was implemented in Lilongwe and Nkhotakota districts as primary districts while Blantyre, Chiradzulu, Balaka and Chitipa districts came in as secondary districts from which seed companies adopted weaned community seed multiplication groups.

The Sustainable Agriculture Production Program, SAPP

The Sustainable Agriculture Production Programme is a nine-year program funded by IFAD that is being implemented in six districts of Blantyre, Chiradzulu and Balaka in the southern region, Lilongwe and Nkhotakota in the central region and Chitipa in the northern region. The program, which commenced in 2012, aims at contributing to reduction of poverty and improved food security among the rural population targeting 200,000 smallholder farmers. The specific development objective is to achieve a viable and sustainable smallholder agricultural sector employing good agricultural practices (GAPs). The target group of the program is defined as "smallholder food security farmers." These farmers comprise households with men, women and youths who have the potential to achieve household food security but due to limited resources find it difficult to produce a surplus for the market. This group consists of 80% of smallholder farmers and is the focus of the public extension service. The program has three components:

- Adaptive Research
- Farmers Adoption of Sustainable Good Agriculture Practices
- Program Management & Knowledge Management

Program components

Adaptive research

Under this component, improved agricultural techniques are being refined further to suit Malawian conditions. In addition, the evaluation of advanced lines of beans, cowpeas, soya beans, groundnuts, and pigeon peas are being undertaken under farmers' conditions in order to assess their adaptability and farmer acceptance. In collaboration with national, regional, and international research institutions. The adaptive research component aims to strengthen action research programs which develop and refine GAPs packages adapted to various agro-ecological and socioeconomic contexts. The component also aims to ensure that appropriate good agricultural technologies are developed and understood by potential farmers. Within the intervention logic, the component has two outputs, namely, adaptive research and seed certification and management.

The purpose is to facilitate the on-going processes for certifying legume seed for multiplication and farmer use. In order to improve results and the impact of the program, the major activities under this sub-component include: (a) Maintenance and production of pre-basic and basic seeds, (b) Capacity building for regulation and certification, (c) Certified seed inspection, (d) Study monitoring of certified seed in the market.

Farmers' adoption of sustainable good agriculture practices

The component facilitates the dissemination and adoption of GAPs with the intention of increasing crop yields, diversifying production, reducing yield variability, reducing labor inputs, and improving soil health through integrated packages of improved soil and water management. There are two main requirements for farmer adoption: (i) Increased awareness of available technologies and their benefits; and (ii) access to key inputs. These are addressed by the sub-components on Improved agriculture extension, and Access to key agricultural inputs.

Improved agriculture extension

This aims at ensuring that improved agricultural extension services are accessible to the target group and contribute to raising awareness and sensitizing farmers about GAPs. The success of the program rests on accelerated adoption of GAPs by embarking on an effective program of farmer organization and information dissemination. The principal activities

under this sub-component are: (a) Stakeholder participation and research and development (R&D) linkages, (b) National and Agriculture Development Division (ADD), agriculture extension support and promotion services, (c) Integrated agricultural extension management at local level, (d) Capacity strengthening of farmers and organization development, and (e) Household nutrition improvement.

Access to key agricultural inputs

This sub-component aims at improving and increasing access to key agricultural inputs for sustained adoption of good agricultural practices by the target groups. It is evident that farmers experience problems adopting GAPs due to the of the non-availability and un-affordability of key inputs, particularly legume seeds (beans, cowpeas, soya beans, pigeon peas, groundnuts, and leguminous trees) and small livestock which are important elements of the GAPs being offered by the program. Thus, it will create a network of farmer groups to multiply and distribute selected seeds. The program will engage private seed companies to make improved seeds available to farmers, and the following major activities will be undertaken: (a) Engage with input suppliers/agro-dealers to encourage supply of inputs needed for GAPS (seeds, fertilizers, agro-chemicals, tools, implements etc.). While the program will supply maize seed. Other seeds, such as legumes, will be supplied through arrangements with producers of certified seeds, preferably private sector actors. Fertilizers, agro- chemicals (herbicides for early stages of CA adoption), implements (used for CA and establishment of communal nurseries for both vertices and tree species for agro- forestry component) will be supplied as well; (b) Promote access to small stock and support services through a small-stock pass-on program for goats and chickens with the objective of supporting household (HH) nutrition, increasing income and assisting in improving integrated soil fertility management; (c) Strengthen agro-dealer networks and promote agro-dealership at local level, and establish partnerships with microfinance institutions to facilitate adoption of agricultural practices which require access to financial services.

It is evident that farmers experience problems in adopting GAPs due to the non-availability and un-affordability of key inputs, particularly legume seeds (beans, cowpeas, soya beans, pigeon peas, groundnuts, and leguminous trees) and small livestock which are important elements of the GAPs being offered by the program.

Program management and knowledge management

The component is aimed at overall program management and coordination in accordance with the Government of Malawi policies. The focus of the component is to put in place strategies, systems, guidelines and organizational arrangements and structures to facilitate smooth implementation of IDSST.

The program has so far:

- Reached 198,000 Households (103,000 Male Headed Household and 95000 Female Headed Households out of Program target of 200,000 Households (120,000 MHH and 80,000FHH)
- Reached 9,289 Lead Farmers that are assisting fellow farmers with specialized agricultural technologies out of 10,000.
- Mainstreams the support to households through various interventions such as seed multiplication, adaptive research, matching grants, small stock pass on, and on promotion of Good Agriculture Practices.

Implementation Framework of the IDSST Grant

IDSST was delivered through:

i. Sub-grants to DARS, MUSECO, and RUMARK to build a sustainable seed system to increase uptake of high-quality seed of improved legume varieties.

ii. Support an engagement of service providers to ensure that knowledge of processes, outcomes, best practices, and lessons learnt were well captured and documented.

iii. Technical expertise in seeds and soil mapping.

iv. Financial leverage and alignment with other existing investments.

The Department of Agriculture Research Services (DARS) and MUSECO were strategically selected to enhance production and availability of Early Generation Seeds (EGS) for improved varieties. DARS was involved in the bulking and supply of breeder seeds, mounting a variety of demonstrations as well as in training farmers. The bulked breeder seed played a crucial role in commercializing legume varieties, most of which had never moved out of R&D. The breeder seed was injected into the seed system and sold to seed companies.

However, DARS could not supply all the seeds required. As a result, MUSECO partnered with ICRISAT, IITA and CIAT to make available additional EGS for further multiplication. The Department of Crop Development (DCD) was involved in the identification of community seed multiplier groups. DCD backstopped by Seed Services Unit (SSU) also supervised and inspected community seed producers. The Department of Agricultural Extension Services (DAES) managed community groups, organized field days for community demonstrations in collaboration with MUSECO and provided technical backstopping and extension services. RUMARK was involved in the identification and capacitation of agro-dealers and village-based agents as outlets of selected technologies.

DARS has been releasing good performing varieties for farmers, most of the already available technologies remain on the shelf due to limited capacity to produce early generation seed for subsequent production of other classes of seed. DARS, a public institution under the Ministry of Agriculture, and MUSECO, a private seed company, formed a Private Public Partnership (PPP) to demonstrate how to work together to address agricultural challenges of smallholder farmers.

RUMARK interventions strengthened agro-dealer networks in Lilongwe and Nkhotakota districts to enable them to support the improved delivery of seeds and soil health technologies to SAPP farmers. Interventions under this initiative are geared towards improving the proximity of agro-dealers (in terms of zones of coverage) and investing in demonstration plots to increase awareness of new technologies and improving the adoption of the same.

Seed multiplication

The government of Malawi recognizes seed as an important catalyst for the development of agriculture for sustainable increased production. Through the Ministry of Agriculture, the government is working to improve the seed sector to alleviate poverty and hunger as stipulated in the Malawi Growth and Development Strategy (MGDS) III and in the National Agriculture Policy (NAP). A reliable seed supply system is key to improved agricultural productivity and agricultural development and, as such, a vibrant seed system that involves smallholder farmers in seed production and distribution is important.

Malawi has an established seed sector driven by 28 private commercial companies (comprising a mix of national, regional, multi-national and public sector companies), plus a number of public agencies that support the system through plant breeding, seed quality control and certification. Seed certification and testing and the overall regulatory enforcement is the mandate of the Seed Services Unit (SSU) under the Directorate of Agricultural Research Services (DARS). Whilst there has been notable development of the seed sector, availability and access to high quality seed remains insufficient, with a heavy focus on maize and cash crops. Outside the government-supported Affordable Inputs Program (AIP), the adoption of improved varieties remains low.

SAPP experienced challenges in accessing adequate high quality basic and certified seed. As such, efforts to address the shortage of high-quality seeds of improved varieties were initiated and led to improvement in the availability of selected varieties of legumes.

To produce enough seeds, MUSECO identified seed out-growers (medium scale farmers and community seed multipliers). Before farmer engagement, MUSECO staff visited each of them to discuss the terms and conditions for seed multiplication, and the crops to be grown for farmers to realize maximum benefit from the contract. During the project period, a total of 231 seed out-growers and 1,010 smallholder farmers were contracted. All smallholder farmers from community seed multiplying groups that were engaged in seed multiplication were beneficiaries of SAPP. The onset of the project was boosted by the fact that MUSECO had seeds from partners (DARS, IITA, CIAT and ICRISAT). The seed was produced in the previous year (2017/2018). The acquired seed comprised of 1.5T of breeder seed 26.709T of pre-basic and 544.714T of basic seed.

In the first year (2018/2019), 70% of the contracted smallholder farmers were supplied with seed by SAPP, while the remaining 30% were weaned farmers from SAPP. The weaned farmers accessed seed from MUSECO on loan. In the following year (2019/2020), 80% of the contracted smallholder farmers were weaned farmers who obtained seed on loan from MUSECO. The connection of the smallholder farmers to MUSECO was a game changer since the farmers had a ready market for their seed after harvest. Before the engagement with MUSECO, farmers had faced challenges with finding a market for their seed and ended up selling certified seed as grain to vendors.

To maintain seed quality, extensive and periodic inspections were carried out by Seed Services Unit, MUSECO field inspectors and para-seed inspectors at district level. The inspection and advice given during

supervisory trips improved the knowledge and skills of the farmers leading to production of high-quality seed. The technical backstopping benefited farmers as it led to improved productivity and reduced rejection rates from 20% to 10% and thus led to increased income for the farmers.

