CATALYTIC GRANT CASE STUDY: TANZANIA

INTEGRATED APPROACHES PILOT PROJECT

LAKE ZONE SMART FARMS (LSF) PROJECT - BUILDING RESILIENCE OF THE SORGHUM VALUE CHAIN IN SMALLHOLDER FARMING SYSTEMS

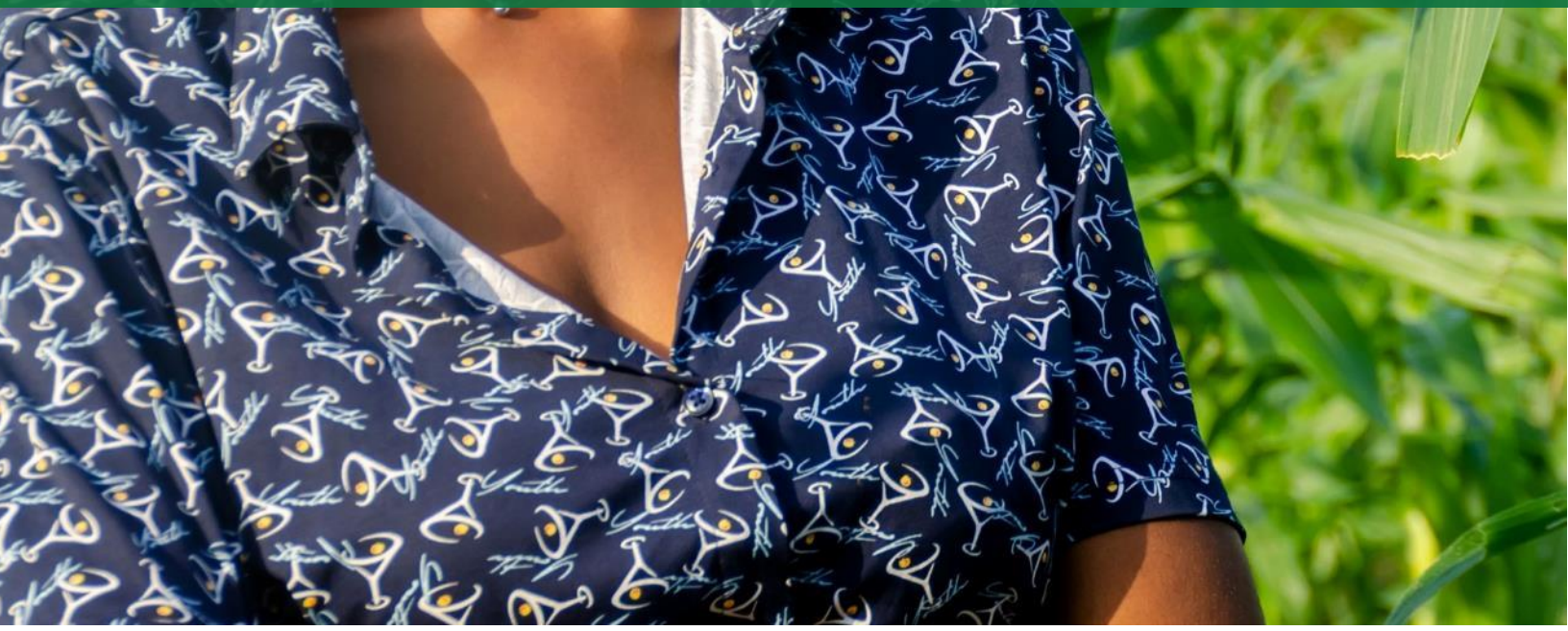

Table of Contents

Figures & Tables

Abbreviations

AGRA	Alliance for a Green Revolution in Africa
GAP	Good Agronomic Practices
GEF	Global Environment Facility
IAP	Integrated Approaches Pilot
LSF	Lake Zone Smart Farms
MSP	Multi-stakeholder Platform
RFS	Resilient Food Systems
UNDP	United Nations Development Programme
VBA	Village Based Advisors

Introduction

Under the second outcome of the Resilient Food Systems (RFS) Programme, one of the Integrated Approach Pilots (IAP) funded by the Global Environment Facility (GEF), UNDP and AGRA co-designed three catalytic grant projects to pilot innovative approaches and model projects to showcase and develop practical methodologies of promoting *Green Value Chain Development* in East, Southern and West Africa.

In Tanzania, the catalytic grant project *"Lake Zone Smart Farms (LSF) Project – Building resilience of the sorghum value chain in smallholder farming systems*" was implemented in three districts: Shinyanga, Kishavu in the Shinyanga region, and Meatu in the Simiyu region (Figure 1). The project sought to demonstrate how integration, promotion of alternative crops within dominant farming systems for diversification, and improved natural resources management such as soil health and nutrient management cycles can create sustainability in the transformation of food systems. The project also utilised active and targeted learning through on-field demonstrations and facilitated/strengthened linkages between value chain stakeholders. It further addressed key bottlenecks in agriculture input and output systems.

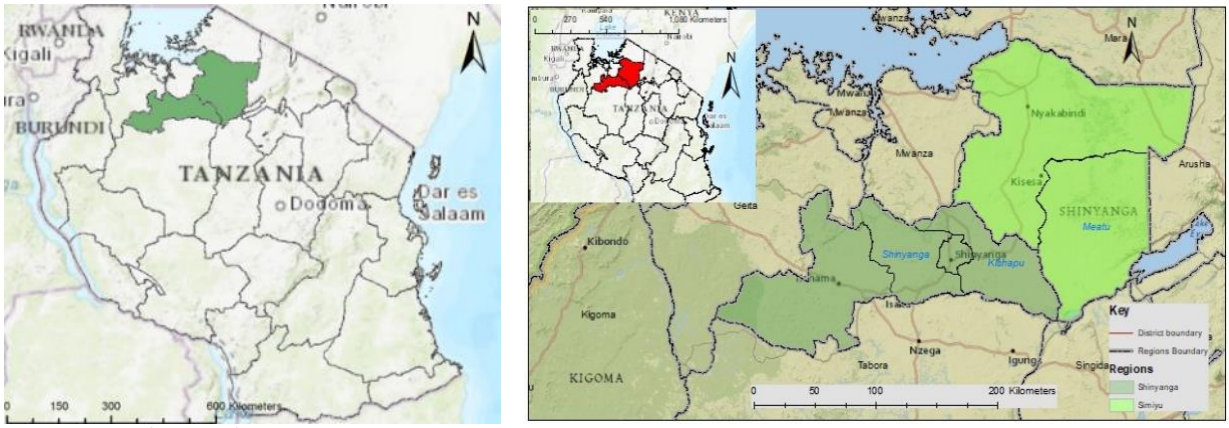

Figure 1: Map showing the project area

The project targeted 15,000 smallholder farmers intending to enhance their resilience to cope with the external shocks and stresses due to the continued changes in the agro-ecological and climatic conditions in the region.

The value chain selected for this project was Sorghum. The crop can thrive in marginal and vulnerable areas that are highly susceptible to the changing climate. It is therefore, categorized as a climate-smart crop due to its key characteristics of being drought and heat stress tolerant. Furthermore, it is also nutrient dense, making it key in improving food and nutritional security.

The project supported the emergence of a more efficient sorghum value chain to contribute to increased and consistent productivity under the current climate conditions.

This case study therefore documents the process of implementation of the catalytic grant. It puts together key lessons success and/or failure factors and outlines the project results as part of the process of documenting and disseminating information that can be used by multiple stakeholders. These include policy and decision-makers, project developers, funding agencies, and the private sector for widescale application of greening principles in food systems, particularly in response to the challenges and impacts of climate change and environmental degradation.

Context

Sorghum (Sorghum bicolor L.) is among the major staple food crops in the world, and it is primarily grown in semi-arid regions[1]. In Tanzania, sorghum is the third most widely grown cereal after maize and rice, with 834,284 hectares planted and yielding 500,000 tons[2].

Over the past decades, the precipitation in Tanzania has become unreliable, unpredictable and more unevenly distributed over the geographical zone due to climate changes. The average annual precipitation in Tanzania has decreased significantly since 1960. The low productivity of sorghum is attributed to many constraints, including climate change-related variables, such as highly irregular rainfall patterns, high incidences of drought, floods, pests and diseases, poor soil fertility management, application of suboptimal agronomic practices, and use of inferior seeds. There are also institutional barriers such as lack of access to input, limited and/or low access to financial services (including loans), limited markets and, coupled with low adoption of environmental sustainability agricultural technologies.

Tanzania has a readily available market for high-quality sorghum due to increased awareness of its health benefits and a growing export market demand among processors[3]. However, commercialized sorghum farming continues to be low and rare in Tanzania and is worsened by the unstructured marketing which offer smallholder farmers low crop prices[4]. Research and experience in other countries has shown that having guaranteed and predictable markets in the sorghum value chain leads to securing better prices and incentives for farmers to adopt improved technologies. To merge competitive marketing and promote the commercialization of sorghum, farmers require shielding from the adverse effects of climate shocks.