During the project period, MUSECO trained a substantial number of farmers and government's field staff on production and quality management. The training sought to improve seed production, productivity, and quality. A total of 212 seed out-growers were trained in best field practices for seed production. Twenty-three (23) agriculture staff and three MUSECO staff were also trained in seed production and quality management to improve seed production, productivity, and quality of seed. Another six MUSECO staff were trained in field inspection and three in seed business management. The trainings improved knowledge and skills for both the extension and MUSECO staff, leading to improved productivity and quality of seed, as well as management of the seed business.

Processing, packaging and distributing seeds

In the 2018/2019 season, 30.240T of pre-basic seed, 358.473T of basic seed and 169.769T of certified seed respectively were produced. More basic seed was produced in anticipation of high demand, but more than 300T of basic seed was sold as certified seed as there was low demand for basic seed. Projects of the Consortium of International Agricultural Research Centers (CGIAR) produced a lot of basic seed and as a result more companies and seed growers bought from the CGIARs rather than from MUSECO due to price advantage, since CGIAR's pricing was not for cost recovery but to meet project targets.

The seed produced was processed, packaged, and distributed. Distribution was done through direct sales to various NGOs, international organizations, companies, government projects, and individual farmers. In addition, cash sales and sales through the Farm Input Subsidy Program (FISP) were done through agro-dealers and retail outlets. Seeds were made available to farmers through the agro-dealers based closest to farmers. However, a challenge was encountered when some agro-dealers did not remit the funds to MUSECO after selling the seed and this was later addressed by RUMARK through capacity building and by contracting only trained agro-dealers.

Farmers from the 64 community groups with contracts with MUSECO were further trained in seed production, grading and sampling processes. The certified seed realized by the community seed multipliers was sold to MUSECO. Earnings from the groups averaged between USD 1,852 to USD 3,704. Groups that showed interest in selling seed locally in their communities (Village-Based Agents) were trained on the process of acquiring licenses for seed selling from the government.

Farmers impressed by high yields from demonstrations

MUSECO implemented a total of 59 demonstrations in the target districts. The demonstrations were a strong vehicle for technology transfer to farmers and included the double row system of planting soya bean and groundnut, early planting of legumes, application of fertilizer to legumes, and the demonstration of new varieties for groundnut and maize. Most farmers who witnessed and followed the demonstrations have since started using the double row system of planting groundnut and soya bean. MUSECO also organized 10 field days, that were attended by over 800 farmers

The yield gap for maize was quite remarkable, ranging from the previous 2T to 2.5T per hectare to 7T and 8T per hectare after the intervention. Both farmers and extension officers were impressed by the performance of the varieties that were tried out. Encouraged by the high yields, Malingunde Farmers' Club comprising 20 farmers bought 200 kg of Manthu (MH36) certified seed using their own funds after seeing that Manthu was able to produce an average of 8.333T per hectare in the demonstration plot. MUSECO also received a substantial order from Balaka District for Thanzi (MH44A) due to its early maturity, twin cobbing, and high yields. Since the region in which Balaka is located experiences frequent dry spells, they chose Thanzi. In Blantyre farmers chose Manthu (MH36) based on its performance during try-outs. MUSECO also promoted new maize varieties by distributing small packs of 50 grams each to farmers to try out. A total of 9,970 small packs were distributed in the target areas.

Public-private partnership enhances farmers' decision making

The project confirmed the success of private-public partnerships. The involvement of the private sector in SAPP illustrated a great difference in seed multiplication; farmers were aware of the market and price of the seed long before they started production. This gave them an opportunity to make informed

decisions. The healthy partnership between MUSECO and DARS also contributed to the success of the project with DARS making available breeder seed to MUSECO for further multiplication. Farmers' willingness to continue working with MUSECO showed their confidence in partnering with the private sector actor.

High germination rates and yields were realized from the sale of unshelled groundnut seed which were to be shelled just before planting. This led to quick adoption by seed out-growers, some farmers, national and international organizations. However, the SAPP PCU is yet to adopt procurement of unshelled seed as the policy for the unshelled seed awaits the official go-ahead from the Ministry. This has left farmers experiencing low germination percentage challenges with shelled groundnuts. After the lid was lifted on those involved in side-selling, the introduction of supervision of farmers during postharvest seed handling enhanced tracking of seed on the one hand, while registration of community seed multipliers by MUSECO boosted tracking for side-selling on the other hand.

Strengthening seed distribution

Over the years, the lack of capacity of agro-dealers to serve rural communities in Malawi has led to a situation where farmers are ill-advised and have inadequate knowledge about inputs, such as high-quality legume seed and good agricultural practices. Information on new improved technologies is seldom available or accessible to farmers. At times, there is low availability and limited access to high quality improved seeds, limited farmer knowledge and understanding of proposed innovations and their implementation risks. Old technologies are often demonstrated with little innovation. Demand creation by agro-dealers is also not extensive.

Agro-dealers are best positioned to provide much needed technology transfer and technical assistance in the input supply value chain. Agro-dealerships need to be strengthened to play the vital role of bridging the last mile in the distribution of inputs and technologies to smallholder farmers and the first mile in the market produce chain. Community based agro-dealers can help to reduce the distance that farmers travel in order to access their farm inputs. RUMARK's role in the IDSST project was to strengthen the agro-dealer networks to enable them to support the improved delivery of seeds and soil health technologies in some of the IFAD-supported SAPP districts.

Training agro-dealers to reach smallholder farmers

To increase access to high quality seed of improved crop varieties, as well as to create awareness about improved seed and soil fertility techniques, RUMARK started by mapping and selecting agro-dealers willing to operate businesses in remote and underserved areas and to reach out to smallholder farmers. The 86 identified agro-dealers comprised of 27 females and 59 males, were trained in business management for four days to enable them to grow their businesses and to ensure that they are mentored and exposed to profitable and sustainable business models. The business training strengthened the network of agro-dealers and has ensured that there is a sustainable supply of agricultural inputs especially legume and maize seed, among other agro-dealer services, in close proximity to smallholder farmers in the target districts of Lilongwe and Nkhotakota.

The technical modules of the training covered product knowledge and safe use and handling of improved inputs and technologies. The agro-dealers were introduced to various input supply companies and their representatives and trained to spot the differences between hybrids, open pollinated and unimproved local seeds alongside training on different types of chemicals. They were taught customer care to ensure they provided complimentary extension information to farmers and improved their relationships with supply companies. The trainings were supported technically by SAPP, the MoA through the Department of Crops, MUSECO, Afriventures Blantyre Limited, and regulatory authorities such as Seed Services Unit (SSU) and the Pesticides Control Board (PCB).

Following the training, an improvement in the business efficiency of agro-dealers has been noticeable. Specifically, record-keeping and business planning skills among agro-dealers have shown remarkable improvement. The most noticeable effect of the trainings is the transformed confidence and self-empowerment observed in women agro-dealers. Agro-dealers have expanded their networking with input suppliers. This is evidenced in the contractual agreements that 58 agro-dealers made with various input suppliers, recording a total of 84 signed contracts within the project period with a total value of USD 652,061.

Developing hub agro-dealers to mentor remote agro-dealers

Hub agro-dealers are seasoned agro-dealers with the capacity to be wholesalers and supply inputs to smaller and more remote agro-dealers. They are linked to major input suppliers who provide them with inputs in bulk, allowing them to enjoy discounted volumes that trickle down to retail agro-dealers, who may not have bulk purchasing or negotiation powers, thus keeping the small rural agro-dealer competitive with pricing. As part of the development process, hub agro-dealers are provided with Advanced Business Management Training (ABMT), followed by linking the hub agro-dealers to input suppliers especially legume and maize seed suppliers and good agricultural practices to increase the flow of inputs in the target districts.

RUMARK was able to develop 12 hub agro-dealers including five women and seven men. This model has benefited the newly trained retail agro-dealers who lacked access to formal financing channels. Major seed input suppliers provide inputs to hub agro-dealers at distributors' price, while the hubs provide the same to retail agro-dealers at a wholesale price, and the retail agro-dealers provide inputs to smallholder farmers at the input suppliers' recommended retail price. Fertilizer input supply companies use a similar model. Hub agro-dealers developed by the project are offered better discounts by input suppliers than agro-dealers outside the model. This made transaction costs higher for agro-dealers outside thereby rendering their business less profitable. They also lost valuable time trying to solicit stocks. Other key elements developed during the training were mentoring of retail agro-dealers and hub agro-dealers to build and develop trust with each other before forging and developing sales agreements. The mentorship addressed risk and how to reduce uncertainty and how good and bad reputation and accountability can affect their business performance.

Although the program targeted the development of eight hub agro-dealers, 12 were developed due to demand for the training. The newly trained agro-dealers that were linked to hub agro-dealers are currently operating because of the support provided by the latter. In the 2019/2020 season, hub agro-dealers sold 38.5T of seed through retail agro-dealers in the two target districts. Stakeholders that provided technical support during the trainings included VisionFund Malawi, Multi Seeds Company, Sunseed Oil Limited, Malawi Revenue Authority, Agricultural Commodity Exchange (ACE) and the Sustainable Agricultural Production Program (SAPP) Secretariat.

Providing support to start up agro-dealers

The development of hub agro-dealers is designed to ensure the continued sustainability of the agro-dealer model as they support new start-up agro-dealers who would otherwise have had no support system in terms of financing for their businesses and linkages with the hubs. It is also easier for start-up agro-dealers to acquire stock and run their shops. The discounted prices enjoyed by the hub agro-dealers for bulk procurement are passed on to the retail agro-dealer keeping the retail prices competitive. In some cases, the provision of inputs to the hub agro-dealers by consignment can be extended to the agro-dealers as a form of financing. The 12 hub agro-dealers support a total of 122 retail agro-dealers. However, as the hubs businesses grow, they add on more retail agro-dealers to their network and more growth results. This has already been seen within the limited lifespan of the project. The agro-dealer trainings have also inspired the need to develop a strong network through the development of district associations that provide a wider platform for interaction and cohesion among agro-dealers. Through this network, they can share knowledge and experiences since the network accords them opportunities to speak with one voice on advocacy around issues that directly affect their business operations. It also helps agro-dealers to standardize and harmonize or tailor-make technology transfer approaches to smallholder farmers. Using modern social media platforms, agro-dealers interact in real time almost daily and share information.