[1] Kalema, E.P.; Akpo, E.; Muricho, G.; Ringo, J.; Ojiewo, C.O.; Varshney, R.K. Mapping out market drivers of improved variety seed use: The case of sorghum in Tanzania. Heliyon 2022, 8, e08715. https://doi.org/10.1016/j.heliyon.2022.e08715.

[2] FAOSTAT. Food and Agriculture Organization, Statistics Division; FAOSTAT: Morogoro, Tanzania, 2023.

[3] Saleh, A.S.; Zhang, Q.; Chen, J.; Shen, Q. Millet grains: Nutritional quality, processing, and potential health benefits. Compr. Rev. Food Sci. Food Saf. 2013, 12, 281–295. https://doi.org/10.1111/1541-4337.12012.

[4] Kaliba, A.R.; Mazvimavi, K.; Gregory, T.L.; Mgonja, F.M.; Mgonja, M. Factors affecting adoption of improved sorghum vari-eties in Tanzania under information and capital constraints. Agric. Food Econ. 2018, 6, 18.

There is a need to address land degradation, nurture and adopt good agronomic practices and climate-smart/greener technologies, and assure input and output market access.

Project Approach

The project utilized an end-to-end value chain approach to identify all key actors in the sorghum value chain. These included: input suppliers, individual smallholder farmers, farmer groups, aggregators, local cereal grain retail and wholesale traders, off-takers, processors, extension service providers, agricultural officers, non-governmental organizations, financial institutions, and agribusiness service providers such as machine/thresher fabricators. It also Identifies key activities that facilitate sorghum production from input acquisition, production, and assorted value addition processes that are undertaken to the product at each value chain stage to final consumption (Figure 2).

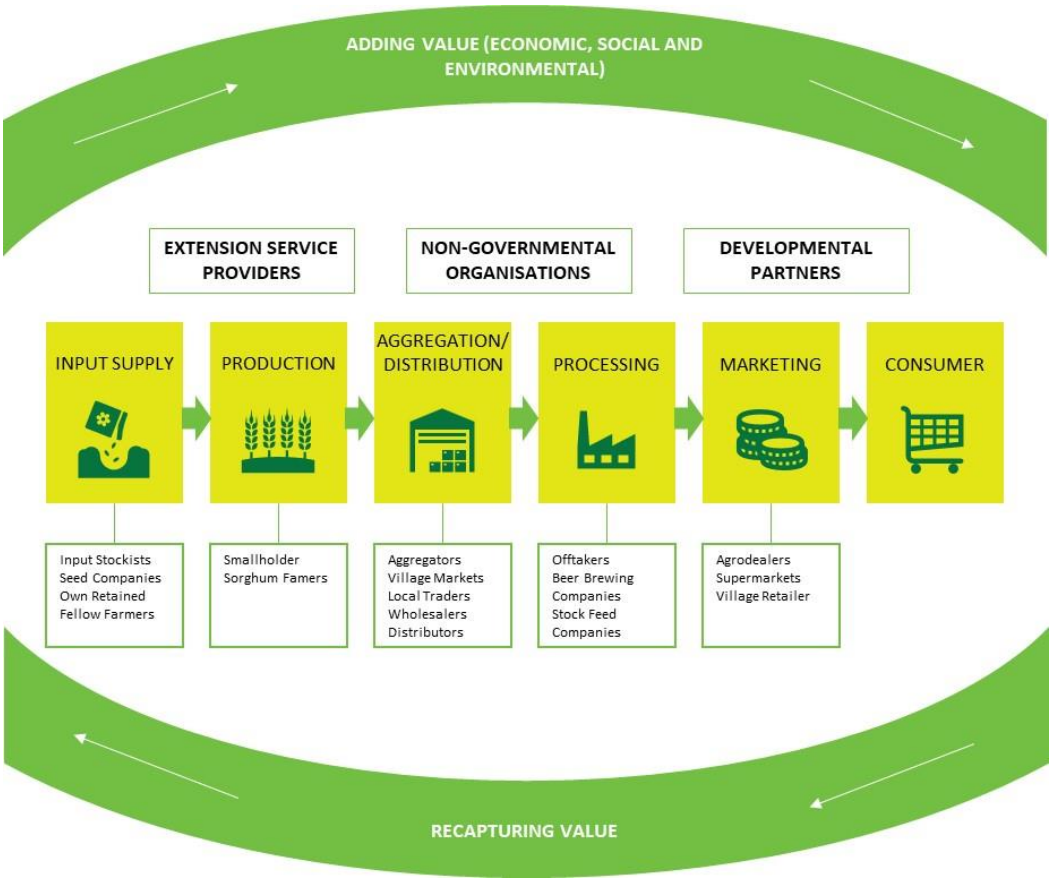

Figure 2: Sorghum value chain activities and actors

Table 1 refers to Key partners that were identified and the roles they played in the project and value chain.