Demonstrating new technologies to improve productivity

Smallholder farmers need to be aware of available technologies that they can adopt to increase their production and ultimately their incomes. The project used new technology demonstrations to teach various agricultural techniques and good agricultural practices (GAPs) and to showcase new or improved technologies for improved production. One hundred and forty-nine demonstrations (69 summer demonstrations and 80 winter demonstrations) were used to showcase the efficacy of available technologies, such as double row planting for legumes, to maximize production on available arable land as opposed to the old technology of planting a single row on a ridge. The demonstration plots also showcased the utilization of inoculum in legumes to ensure enough of the correct type of bacteria are present in the soil to establish a successful legume-bacterial symbiosis as required for increased

production. Improved seed varieties that had been released but which smallholder farmers had no prior awareness of or access to, were also demonstrated.

The demonstrations were made possible by the positive collaboration of stakeholders - mainly smallholder farmers who provided arable land and the input supply companies who provided inputs. Fertilizers, for example, were provided by Afri-Ventures Limited while the inoculant for legumes was provided by Mandolo Plus. The MoA agricultural extension officers provided technical support in the establishment of technology demonstrations which proved to have great potential for the adoption of new technologies as they accorded farmers the opportunity to acquire hands-on skills in good agricultural practices for optimum results. Farmers were equipped with practical advice on how to handle ongoing agricultural challenges such as climate change. Demonstration sites also provide a conducive arena for interaction between farmers, agricultural extension staff and agro-dealers alike. For the agro-dealers, it created an opportunity to interact with farmers for business linkages translating to increased sale of inputs and services. The demonstrations linked 17 agro-dealers to MUSECO and four to Global Seeds through contractual agreements. During the implementation of the project 84 agro-dealers were facilitated in signing contracts. The demonstrations were conducted during 85 field days reaching 9,771 farmers in Lilongwe and Nkhotakota. Field days provided farmers with the opportunity to learn by seeing the performance of recommended practices and provided a chance for farmers to discuss the pros and cons of the technologies under demonstration. This helped to convince even the most skeptical farmers and led to increased adoption of improved technologies by smallholder farmers.

Technical assistance in soil fertility technologies

Digital soil maps for all six SAPP implementing districts developed

From consultations conducted by AGRA at the start of the project, SAPP expressed serious concerns with the delay in finalization of the soil mapping exercise which had stalled for five years despite receiving support. SAPP reiterated its interest in seeing the soil maps finalized and fertilizer recommendations for SAPP implementing districts being implemented. SAPP also wanted to see the national maps and fertilizer recommendations in use by all players. AGRA was requested to support and provide technical capacity to the MoA. In February 2018, AGRA convened key stakeholders involved in the soil mapping exercise in Malawi. Members agreed to form a National Soil Mapping Taskforce to spearhead and escalate the exercise ensuring quick completion of fertilizer recommendations with technical support from AGRA.

The Taskforce, currently headed by the Department of Land Resource Conservation, comprised key stakeholders from DARS, DLRC, DAES, the Fertilizer Association of Malawi, Malawi Fertilizer Company, OPTICHEM and AGRA. AGRA has supported the completion of soil maps in six districts and made a complementary grant to support the development of fertilizer blends and validation of these. Consequently, RUMARK will work closely with African Fertilizer and Agribusiness Partnership (AFAP), that is already part of the fertilizer grant, to make sure that agro-dealers stock and demonstrate the balanced fertilizers.

Limitations and challenges

- The level of funding vis-à-vis the expected results were not in tandem. Implementers felt that the funding was too low against what was expected to be achieved. Most of the activities were financed by MUSECO to ensure compliance with the agreement signed. MUSECO was expected to buy seed from seed multipliers yet the AGRA and SAPP projects had no funds allocated for this. When the company delayed in making the seed purchases, farmers resorted to side-selling seeds. In the end, MUSECO managed to recover less than 50% of the expected volume of seeds.
- The lack of start-up capital meant that farmers had to be given seeds on loan, a gesture they did not embrace, leading to poor recovery of the loaned seeds. This highlights the need to set aside funds that farmers can use to access inputs in a timely manner and pay out-growers on time.
- Despite the success of the farm demonstrations, data collection and retrieval were a challenge due to lack of adequate staff. Data collection was carried out by district agriculture staff who lacked resources to adequately support the project and conduct frequent follow ups with farmers who hosted demonstrations. There is a need to ensure that demonstration areas are competently staffed and resourced for data collection and to provide technical backstopping. For example, Community Agribusiness Agents (CAA) can be trained to conduct the demonstrations and to collect data. Therefore, financing is required to support start-ups for local seed companies and seed multipliers.

- The duration of the project was too short to realize the anticipated impact and it is recommended that future projects consider a longer timeframe. Partnership-building takes time, and an expanded project cycle would have allowed for meaningful impact to accrue beyond the outcomes and impact registered.
- The involvement of the private sector appears to have been an afterthought, yet their involvement in the initial stages would have been key to project ownership building in resources and planning for their activities. In this case project funds for private sector activities were limited.
- Collaboration with government officers helped in the identification of reliable community groups to partner with, which supported the successful implementation of the project while the partnership between MUSECO and DARS opened up new markets for MUSECO.
- To enhance communication and address issues of contract signing and seed delivery, MUSECO worked directly with community seed multipliers, with backstopping from the agriculture office.
- The implementers noted some capacity gaps, hence the need for capacity building for government officers and farmers to appreciate what a contract means and its implications. The many scattered fields used by community seed multipliers presented challenges in quality control. In mitigation, farmers were advised to cluster two or three fields. Sampling of seed from each farmer was also a challenge and farmers were advised to pool their produce to cut down sampling costs. Some of the project activities had to be implemented by third parties over whom MUSECO had no control, making it difficult to supervise the delivery of these activities. This included data collection for demonstrations, and identification, briefing and contract signing for community seed multipliers.
- A key lesson picked at the end of the project is the impatient nature of farmers as demonstrated by the side-selling due to delays in buying their seeds. Opportunists took advantage of the farmers' impatience and bought seeds from contracted farmers. Well known cooperatives were identified as being notorious side-sellers. Adequate funds need to be set aside for the seed companies to enable them to pay out growers in good time.
- Political instability: General elections held in Malawi on May 21, 2019, to elect the President, National Assembly, and local government councilors were highly controversial leading to political tensions that were demonstrated through nationwide protests. This negatively impacted implementation of project activities. This was mitigated through granting of a no cost extension to cover for the lost time.
- COVID-19: The onset of COVID 19 during the latter period of implementation saw the introduction of lockdowns as a preventive measure during which project activities could not be implemented. This also impacted the operations of agro-dealers. Mitigation measures included budget realignment allowing the project to adapt to COVID-19 prevention measures and utilize digital technologies to reach agro-dealers and farmers as well as the granting of a no cost extension.

Key lessons and recommendations

Overall results of the project: Over the years, there have been a growing number of seed companies in Malawi. However, most of these companies depend on the DARS for EGS of most legumes, leading to shortage of seeds in the market. The release of good performing varieties to farmers by DARS has not helped to address the situation and most of the new technologies produced remain on shelves due to the limited capacity to produce EGS for subsequent production of other classes of seed.

The partnership between DARS and MUSECO under IDSST has seen DARS increase in the quantity of seed that has been made available and procured and further multiplied and distributed to farmers. This complements efforts by SAPP to increase access to improved legume seed locally and to make the farm business of smallholder farmers more viable. The quantity of seed produced and procured by MUSECO and other seed companies such as Global Seeds and government projects such as the Agricultural Sector Wide Approach II (ASWAP II) has also increased. There is also increased access to improved seed varieties by farmers. Other impacts of the project are improved adoption of technologies, increased yields, increased access to needed inputs and growth of rural retail agri-businesses.

Knowledge on GAPs for increased production of legumes and maize was shared among implementing partners with the collaboration and support of extension workers from the MoA. Such information included the advantages of using certified seed, double

row planting, recommended plant populations and agronomic practices to be followed. Under the IDSST grant, MUSECO and other private seed companies have been key in providing farmers with information on new crop varieties produced by the companies and these have been distributed through trained agro-dealers. Demonstrations of new varieties of pigeon peas in Nkhotakota by both DARS and MUSECO further enticed farmers to adopt the varieties.

The project was set up to improve the coverage of agro-dealers in the target areas and to invest in demonstration plots for improved awareness and adoption of technologies. Some of the lessons learned that need to be addressed to support scale-up in IFAD loan programs include:

- **Open agricultural policy in partnership engagement:** The open agricultural policy in Malawi accommodating development partners played a key role in the project. SAPP was instrumental in leading and engaging with the identified partners and departments under the MoA to understand the role they were expected to play and contribution to the IDSST grant. The basis of IFAD – AGRA co-funding also played a critical role in enacting this partnership as both AGRA and IFAD had similar interests.
- **Identification of preliminary interventions:** AGRA's validation of preliminary intervention areas that were identified during the grant development phase, in this case SAPP, played a key role that enabled IDSST to identify the gaps in SAPP's long-term targets of ensuring that appropriate agricultural technologies and GAPs are screened and adapted for each agro- ecology. IDSST, therefore, addressed the identified gaps and challenges.
- **Investment in public-private partnerships (PPP):** IDSST has demonstrated the importance of the PPP model in delivery of seeds and soil health technologies to farmers by enabling DARS, a public institution leads the production of breeder seeds to directly partner with private seed companies, MUSECO and Global Seeds which eased commercialization of legume varieties which were released by research a few years ago but could not be accessed by farmers. The sub-granting of private seed companies such as MUSECO realized increased production and distribution of high quality pre-basic, basic seed and certified seed respectively to the farming communities in the SAPP districts.
- **Creation of complete input supply chain:** The agro-dealer model proved successful due to the partnership which led to an increase in the number of seed producers, input supplies and distributors, thereby reaching more consumers. The supply chain link resulted in an increased number of agro-dealers stocking and providing a variety of farming inputs to smallholder farmers in remote areas.
- **Increased seed producers enable more basic seed production:** The increased number of seed producers in the project enabled DARS to produce more basic seed, which in turn was purchased by private seed companies such as MUSECO and Globe Seeds. Future collaborations should continue to involve more seed companies so that farmers have choice. The benefit of this was evident when AGRA brought in Global Seeds in the final year of the project where some farmers opted for Global Seeds because they paid them on collection of seed. This brought some competition with MUSECO enabling farmers to access the best.
- **PPP promotion in seed multiplication encourages private seed companies to supply basic seeds to farmers:** The promotion of PPP in seed multiplication led to private seed companies supplying basic seed to the farmers in districts under contract farming arrangements. In return, the seed companies buy back the certified seed produced by farmer groups giving seed multiplying farmers a ready market. Training of community seed production groups also led to an increase in production of basic seed to meet the demand for new varieties among smallholder farmers. This will increase adoption and use of quality improved seed by farmers. The community seed production groups are connected to seed companies that are outlets for the certified seed.
- **Training agro-dealers in business, linking them with suppliers:** For a long time, many agro-dealers operated on a seasonal basis profiting only when there was demand for specific farm inputs. They lacked the financial literacy and business knowledge to enable them to operate long term and to re-invest to enable them to expand their businesses. IDSST allowed institutions to identify existing and new agro- dealers, train agro-dealers and retailers in business management, marketing and product handling and link them with bulk input suppliers. This has allowed some agro-dealers to benefit on a rotational profit basis which they invest into business expansion.