Table 1: Key project stakeholders and roles

Project partners	Key roles
Kilimo Trust	Technical Support, Convenor, Project Management and partners mobilization
Government (Ministry of Agriculture)	Supervisory and Technical oversight of the community extension agents, partners mobilization and coordination
Fabricators and Thresher Businesses	Threshing services, reduction of postharvest losses through value addition and improved storage facilities
Musoma Foods	Capital injection into the value chain, contract farming, technology transfer.

The project employed multi-stakeholder platforms (MSP) as entry points in the different locations it operated. The MSP were considered an important beginning point for the actors to cooperate to produce higher-quality products and provide services to one another (Figure 3).

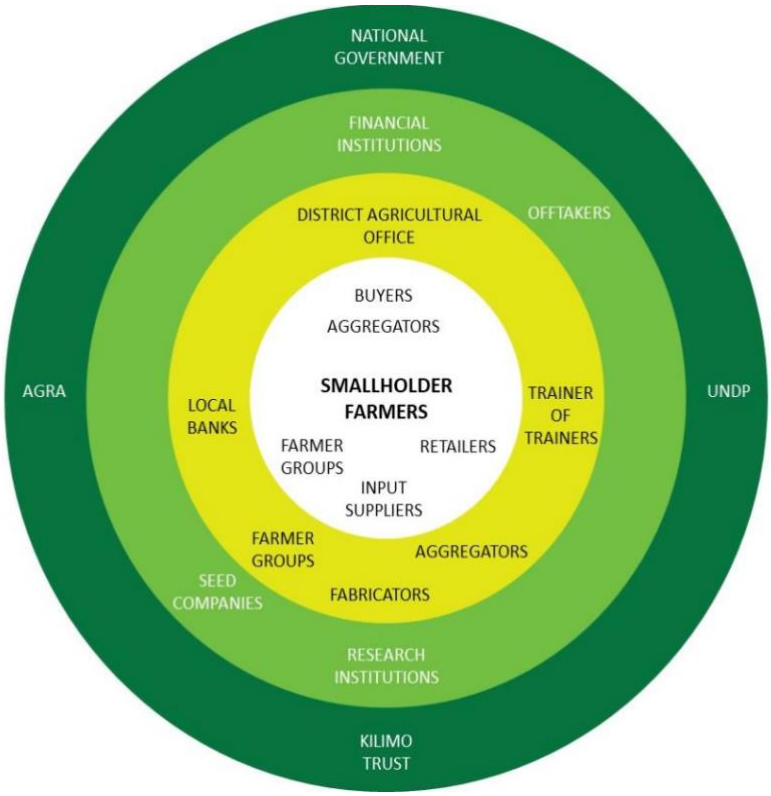

Figure 3: Sorghum value chain actors in the multi-stakeholder platform.

The linkage between agro-dealers (input suppliers) and farmers was strengthened, to enhance access to inputs by, providing farmers access to improved seeds, fertilizers and advisory services on good agricultural practices such as planting methods and pest management. Improved seed varieties that were drought tolerant, early maturing, and high yielding were promoted using demo plots.

Farmers were organized in groups and were supported to formalise the groups by creating local accountability structures to enhance advisory services. Good agricultural practices, including row planting, plant spacing, seeding rate/plant population, application of various soil inputs, and climate-smart technologies such as waste recycling, also aided in improving sorghum production.

Aggregation of sorghum grain provided an assured market for farmers in the processing of sorghum using shelling machines, hence improving high quality of the crop. Market assurance reduced credit risk and positively influenced financial (credit) provision from aggregators to farmers.

Specific Project Activities

- ### Input Supply

For resilience in the sorghum value chain, the linkage between the agro-dealers (input suppliers) and farmers was created to improve farmers' access to improved seeds and fertilizers and advisory services on good agricultural practices, e.g., planting methods and pest management.