- **Awareness creation on high-quality improved seed varieties, other inputs:** While a minority of farmers still use uncertified seed, leading to low yields, there is potential to improve adoption of new technologies by farmers if more awareness is created. Under the IDSST model, RUMARK has been building the capacity of retail agro-dealers and linking them to hub agro-dealers. Through the partnership, district specific agro-dealer directories have been developed which show agro-dealer location, contacts and inputs that are stocked for farmers to access.
- **Training agro-dealers creates additional channels for knowledge access:** The agro-dealers who underwent training in business management and technical knowledge on proper use and storage of seed and agrochemicals by RUMARK, Malawi Pesticide Board and DCD provide complimentary over-the-counter services and advice to farmers at various points where farmers access inputs.
- **Joint planning and review meetings are key to learning:** Sub-grantees and implementing partners in the IDSST-PPP model benefitted from the joint review meetings, monitoring exercises, and AGRA's technical support and supervisions to strengthen weak areas of implementation. These meetings offered opportunities to share experiences among implementing partners.
- **Blanket promotion of grain legumes underestimates commodity market dynamics:** There is a need to promote grain legumes based on market appeal and to filter out and identify crops with a strong domestic and/or export market potential. For example, cowpeas are a non-starter. Mgomera Seed Company struggled to sell a huge stock of cowpea seed. In addition, there should be clear cut market interventions in the project design, including identifying contract buyers, partnering with organizations that have secured buyers, market information system, and supply chain management among others.
- **Demonstration plots and field days as key drivers of technology awareness among farmers:** Most farmers who participated were inspired to adopt the demonstrated technologies. Extension Planning Areas (EPAs) asked for between 20 to 30 demonstration sites pointing to a need to allocate adequate budgets in future to cater for demonstration plots and field days.
- **The agro-dealer business expansion favors hub agro-dealers:** Hub agro-dealers (big brothers) have different needs from smaller actors; they have the financial muscle to procure farm inputs and access credit facilities from input suppliers. It is important to support agro-dealers based on their financial muscle. Hub agro-dealers need linkages to financial institutions offering large credit facilities. They also require mentorship on the use of computer software for business management. Retail agro-dealers need mentoring and linkage to financial institutions offering smaller credit facilities. They also need to be linked to input suppliers offering credit facilities to enable them progress.
- **Media messaging to support project objectives:** Since radio is still the undisputed authoritative medium for communicating with farmers, future interventions must ensure that there is an adequate budget for radio messaging. It is also important to include partnerships with media organizations such as Farm Radio Trust.
- **Knowledge and information sharing forums support business linkages and agricultural productivity** among stakeholders. Farmers benefited a great deal from knowledge and information sharing forums that were convened by RUMARK and such knowledge sharing platforms must continue to be encouraged and used.
- **Need for a business approach to entrench and promote the role of village-based agents:** While deployment of village-based agents (VBA) and the linking of agro-dealers to farmers proved to be instrumental in promoting input sales, the incentive system remains underdeveloped for sustainability. There is, therefore, a need for a business approach where VBAs make money from the business they undertake for agro-dealers by being paid a commission for input sales deals concluded.
- There is a need to consider Quality Declared Seed (QDS) in Malawi, seed producers for wider availability of high quality and affordable seed.
- One of the bottlenecks that MUSECO faced during implementation of the project was that of inadequate funds to pay seed growers on time. Farmers also had challenges with accessing funds to enable them to invest in land, labor, seed, and chemicals. Future initiatives should aim at making funds available for paying seed growers and loan or grant facilities for farmers.
- Mobility was crucial during inspection and supervision of smallholder farmers due to the small

and scattered nature of their fields. The District Agriculture Offices played a vital role in inspection using their para seed inspectors to mobilize and monitor clubs and train farmers. It is important for such collaboration to continue if smallholder farmers will be involved in seed multiplication.

- Warehousing is critical for both seed companies and farmers groups and provision for such infrastructure funds should be considered. A warehouse would help farmers store their harvested produce in one place which would minimize issues of side selling.
- Despite the success achieved in strengthening seed distribution, farmers' agricultural incomes remain low and sporadic due to market fluctuations making agriculture unattractive as a dependable source of income. It is recommended that future programs seriously consider marketing as an integral part of the project design. Space should be provided for domestication of projects to allow for such changes.
- This being an agricultural project, some activities need to be tied to seasonality. Activities such as demonstrations must be aligned with the growing season and delay in funding negatively impacts the outcome of some interventions. However, this was mitigated through a granted no cost extension to cover for the lost time.

Recommendations for scale up

A three-pronged intervention entailing production (seed and agronomy), finance (credit/risk sharing mechanism/services) and markets (inputs/outputs/ farmer organizations/market information/supply chain management) is the way to go.

- Village based agents create linkages, increase demand for agro-dealers: Identifying and training for village-based agents (VBAs) created farmer linkages with agro-dealers in rural areas. VBAs were trained to assist in demand creation by setting up demonstrations and distribution of small packs to smallholder farmers to increase adoption of new crop technologies on the market. RUMARK championed the introduction of a platform which introduces farmers to trained agro-dealers as a way of creating business linkages. This has enabled VBAs to be the link between smallholder farmers and agro-dealers where they solicit input requirements from the smallholder farmers and liaise with the agro-dealers to supply the inputs.
- Improving supply distribution by linking with input suppliers: The linkages that were established between agro-dealers and input suppliers led to improved input supply distribution channels for smallholder farmers in the rural areas. The partnership between RUMARK and MUSECO has seen the latter supplying seed to hub agro-dealers who then distribute inputs to a network of agro-dealers in remote areas from where they are accessible by many farmers.
- Face-to-face interactions promote knowledge transfer and awareness raising: Farmer field-days proved to be key in raising awareness and in promoting new varieties and technologies. They provided a platform for knowledge transfer as farmers were able to interact and receive advice from research teams, agriculture officers and seed suppliers. Research teams and seed suppliers also had the opportunity to learn from farmers and receive feedback on the performance of new technologies, high quality seed and improved varieties. The field days also offered opportunities for creating linkages between farmers and trained agro-dealers within their localities. The type and nature of interaction during the field days pointed towards creating demand and awareness for agro-dealer services.

The project has been a flagship in demonstrating how gains achieved by public programs can be sustained. The engagement of MUSECO and Global Seeds to take up weaned community seed multiplication groups has guaranteed continued seed production for the farmer groups. This guarantees markets for farmers' seed and has unlocked opportunities for other services such as obtaining improved seed on credit and training. Some farmer groups have gone further to form Village Saving and Loans facilities.

Some of the factors pointing to continuity after the exit of the funders are:

- The available market and business opportunities will continue driving the demand, especially for groundnuts, soya beans and beans. However, while the market for cowpea is unclear, that for pigeon pea is unreliable.
- The fact that there is a network of community-based extension workers (lead farmers and village-based agents) to deliver farmer to farmer agronomic training will go a long way in ensuring that farmers are up to date with new technologies and their capacity is constantly built.

- The established business linkages between agro-dealers and farmers will drive the agro-dealer business to greater heights.
- The agro-dealer input credit facilities that have been established and extended to farmers will drive agro-dealer business for a long time.
- The pro-export government policy, such as the recent lifting of export trade restrictions on soya beans and other legumes, will stimulate export trade, which in turn will sustain high prices as incentives for farmers.
- The creation of farmer knowledge in the production of high-quality seed is a sustainable way to ensure continuation for the production of quality seeds.
- The two key partners, the agro-dealers and MUSECO, are private businesses and will continue to collaborate and exist if they make profits.

Conclusion

Despite the constraints to training and access that resulted from Covid-19 restrictions on movement, the project made a significant impact in linking smallholder farmers to improved inputs, and associated technologies. As a result, 86 new agro-dealers were certified in business management. These agro-dealers have also been trained in safe product usage and handling, product knowledge and good agricultural practices and are now able to provide inputs as well as impart knowledge to smallholder farmers about improved production practices through demonstrations.

The project has also developed a critical mass of 661 village-based agents who provided strong linkages between agro-dealers and smallholder farmers. Village-based agents assisted farmers in good agricultural practices that have significantly increased yields. The project, through agro-dealers, lead farmers and village-based agents were involved in the establishment of 149 demonstration plots in the project target districts as the principal activity for generating demand for yield-enhancing inputs among the agro-dealers' farmer customers.

The project also facilitated knowledge sharing and learning events for both smallholder farmers and agro-dealers where best agricultural practices among farmers were shared to encourage adoption.

On realizing the need for a sustained system of input supply, the project facilitated business linkage forums for agro-dealers and input suppliers with the aim of establishing long-term partnerships between the two parties that will facilitate a sustained flow of inputs throughout the input supply value chain. To this end, partnerships were forged and trust between agro-dealers and input suppliers restored as evidenced through the increased transactions between the two parties. The project rapidly increased customer base and business volume for agro-dealers.

The participation of the Private Sector in SAPP led to a great difference in seed multiplication. Farmers became aware of the market and price of the seed before production started, giving them an opportunity to make informed decisions.

3 Improving production and commercialization of cassava in Mozambique

Mozambique is the eighth largest producer of cassava in the world, producing an estimated 10 million tons per year. Along with maize, rice, beans and sweet potatoes, cassava is one of the most important staple foods and it is cultivated by more than 80% of farmers in rural Mozambique. In the north, it is mostly consumed as flour while in the south it is preferred as a *grate* (toasted cassava dough).

Most Mozambicans practice small-scale (subsistence) farming. Approximately 61% of the subsistence farmers are involved in cassava farming (TIA1, 2008). Cultivation of cassava is mostly in plots ranging from 0.25 to 2 ha. It has been shown that farmers would need to achieve 15 tons/hectare to be commercially viable, compared to average yields of between 5 tons and 9 tons/ha in Mozambique. (IDSST end of project evaluation). The lack of clean planting material, fueled by traditional methods of propagation which allow virus transmission through successive propagation is recognized as a constraint on production. As farmers begin to understand the effects of low-quality planting materials on yields, this has created high demand for disease-free planting materials in the cassava value chain which are not readily available.

The Pro-Poor Value Chain Development Project, PROSUL

The Pro-Poor Value Chain Development Project (PROSUL) is a project of the government of Mozambique that aims to improve livelihoods and the climate-smart resilience of smallholder farmers in the Maputo and Limpopo corridors through increased returns. The project area includes 19 selected districts in Gaza, Inhambane and Maputo Provinces. Its expected outcome is a sustainable increase in the incomes of farmers producing irrigated horticulture, cassava and red meat. A survey of small-scale cassava farmers was undertaken as part of the PROSUL implementation process to assess the production and impact of the commercialization of cassava in the southern region of the country. The survey data revealed several aspects related to cassava yield by area of production, varieties produced and market access.

Most of the farms surveyed produced 3 to 8 tons/ha despite the potential to produce over 40 tons/ha. There is, therefore, a need for introduction of improved varieties with high yield potential and sharing of knowledge on management techniques. The need for service providers operating in smallholder areas and delivering improved inputs and extension also stood out in the survey as did the need for promotion of farmer associations for better access to service providers and greater availability of market intelligence for smallholder farmers. Most farmers interviewed do not sell cassava while those who do, sell directly from their farms, possibly due to lack of transport to large markets. This highlights a skills gap in marketing to enable farmers create market alternatives for cassava.

IDSST in Mozambique

The IDSST grant addresses the production of high quality, disease-free cassava cuttings in Mozambique. A key goal of PROSUL is to address farmers' demand for clean planting material and increase sustainable returns to smallholder farmers in the cassava value chain through capacity building. The inception meeting and validation process for IDSST in Mozambique agreed to focus on the following areas:

1. Strengthen capacity of Mozambique Institute of Agricultural Research (IIAM) – laboratory facilities and green houses to ensure production of higher volume and health materials of cassava seedlings using tissue culture technologies.
2. Promotion of post-harvest and good agronomic practices for cassava
3. Strengthen agribusiness linkages for cassava.

IDSST engaged the following strategic partner institutions:

1. Instituto de Investigação Agrária de Moçambique (IIAM)
2. KULIMA, a local NGO in the development sector
3. Universidade Eduardo Mondlane (UEM)

These strategic partners worked together to conduct multiple trainings to enhance the capacity of public

and private extension service providers to impact farmer groups, commercial and emergent small-scale farmers with the skills and knowledge for increased productivity including the adoption of improved cassava varieties and integrated soil fertility management practices to increase crop productivity.

Program Components

Increased cassava production through increased capacity of other cassava seed value chain actors

Stepping down agribusiness training: Extension officers and VBAs/CAEs were trained in agribusiness under this component with the aim of strengthening the cassava value chain. Once trained, they were given the responsibility of cascading the training to other groups of farmers and processors.

Deepening participation in the cassava value chain: This component seeks to cascade knowledge, business skills and capacity to smallholder farmers through training provided to a core group of extension officers, cassava processors and Village Based Agents (VBAs) also known as community agribusiness entrepreneurs (CAEs) so they are able to engage with the value chain. The package included business planning, partnerships and sources of finance. The trainees are also taken through processing and commercialization of cassava root and its derivatives as well as simplified accounting, business strategy, registration and management of trademarks and labelling. This group of trainees then has the responsibility of stepping down training for other farmers.

Stepping down agribusiness training: Extension officers and VBAs/CAEs were trained in agribusiness under this component with the aim of strengthening the cassava value chain. Once trained, they were given the responsibility of cascading the training to other groups of farmers and processors.

Increased access to disease-free cassava planting materials

Production of disease-free materials: Under this sub-component the cassava tissue culture project had the mandate of generating enough disease-free cassava plantlets to feed the seed value chain so that smallholder farmers could access clean planting material. New disease free, tolerant and high yielding varieties of cassava were introduced, multiplied and made available to farmers. Massive multiplication of improved cassava varieties: This sub-component focused on training cassava seed producers, including extension workers, field and laboratory technicians on the massive multiplication of seedlings in the laboratory as well as the establishment of primary fields for basic seed multiplication.

Building the capacity of extension systems in the Limpopo and Maputo areas to ensure increased cassava productivity through the use of improved inputs and access to markets.

Promoting the adoption of improved technologies through strengthening knowledge and building capacity of extension agents: This sub-component sought to address the low adoption of improved technologies among smallholder cassava farmers by enhancing knowledge and capacity of public and private extension officers on the right seeds, fertilizers and other inputs, good agricultural practices, providing technical assistance to farmers and growing farmers access to input markets.

This sub-component was part of improving knowledge and skills of cassava actors which include cassava processors for processed cassava derivatives as a contribution to improved food security and incomes among smallholder farming families.

Implementation framework of IDSST in Mozambique

IDSST awarded three sub-grants to support PROSUL in 11 districts of Mozambique, namely:

i. Increased cassava production through increased capacity of other cassava seed value chain actors

ii. Increased access to disease-free cassava planting materials

iii. Capacity building of extension systems in the Limpopo and Maputo areas to ensure increased cassava productivity through the use of improved inputs and access to markets.

The three components were implemented through sub-grants to:-

1. Instituto de Investigação Agraria de Moçambique (IIAM), a government research organization
2. KULIMA, a non-governmental organization
3. Universidade Eduardo Mondlane (UEM)

Building the capacity of extension systems in the Limpopo and Maputo areas

The goal of strengthening the extension system is to reach more farmers with the requisite knowledge, skills and technologies to scale up cassava productivity. In the Limpopo Corridor, the production and processing of cassava is mostly for subsistence, with yields of 4 tons to 8 tons/ha against a potential of 15 tons to 35 tons/ha from the new improved varieties. The role of extension agents in stimulating adoption has proven essential in the process of dissemination of improved agricultural technologies among smallholder farmers. The project conducted multiple trainings in order to enhance the capacity of public and private extension service providers to impact farmer groups, commercial and emergent farmers with the skills and knowledge for increased productivity including the adoption of improved cassava varieties and integrated soil fertility management practices to increase crop productivity. Under this project a lot of focus was placed on disease diagnosis, prevention and treatment in cassava production. The extension officers were also equipped to assist those cassava farmers mainly involved in seed production. To achieve its objective, KULIMA worked with BINDZU, IIAM and Biochem to develop training materials for the extension agents and VBAs/CAEs. The theoretical training was delivered by BINDZU, IIAM and Biochem while the practical training was done by the Servico Distrital de Actividades Economicas (SDAE), Mozambique's public extension service, that also oversaw the establishment and development of mother and baby demonstrations by the extension agents and VBAs/CAEs.

Of the 28 extension agents and 154 VBAs/CAEs reached respectively, the training covered cassava production and marketing in Gaza and Inhambane provinces. The VBAs/CAEs training had a multiplier effect since each VBA/CAE trained about 20 farmers, who in turn trained 5 farmers, accruing to a total of 15,400 beneficiaries. Mother and baby demonstrations were established for awareness creation on the technologies. In total 154 mother and 3,600 baby demonstrations of improved varieties and fertilizers were established by KULIMA. Out of the mother demos established 28 displayed varieties and use of fertilizers while the remaining 126 focused on use of improved varieties. In addition, the project introduced/disseminated 3 improved and cleaned varieties of cassava (Umbeluzi 2, Tapioca and Chinhembwe) that benefited a universe of 18,200 farmers. Data from 2800 demonstration plots indicates an increase in varietal yields of cassava from 4 T/ha - 8 T/ha under farmer practice to 15 T/ha - 20 T/ha under farmer-managed research trials. KULIMA was also involved in linking farmers to markets in the districts of Bilene, Homoine, Limpopo and Chibuto. Extension agents and VBAs/CAEs were trained on different topics such as fertilizer application in cassava production, the establishment of mother and baby demonstrations, seed production and use of best agricultural practices.

Market-oriented interventions for the cassava value chain

The absence of linkages and contracts between cassava farmers and processors/buyers has impeded production and the development of markets. Limited access to formal markets for cassava roots and derivatives has also affected cassava production and the fact that prices are generally fixed by middlemen and retailers who have nothing to do with production has kept prices low and out of sync with production costs, hence weakening the cassava production chain. Processors/buyers also grapple with lack of packaging materials because there are no suppliers at the local level and those that are available sell in large quantities, which farmers cannot afford. This forces farmers to travel all the way to Maputo to buy packaging materials. At the time IDSST started, the government of Mozambique was already implementing the Cassava Value Chain Development intervention as part of a large IFAD project called the Value Chain Development Project in the Maputo and Limpopo Corridors. These cassava value chain interventions targeted 8,000 farmers organized in about 300 groups for the six-year implementation period. AGRA's involvement was to fill the gaps in the PROSUL project especially in the area of building business skills of farmers.

This was done through the sub-grant to Universidade Eduardo Mondlane (UEM) Faculty of Agronomy and Forestry Engineering who worked in collaboration with the School of Business and Entrepreneurship of Chibuto (ESNEC), BINDZU and Fundo de Desenvolvimento Agrario-Prosul (FDA-PROSUL) to implement the project in 7 districts of southern Mozambique, and 2 in Gaza province (Chogoene and Manjacaze) and 5 in Inhambane province (Zavala, Inharrime, Jangamo, Morrumbene and Massinga).

Agribusiness training

At the beginning of the project, staff from Eduardo Mondlane University trained VBAs/CAEs and extension officers equipping them with business skills and building capacity for best practices in cassava processing.