> Johnson, an agro-dealer in Shinyanga, explained, "I have been selling sorghum seeds to the farmers, training the farmers as well as implementing demonstration plots. I also advise them on various good agricultural practices such as the required planting spacing, which should be 70 cm inter-row by 25 cm intra-row with a plant population of 2-3 seeds per hill, and pest management. I supply them with the seeds to plant in the demo plots. Other farmers then visit the demo plots to learn about the higher yields from the plots after planting seeds that resist droughts and diseases."

In addition to the seeds, agro-dealers sell fertilizers, i.e., NPK, DAP, and Urea, to the farmers for use during sorghum production (Figure 4). Through project outreach, promoting of good and greening agricultural practices, the agro-dealers reported an increased sale of inputs, especially seeds.

Figure 4: Agro-dealer selling points

- ## Production

Farmers were organized in groups and supported in the formalization/registration of the groups to enhance production. Organising farmers in groups helped them access technical and financial resources easier that when they were operating as individuals. The groups provided an entry point for service providers, extension systems and off-takers to engage with farmers in this value chain.

"More than 12,000 farmers were trained on good agricultural practices (GAPs), climate smart technologies and postharvest management practices."

Good agronomic practices (GAP) training included row planting, plant spacing, seeding rate/plant population, application of various soil inputs including mineral fertilizers, organic manure, pest management, and regenerative agriculture. Practicing good agricultural practices enhanced productivity. For example: through regenerative agriculture, to recycle sorghum and rice crop waste due to a shortage of inorganic fertilizers, farmers increased their crop yield from 650 kg/ha to 1050 kg/ha in one season.

The training on climate-smart technologies included crop rotation using green grams, cover cropping, intercropping, waste recycling, zero tillage, and improved seed varieties. The promotion of improved seed varieties was conducted by implementing demonstration plots.

Farmer sentiment,

"I have farmed a white variety of sorghum known as Macia[5]. We started growing Macia last year after being trained by Kilimo Trust on land preparation, planting techniques, and spacing. Despite the higher yields from this variety of sorghum, we face a challenge of high bird infestation (Figure 5). We formed the group and registered it with the help of Kilimo Trust. The training has been of great help to us in terms of production."

[5] The improved sorghum variety Macia (SDS 3220) was released on 14 Dec 1999 by the Tanzania National Variety Release Committee. Macia is a high-yielding, early maturing, white-grained variety developed jointly by ICRISAT and national scientists in southern Africa. It is suitable for areas with a growing season of 3-4 months (https://oar.icrisat.org/1894/).

Figure 5: Birds feed on sorghum

- ## Postharvest Management

Effective postharvest management is essential in sustaining quality sorghum grains. Kilimo Trust, the partner organisation that was responsible for the implementation of the catalytic grant in Tanzania, actively participated in training farmers on proper harvesting and storage practices. The organization imparted skills to farmers on the use of threshers and improved storage hermetic bags such as the Aro-bag. The Agro-bags are biodegradable and airtight thereby reducing contamination. The bags reduce farmer utilization of agrochemicals. Limited utilization of agrochemicals reduces greenhouse gas emissions and lowers expenses while maintaining quality.

Johnson Kasyoka, one the project facilitators on the ground, explained that,

"Training farmers on pest control and proper storage stabilises their food stores and builds their ability to have food throughout the year until they are able to plant in the following planting season."

Daudi Mangiri, a threshing machine fabricator and agri-service provider, asserted that,

"I train farmers to use machines to thresh their sorghum and dry their products fully and properly store them to avoid cases of aflatoxin. This tends to improve the quality of the crop for both home consumption and for the market."

One of the main challenges facing smallholders in sorghum postharvest management is aflatoxin and grain losses. Due to poor timing of harvesting, rush to harvest, and poor storage by farmers, the sorghum gets infected by aflatoxin. The infestation by aflatoxins lowers the sorghum value and endangers consumers' lives. However, there are concerted efforts to curb this challenge by introducing proper training on harvest timing and quality storage.

Sorghum losses occur at different stages, including storage. The losses are mainly due to limited access to innovative storage technologies and the use of dilapidated local infrastructure. Mechanisms for lowering or preventing postharvest losses remain as a gap in the value chain.

Figure 6: Postharvest: Metal grain silo.

- ## Aggregation and Processing

Aggregation of sorghum grain at project level assured accessibility of markets for farmers. Aggregation has the potential to generate high levels of efficiency in value chains and helps farmers meet the standards and requirements of markets. Strengthening aggregation while creating/facilitating linkages to processors/buyers enhanced private sector participation in the greening value chain process. Off-takers found it easier and less expensive in the collection or buying of the produce due to aggregation.