These business skills sessions were attended by 28 extension officers, 38 leaders of cassava processors and 38 Village Based Agents (VBAs) also known as community agribusiness entrepreneurs (CAEs). The training packages were proposed by PROSUL and included business planning, partnerships and types of financial sources. The trainees were also taken through processing and commercialization of cassava root and its derivatives as well as simplified accounting (such as cost determination), estimation of business earnings and strategy for market prospecting for cassava and its derivatives. Lastly, they were taken through registration and management of trademarks and labelling. The training simplified business planning and included on-farm sessions to allow participants to better absorb the content and to enable the participation of women who could not travel long distances or leave their homes for long periods of time. At the end of the training, about 1,844 farmers belonging to 52 groups had been trained. Some of the trainees were involved in cascading the training to other groups through step-down training sessions.

Step-down agribusiness training for processors and cassava farmers

Trained VBAs/CAEs and extension officers were given the responsibility of cascading the training to other groups of farmers and processors. However, due to the lack of resources not all the VBAs/CAEs were able to undertake the assignment. In the end, 23 processors (14 women) belonging to 12 groups of processors were trained. Of those, 11 groups of processors came from two districts (Massinga and Mabalane) of Gaza province that did not benefit from the previous training program of the project. The group received training in hygiene and safety practices for cassava processing and elaborate business planning. In total about 831 cassava farmers, 68% of them women, were trained by VBAs/CAEs and extensions officers during implementation of the IDSST grant. More could have been trained but the number of training sessions and participants was reduced due to the COVID-19 pandemic. The 831 are drawn from cassava farmers groups that link back to 8,032 farmers. A second session of step-down training took place at VISECO Association, Manjacaze district, Gaza province where about 70 participants, including 24 women, belonging to eight farmers groups were trained. The training was on best practices in production recording and the elaboration of a simplified business plan.

Hygiene and safety in cassava processing units

PROSUL supported 17 processor groups with cassava processing machines. Of these, 13 were using equipment for the first time in their operations. After the installation of units at the premises of Maita and Josina Machel associations, two machines were used to train other cassava processor groups in project implementation regions. The training focused on best practices in hygienic and safety during cassava processing and will enable the processors to migrate to the mechanized processing units. Safety was a big component of the training as mechanization poses a risk of accidents to operators as does the switch from firewood to gas as a source of energy. Participants were supplied with safety kits including glasses, gloves and sound protectors and hygiene kits that enable them to meet hygiene standards and access formal markets. In total, 103 participants belonging to 27 cassava processor groups were trained.

The project also supported the certification of cassava processing units and their derivatives and linked them to markets. While the traditional procedures could only handle a small quantity of about 500 kilograms a month, the processors have added value to cassava. The mechanized cassava units will now handle six tons of cassava roots per day. The 18 cassava units that have been established will demand 9,000 tons of cassava roots leading to production of 3,000 tons of rale. The potential demand of roasted cassava root in the southern part of Mozambique is around 30,000 tons per year representing a demand of about 90,000 tons of cassava root.

Equipping farmers and processors with record-keeping skills

Keeping records is crucial for any business. Records enable farmers and processors to evaluate their profit, to record the history of the business and allow for traceability of produce. A total of 59 processors were trained on production recording - 52% of whom were women belonging to 20 groups of cassava processors.

Improving cassava processing

Other than training, some of the farmers were supported to ensure their working conditions complied with market requirements. Since one of the requirements for cassava certification is to show evidence of quality control of cassava roots and the derivatives, two masters students of Food Technology sampled and analyzed roasted cassava roots (rale) from the Josina Machel unit to see if the moisture and cyanide content met safety standards. The results showed that the rale was of good quality and safe for consumption. To increase the production capacity of dried cassava chips purchased by the Mozambique Good Trade, 30 solar dryers were designed and

produced to improve the process of drying cassava. The 30 units were distributed to four cooperatives, namely Josina Machel received 10 units, Maita received10 units, Zama received 5 units and Licaca received 5 units. The 10 trays given to Josina Machel allows them to increase their capacity for processing of cassava roots into dried chips from 200 kg to 1,000 kg per week. The project also supported the design of packaging labels, registration of product labels, acquisition of the first batch of labelled packaging bags and rale quality certification of the Josina Machel cassava processing unit. The bags, which will be produced once results of quality from national accredited laboratories are out, will include a stamp to indicate that the product is certified.

Cassava market study demand

The results from the cassava market demand study show that the total official record of actual cassava demand (Industrial use and household consumption) for cassava roots in the southern part of Mozambique is 48,000 MT. This quantity is just 10% of the potential cassava roots production in this region, since most of the cassava produced by farmers is for their own consumption. The project promotes the diversification of cassava roots with the potential for use in the baking industry. Should the baking industry adopt cassava roots start to be used in the baking industry this has the potential to replace wheat flour I ports by between 10% and 20 %, corresponding to potential use of cassava roots of 300,000 MT. The starch unit in the north of Maputo that intends to use cassava roots as raw material has an annual demand for 60,000 MT. Cassava is also processed with stable products such as *rale* using traditional procedures. The mechanized cassava units that are promoted in this project can handle between 2 MT and 6 MT of cassava roots per day. The 18 cassava units that are currently established can process between 6,000 MT and 9,000 MT of cassava roots corresponding to a production of 2,000 MT to 3,000 MT of *rale*. The potential demand of *rale* in the southern part of Mozambique is around 30,000 MT per year against availability of about 90,000 MT of cassava roots. In conclusion, the potential demand for cassava roots in southern Mozambique alone is about 400,000 MT, and what is needed are improvements to the market structure for cassava.

Producing high quality planting materials from tissue culture

The project introduced three varieties of cassava crops, namely, Chinhembwe, Umbeluzi 2 and Tapioca, which were clean from diseases and disseminated to farmers. Demonstration of the advantage of these varieties was important; for example, Chinhembwe is an old variety, good for yields, and although farmers like it more, it has problems with disease susceptibility, especially cassava mosaic even as seed was multiplied. Eighteen laboratory technicians from the biotechnology and molecular biology fields were then trained on disease free cassava plant production by experts from Eduardo Mondlane University and Tanzania Agricultural Research Institute. The training also covered enhancement of tissue culture protocols and was able to improve the skills of IIAM lab technicians to enable them to produce and handle high quantities of disease-free plantlets, with greater efficient use of time and resources without affecting the quality of the generated materials.

Also trained were extension officers and seed farmers from Gaza and Inhambane provinces. The training also built the capacity of laboratory technicians for acclimatization during lab-to-land transfer of plantlets which requires special attention as well as for standardization of tissue culture protocols. Training also covered procedures for avoiding the spread pests and diseases from the field of origin when harvesting stems to serve as seed elsewhere. In addition, the skills of laboratory technicians for development of and acclimatization procedures was also advanced. The project was able to rehabilitate two greenhouses including installation of a complete irrigation system for pre-acclimatization and replacement of the roof. With the greenhouses rehabilitated and the capacity of trainees expanded the production of cassava plantlets increased from 3,000 to 10,000. With irrigation in place the plantlets from the laboratory can now go to a research station or to a seed producer. So far, 5.55 ha of disease-free cassava have been established, 1.5 ha in Maniquenique, 2.13 ha in Chókwè Research Stations in Gaza province and 1.42 ha in Nhacoongo in Inhambane province. Recognizing the powerful catalytic role of extension officers in fast-tracking dissemination research outputs and agricultural knowledge to farmers and seed growers, the cassava tissue culture project also trained 54 extension officers in Gaza and Inhambane, mainly focusing on disease diagnosis, prevention, and treatment in cassava production along with building their capacity to provide technical assistance to farmers

and expanding farmers access to input markets. The extension officers were also equipped with the knowledge and skills to assist cassava farmers involved in seed production.

To achieve good yields in the cassava value chain, the production of top-quality cassava seed cuttings is important. UEM in collaboration with IIAM held three training sessions in three districts namely, Manjacaze, Inharrime and Massinga where seed cutting producers from the seven districts learnt about the cassava varieties recommended for southern Mozambique. The trainees also went through training on good agricultural practice for the entire cassava production system including cropping, harvesting and conservation of cassava seed cuttings, seed cutting certification standards and inspection. In total, 52 cassava seed producers were trained, 15% of them being women. The seed producers have been playing the role of VBAs/CAEs.

The implementation of the project has led to capacity building for all stakeholders in the entire value chain, starting from the production capacity of the research institutions to make the disease-free planting material available, to the awareness creation for smallholder farmers as well as processing and marketing of the product. Among the notable achievements, 30 of the trained cassava seed producers have had their fields certified and each producer has a capacity to produce about 80,000 seed cuttings, sufficient for 8 ha of cassava. The area using certified seed will therefore increase from 240 ha to 400 ha.

About 4, 000 ha of farmland will be planted with cassava for commercial purposes with an estimated output of 40,000 tons of cassava root. Among the notable achievements, 30 of the trained cassava seed producers have had their fields certified and each producer has a capacity to produce about 80,000 seed cuttings, sufficient for 8 ha of cassava. The area using certified seed will therefore increase from 240 ha to 400 ha. Also worth noting is that on average, individual smallholder farmers cultivate up to 2 ha of the crop and that 2,009 farmers have received agribusiness training.

While 52 farmer groups were directly assisted in business plan development, 27 groups of cassava processors comprising a total of 103 individuals were trained on production recording and assisted to develop business plans. Eighteen have received support from PROSUL and 11 were supported by FAO. Of these groups, 18 have fully functional processing units and are ready to absorb about 9,000 tons of cassava roots with five groups among them already producing and processing certified cassava derivatives.

Limitations and challenges

The challenges and limitations encountered during implementation are explained below.

- Reliance on rain-fed agriculture put project initiatives at risk. About 15% of mother plots and 50% of baby plots were lost when rains failed during the cropping season.
- While initially designed for 7 districts, the inclusion of 4 other districts (Bilene, Limpopo, Chibuto and Homoine) after an agreement between AGRA, PROSUL and KULIMA, increased the coverage area and stretched the project. This led to KULIMA partnering with BINDZU to include trainings such as business skills and linking farmers to markets.
- The project timeframe was too short to ensure that it delivered to on the expected results and outcomes.
- The process of getting products certified for quality and safety is normally complex and expensive (USD 2,000 for three years) for smallholder farmers and processors.
- The cost of transporting cassava roots and its derivatives remains a big deterrent for farmers due to the high cost involved and needs to be addressed.
- The cassava tissue culture project had the mandate to generate enough disease-free cassava plantlets to feed the seed value chain in order to allow smallholder farmers to have access to clean planting material. However, the IIAM tissue culture lab had no cassava plantlets in stock, which forced the researchers to take the long route of multiplication through the eight stages of tissue culture production- each taking between 40 to 90 days. However, the process could be shortened with a fully functional in vitro germplasm bank with 10 to 20 flasks of each required variety.
- The time required for external licensing processes was not factored into the project cycle necessitating the deferment of certain activities. For example, the correct certification and packaging of cassava products with bar codes helps ensure a ready market. However, in order to be certified, processors must have operated for at least six months, a timeframe that was not provided for in the project.
- Restrictions imposed by the COVID-19 containment measures affected the schedule of activities, forcing the indefinite postponement of some activities.

Key lessons and recommendations

Some of the lessons learned that could benefit future projects and planning or be addressed to support scale-up include:-

- Learning-by-doing is a powerful approach and delivered messages well, allowing for discussion and analysis of topics that fit the specific needs of each group of farmers.
- It was observed that organized and structured farmer groups had better results when negotiating prices. Supporting and strengthening farmers groups as they convert to associations is worth the investment. There is also a need to institutionalize the cooperative movement.
- Training farmers in a conference set-up ended up limiting the number of possible participants and instead accommodated many people that were not implementers. This limited the opportunities for knowledge sharing. On the other hand, training in-field benefited the right people and allowed many others to join and learn at once.
- Project timeframes should also consider the crop production cycle to enable full-cycle hands-on learning for participants. In this case the project start date was not aligned to the cassava production cycle.
- Activities must be closely coordinated and sequenced to ensure the smooth running of the project. For example, combining capacity building with the production of plantlets consumed a significant amount of time allocated to project implementation because some activities were tied to trainings and could not proceed until the actual trainings took place.
- Procurement of certain rare items such as the 24 reagents required for tissue culture takes time and must be factored into project design. Tissue culture is highly dependent on laboratory reagents which must be purchased at the beginning of the project to avoid interrupting the process and resultant great loss of plantlets. Disbursement for items such as tissue culture reagents should not be done in phases.
- Inconsistent purchasing by buyers who come and go without notice discourages producers, creates instability in production and makes cassava unattractive to large industries. Committed buyers and other demand creation structures will encourage production. On the other hand, the cassava derivatives produced by small processors are too small to attract big markets.
- Low prices are unattractive and leave farmers disinterested about selling. Structuring the processing and marketing capacity will increase the demand for cassava roots and encourage farmers to invest and get return on their investments. Since instability in production also works against industrialization, there is a need to stabilize production to enable commercialization of cassava production.
- The fact that cassava has a long development cycle of about 12 months requires commitment between producers and buyers to a level that encourages farmers to cultivate the crop. Likewise, any cassava business planning project that seeks to ensure a market for sub-products needs a lead time of at least three years of implementation, considering the length of time for cassava production which must then be followed by processing, certification and lastly, marketing.
- In order for processing standards to improve, the current approach to management of associations must be overhauled and skilled workers hired to offer leadership and fully utilize the resources to generate revenue that benefits the associations.
- Establish a platform for cassava actors at all levels to facilitate the discussion of cassava value chain issues.
- There is a continuing need for business training for farmers. Going forward this should expand to include learning on how markets function in terms of price variation and fixation and the formation and organization of cooperative entities. Inclusion of new processing methods in the training will also give farmers more post-harvest alternatives.
- Access to packaging is a gap that remains unfilled in the value chain and hampers farmers' ability to get to market. This should be addressed.
- There is a need to expand the establishment of small production units for cassava.
- Incentives for the establishment of cassava-related industries will avoid monopoly, promote local consumption, give incentives to export cassava derivatives legally and provide guidance for quality certification.

- During processing, sub-products that can be reused, such as starch from wastewater derived from cassava pressing, should not be discharged.
- The use of solar driers should be scaled up.

Towards sustainability of the outcomes

- The activities of the project are linked to the government project (PROSUL-PROCAVA) and this augurs well for their continuation.
- UEM continues to support the Josina Machel cooperative which has emerged as a group that is committed and has the capabilities to assist other farmer organizations offering a model for the continuation of ongoing activities.
- Through PROCAVA, more cassava processors can be granted official quality and safety certification.
- The fact that public extension services are delivered through the SDEAs ensures that cassava production and technical support is assured and articulated with IIAM as a supporting research institution and entrenched in the PROCAVA project.
- The efforts put in place to implement an integrated approach whereby the public and private sector are involved, together with market actors, extension agents and farmers makes it more connected and builds stronger interrelationships among stakeholders that will drive continuity of the program.

Conclusion

Despite limitations and constraints, the project achieved much of what it set out to and in the long run it will benefit cassava farmers and processors by increasing their income through access to formal markets and expansion to overseas exporting markets of the cassava roots derivatives.

The project resulted in the training of 84 personnel, eight of whom are agriculture extension officers, 38 VBAS/CAES and 38 cassava processors. These trained personnel took part in the expansion of training of other farmers and processors in different PROSUL implementation regions. In addition, 50 cassava seed producers have been trained in the best practices of cassava seed production and assisted to develop business plans. Of the 50 producers, 30 have had their fields certified. Each producer has a capacity to produce about 80,000 seed cuttings enough to plant 8 ha of cassava. The area using certified seed is therefore projected to increase from 240 ha to 400 ha. In the absence of private sector capacity to multiply cassava seed, the strategy is to train emergent farmers to produce seed that will then be sold to other farmers. The government of Mozambique continues to provide office space for the development of research activities, funds, breeding activities and breeder seed with limited funds. PROCAVA, which is the successor project for PROSUL in Mozambique, is now promoting Chinhembwe, Amarelinha, Umbeluzi-2, and Tapioca.

As in Ethiopia and Malawi, COVID-19 presented serious challenges to the implementation of the grants in Mozambique. The government declared a state of emergency and put in place stringent measures banning public gatherings of more than ten people. Major markets were closed and restrictions were imposed on mobility. These restrictions affected the execution of IDSST grants. For example, it delayed the training of seed producers in post-flask handling and the establishment of cassava multiplication fields. The interruption led to delays in the delivery of seed from acclimatization to producers and return, thus affecting the quantity of cassava cuttings produced. Restrictions on mobility and the closure of main markets also affected the flow of fresh cassava tubers from rural to urban centers.

Training of farmer groups on various aspects of cassava production and marketing had to be put on hold, slowing down the training and certification of 12 cassava-processing units for market linkages. Business linkage meetings between partners, cassava producers, cassava farmers, cassava processors and buyers were also delayed. Field days that were meant to promote the best seed and soil fertility management practices in cassava production were postponed.

End Note

Combining competencies and resources to create value in partnerships

The long-standing partnership between IFAD and AGRA is anchored on the shared goals of improving food security and increasing the incomes of smallholder farmers and SMEs. In deploying a combination of their complementary competences and capabilities to support governments and the private sector in the implementation of the IDSST grant became the trigger for agricultural development that benefitted smallholder farmers in terms of accessing quality seed and soil fertility technologies as well as markets. The project has also attracted private sector investments to government funded programs, thus promoting sustainability and increased government engagement.

The implementation of the IDSST grant was not without its challenges, related to inadequate farmer coverage and penetration linked to the number of demonstrations implemented. It was noted however, that farmers still faced problems accessing high quality planting material. The seed volumes distributed were also insufficient for all the producers while varietal problems persist. For instance, in Mozambique, Chinyembwe is an old variety, good for yields, and although farmers prefer it over other varieties, it has problems with disease susceptibility, especially cassava mosaic. In addition, budgetary and time constraints, as well as COVID-19 restrictions had a serious impact on the project's implementation and achievements.

Despite these challenges, the end of project evaluation concluded that the project was relevant and well-designed and had demonstrated that IDSST interventions generally had fairly positive results that fed into the overall project's goal of a more competitive cassava, maize and legumes value chain in Malawi, Mozambique, and Ethiopia respectively, thus creating a measure of impact around the following two key areas:

- Increased efficiency of government research and development functions that have successfully supported seed and ISFM technology development, release, and dissemination.
- Increased private sector actors' roles and capacity in developing and disseminating improved seed and fertilizer technologies.

In addition to the specific lessons learned from implementing activities that are summarized at the end of each chapter of this publication, IDSST created valuable learning opportunities within the IDSST grant.

It is also worth mentioning some of the cross-cutting issues in the three countries that the IDSST grant brought to light. Firstly, the success of Public-Private-Partnerships established under IDSST has strengthened partnerships with Governments, national agricultural research systems, seed companies, financial Institutions, international research organizations, farmers, and farmers' cooperatives in all the three countries. With the success of these partnerships, AGRA has proved to be an effective go-to partner for implementation support to deliver results effectively and efficiently.

Although it was apparent that the frequent consultations and engagements between AGRA, IFAD and respective Government Implementing partners were key to the success of the IDSST grants, however, future partnerships call for earlier and timely engagements between partners for co-creation based on the identified gaps. This would be preferable at either validation or baseline stage. However, the sub-grant sizes need to be informed by an assessment of the gaps: In this case, grant amounts had to be adjusted in the range of between USD 75,000 to USD 120,000, and above.

Secondly, the development of delivery systems, access to inputs and how farmers successfully used and replicated AGRA's Village-based Advisor (VBA) extension approach in all three countries leading to the success of the project. In addition, farmers' access to modern labor-saving technologies such as the mechanization of cassava operations in production and processing were responsible for the enhanced adoption and positive impacts.

Lastly, the capacity building and refresher courses for farmers, farmer organizations, extension workers, training organized for laboratory technologists led to improved capacity. However, just as important is the

recognition of market access as a critical success factor for any agricultural technology. In this regard, the IFAD loan projects in target countries ought to be backed by market-oriented interventions, including micro-processing and effective off-takers.

The adoption of new agricultural practices by farmers is a process that takes time to understand, accept and adapt to, and the project was also hampered by the short implementation period, leading to a reluctance by some of the farmers to accept the various technologies being promoted. A lesson learned from all three countries is that the project required at least three years, perhaps an even longer period. However, on a more positive note, the awareness already created by the project will lead to adoption of the lessons in the coming years.

IDSST spurred a fair number of improvements on seed systems, soil fertility technologies and the production system in general. These improvements are visible across the national seed value chains by building the capacity of private seed suppliers, government research and regulatory agencies, and seed producers, especially in Malawi and Mozambique. Through logistics and infrastructure support and public-private coordination, the project eased the access constraints faced by smallholder farmers. As a result, the demand for certified seed has grown, with its use rising from 10% of total seed use in 2017 to more than 27% in 2021 in most of the project areas. Significantly, these efforts have also improved partnerships between private seed companies and public research and regulatory institutions.

The project was able to identify and invest in the best-fit soil fertility management technologies available for legumes and cassava. However, the project has been unable to scale these for maximum impact among project beneficiaries, partly due to the short duration given to the sub-grants awarded under the project as well as the COVID-19 pandemic. On a positive note, the project was noted for the significant investments made in raising awareness on soil fertility and integration with improved seed systems.

Throughout, the IDSST grant adopted the use of farmer-friendly technology dissemination mechanisms. Yield enhancing technologies were disseminated largely through farmer-managed demonstration plots and field day events mounted at those sites across the hundreds of demonstration plots established under IDSST. To improve soil health, farmers' productivity, and incomes in the three countries, IDSST teams combined the promotion of certified seed use with intensive messaging through awareness campaigns and demonstration of ISFM technologies and their benefits. ISFM strategies centered on the combined use of mineral fertilizers and locally available soil amendments and organic matter to condition the soils and in some cases, to replenish soil nutrients.

In terms of project efficiency and value for money, the evaluation considered the fact that IDSST was a "testing-of-proof-of-concept" project. Another contextual factor was that AGRA's focus in the IDSST grant was crop productivity, earmarking production, and distribution of early generation seed. Therefore, although the project had limited resources in terms of budget and time, its reach was ambitious.

Market-led adoption of project interventions, especially with seed systems, is a key sustainability pathway and the adoption of project cropping systems has been satisfactory. The interventions are likely to be continued by key stakeholders (among them farmers, seed companies and agro-dealers) due to the demonstrated opportunities. Farmers have seen a strong market opportunity to grow some crops like soya bean and groundnuts, while agro-dealers see a large and growing market for farm inputs, seed, and fertilizer. In Malawi, seed companies under-delivered seed due to the high demand stimulated, hence this could be a significant trigger for increased seed production.

Sustainability

The project bears a strong element of sustainability. The gains from IDSST could be transitioned into the new IFAD investments; among them, PROCAVA in Mozambique and TRADE in Malawi. Although the IDSST grant has ended in Mozambique, field multiplication of cassava is continuing under PROCAVA. With academia, public research institutions and the public extension services in the districts engaged in the project's focus, the promotion of cassava as one of staple food crops in the south and northern regions has necessitated the engagement of village-based advisors (VBAs) who will continue supporting smallholder farmers in the observance of good agricultural practices (GAPs) for crop production. In turn the VBAs will be supported by the public extension officers who also have an interest in the development of the cassava value chain. Further, the two main public research institutions, the Instituto de Investigação Agrária de Moçambique (IIAM) and Universidade Eduardo Mondlane (UEM) will continue providing support to both smallholder farmers and SMEs, as well as integrating public extension services, even as

PROCAVA sustains continuity through its investment in the cassava value chain in the realization that cassava is an emerging opportunity for SMEs with the potential for generating substantial incomes through value addition.

Furthermore, the IDSST grant has paved the way for opportunities for innovation and scaling up lessons learned in other countries like Kenya and Rwanda.

An example is Self Help Africa (SHA) in Ethiopia, that received a sub-grant to roll out soil fertility management focusing on strengthening research-extension linkages through capacity building of Farmer Training Centers (FTC) for the promotion of soil fertility technologies and blended fertilizers in the regions covered by the Participatory Small Scale Irrigation Development Program (PASIDP). Accordingly, SHA has since attempted to incorporate some of the project activities as a cross-cutting feature to other agricultural projects as well as aiming to work on a full-fledged stand-alone ISFM project.

Further evidence of sustainability is found in the IDSST grant's activities in Malawi that have started bearing results. The IFAD country support program is now linked to AGRA- supported private sector partners for the sustainable delivery of seed and fertilizers. A good example is IFAD's Sustainable Agricultural Production Program (SAPP) target beneficiaries, that are already benefiting from AGRA-supported seed companies and agro-dealers. Another score for IDSST's sustainability came about through linking the IFAD loan program to private sector players, among them, MUSECO, a private seed company working with SAPP beneficiaries to produce certified seeds.

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Annex I: Milestones of the CA-CSA capacity building

Reconnaissance visits to PASIDP II target regions were conducted in July 2019. The team used the visit time and interactions with *woreda* level members and other stakeholders to understand the status, necessary interventions, and roles of the various parties towards enhancing capacity building and advancement of CA practice in Ethiopia.

The assessment found out that:

- Target regions were characterized as highly vulnerable and erosion prone with steep highlands and high population density especially in the plateaus.
- People had a mindset which:
    - Considered not tilling the land as a character of lazy farmers.
    - Considered CA to be an Herbicide Technology that is bad for the environment.
    - Confused ISFM and CA and the many technologies and practices introduced rapidly, like No-till, Cover-crops, Mulching, Green-Manure, Vermi-compost, and Hydroponics etc.
- There was limited knowledge about CA and misconceptions due to limited training & CA practice: Only a few days of training had been received by barely 1% of Extension Agents in the regions visited.
- Training had been mostly in Knowledge (What) i.e., the theory, not in Attitude (Justification) and Practice (How) for self-proof and sustained advancement.
- There was a high livestock population seemingly inconsiderate of farm carrying capacity and observable overgrazing. There was high competition for crop residue between animal feed and soil cover. Crop-Livestock Integration would be an important learning subject and practice for the CA Capacity Building process.
- There was limited access to new and CA Crop and Cover-Crop seeds and inputs, some of it due to Federal Government managed supply systems which were reported as inefficient and insensitive to the CA needs of smallholders.
- There were huge value chain gaps in the overly traditional (non-mechanized) subsistence farming practices, poorly linked to markets and incapable of competing in a globalizing world.
- To progress faster, CA practice in Ethiopia (like elsewhere in Africa) needed modern mechanization to counteract the drudgery in farming operations, soil, and environmental destruction practices etc. Mechanization business models that have worked elsewhere in the continent (and beyond), would need specialized attention and introduction.
- There were loose links between CA and CSA, between the place for gender and youth, research interventions and private sector, job creation and employment, among other development considerations. At the conclusion of the Field Assessment, it was clear that these factors would be important as cross-cutting considerations to feature in all modules, to bring out a more holistic approach.

The CA capacity building team also found the following strengths:

- An ambitious development plan and change of attitude backed by a needy Government Extension Service.
- The launch of CA Extension Guidelines in December 2018.
- The ability of the government to lead the planting of 350 million trees in 12 hours and clear interest in seeking more and sustainable ways for environmental protection and conservation.
- The government's recognition of the need for a stronger private sector to take-on seed and other input banks.
- A country with some 24,000 CA practicing farmers (reported by CFGB, 2019) and ready to be supported to create an agribusiness momentum and venture.
- Government programs that are backed by strong and committed NGO and INGO partners to help drive the CA value chains, links to Markets and Movement such as Sasakawa Global 2000, Africa Conservation Tillage Network (ACT), CIMMYT, ICARDA, Canadian Food Grains Bank (CFGB), Self- Help Africa, GIZ, TechnoServe and others.

ANNEX II: Proposals for entrenching National CA-CSA Movement

The CA manual developed for the CA-CSA movement is inclusive, taking a farmer, landscape, sectoral and value chain approach around this resource and the need to plan the next steps for CA and CSA advancement in Ethiopia.

Recommended actions for formalizing the CA-CSA movement

- Organize an inclusive CA-CSA national conference of stakeholders, followed by regional level CA-CSA conferences to ground and popularize the proposed Ethiopia CA movement by:
    a) Establishing a CA-CSA movement coordination desk and stakeholders committee at and operating from the MoA.
    b) Involving all CA-CSA and value chain stakeholders from both the public and private sector.
    c) Holding extensive field-visits for interaction with ground-level actors at every opportunity.
    d) Developing action plans for the movement at all levels and mobilizing adequate resources from ongoing and new sources.
- Support *woreda* level trainers (trained by AGRA and other stakeholders) to perfect and resource their draft plans, to establish farm-level and on-farm proof-of-concept, CA-CSA practice.
- Support on-farm demonstrations and help grow these into large and market-linked commercial centers of excellence for CA-CSA value chain practice.
- Entrench mechanisms for the inclusion of youth and women.
- Expand and rollout CA-CSA movement across the participating regions and beyond. Fast-track the impact of already grounded projects and/or processes that are opportunities to grow the movement even faster, further, and wider by:
    a) Merging ongoing CA-CSA activities (within and between organizations) from *woreda* to national level (where geography and practice allow) with an attitude of inclusiveness and contribution to rapid expansion and sustained change.
    b) Fund-raising seed-funds acquire representative CA mechanization and train drivers and owners to operate them effectively in skill and to scale sustained service business.
    c) Establishing government and other credit-guarantee schemes to help SMEs and others de-risk agribusiness investments among financiers.
    d) Training change drivers, bloggers and athletes/artists as CA and climate change ambassadors.
- Establish CA-CSA performance information, reports and data banks, robust media and other publicity knowledge management products that help spread the "religion" of CA-CSA "fast and furious". Increase the number of exemplary champions at all levels from farm to finance and trade, to help anchor the spread of CA-CSA practice and the Movement in indisputable and progressive agribusiness by:
    a) Forming a stakeholder reporting forum, supported by an innovative media partner.
    b) Organizing CA-CSA committee fora where farmers and other stakeholders are able to challenge the status quo and those responsible for their sustained development and growth.
    c) Preparing publicity materials and knowledge management products that aid beneficiaries to become mini-champions of the greater and mightier CA-CSA movement.
- Support and inculcate the total transition from CA to CSA and regenerative agriculture among all parties by:
    a) Developing primary, secondary, TVET and tertiary curriculum for CA-CSA knowledge acquisition, backed by CSA clubs that practice CA and CSA, housed at Farmer Training Centers.
    b) Working to innovate in the area of emerging and future technologies, spread across the food system, from production processes right along the value chain to consumers.

c) Working to innovate in the area of farmer organization, to attend to different types of farmers.

d) Accommodating the change of diets and transforming food systems considering micro-nutrient provisions.

e) Financing the transformation of food systems under a changing climate.

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