The project engaged various agribusinesses (thresher fabricators, aggregators, processors) in sorghum processing through shelling or threshing, storage, and transportation. Shelling remains the biggest challenge for farmers in the postharvest management of their crops. The project facilitated the creation of linkages with fabricators (makers and providers of shelling machines and services) to extend the reach and increase the use of the sheller/threshing services to more farmers in the sorghum value chain. Local manufacturers/fabricators of shelling machines were directly linked to actors and farmers to sell or offer shelling as a service. Initially, farmers would use the ground to dry the sorghum grain, thus reducing the quality of the produce due to other impurities.

The result of the interventions is reflected from the statement from one of the facilitators.

"In the beginning, the farmers did not acknowledge the use of machines, but with the project's intervention, the farmers now appreciate the use of shelling/threshing machines. With that, we have increased business in selling the machines and providing the service to the farmers. This has increased the amount and quality of the sorghum for farmers leading to increased profitability at farmer level. This has in turn increased our business opportunities too."

- **Marketing**

Limited access to competitive and predictable markets limits sorghum productivity and farmer interest in improving the management of sorghum. To tackle this challenge, farmers were also trained on marketing and linked to market actors for them to understand the market needs and quality requirements.

Kilimo Trust asserts that,

"Farmers were trained on market availability both locally and in neighbouring countries (Uganda). As a result, many of them decided to farm sorghum. As of now, sorghum is very marketable, a 20kg package is sold at TzShs 18,000–20,000. The market for sorghum in Kishapu is readily available (for consumption) within (the country) and outside (Tanzania), e.g., Kenya, especially for the white variety. That is why we encourage the farmers to farm more (of) this variety due to market availability."

Project Results

The number of smallholders and extension officers targeted by the project is presented in Table 2. As a result of implementing the project, particularly through the support of extension services, 13,523 were reached with the technologies. Approximately 201 hectares of land were put under the use of the promoted and supported sorghum variety and technologies.

At the end of 2022, 6,401 households were utilizing the promoted post-harvest technologies/facilities such as threshing, sorting, drying, grading, and proper storage. Evidence and information from the project reported a total of 7,093 MT of aggregated sorghum yield and sold through structured markets by the end of 2022.

Table 2: Number of smallholders and extension officers targeted by the project.

Variable	Extension		
	Total	Target	Achievement
Number of farmers reached with promoted interventions	13,523	15,000	90%
Number of extension services events completed	291	300	97%
Number of field days facilitated	6	300	2%
Number or participants participating in AGRA-supported extension services	12,639	15,000	84%
Number of new Village Based Advisors (VBAs) providing extension services to farmers	56	60	93%

Reflections

The main markets for the sorghum value chain included food processors such as Musoma Food Company which mills the sorghum into flour and also makes other products such as snacks. The quality and quantity of the output remains below expectation across the geography where Musoma sources its sorghum. Input systems of the sorghum value chain remain weak. Farmers still face challenges such as access to seed and soil health products.

Bird infestation is a real challenge. Farmers physically have to sit for long hours in fields to scare birds away. In the project areas, it was found that women and girls are often charged with the responsibility of 'guarding' sorghum fields from bird infestation. This practice can disadvantage girls as it may keep them away from school or other household responsibilities.

Sorghum is a highly versatile crop in the sense that it can be used for both food security and industrial purposes. For example, the market of sorghum to the breweries is lucrative. Whilst this provides increased incomes to farmers, it can cause problems for food security for farmers and communities. The lessons from the project have not fully benefited the overall RFS project due to the late start of the grant and challenges in synchronizing lessons from the project with RFS programmes.

Lessons Learned and Recommendations

The sorghum value chain's potential for resilience and sustainability was positively facilitated by the collaborations between the smallholder farmers, the private sector, BDS (support service) providers, and governments. The involvement of different actors in the sorghum value chain increased the potential for agribusiness growth of the sorghum value chain. The following lessons can be drawn from the project:

- Public, private, civil society partnership is key in sustainability of the sorghum value chain. The intensified and consistent involvement on the project of Musoma Food Limited, Agri-service providers such as threshing services and input providers; public and private section services providers and NGO partners with Technical Assistance, has demonstrated that using a consortia approach provides business and social sustainability of initiatives such as this.
- Involving multiple actors that are across sectors and practices in the sorghum value chain increased the potential for agribusiness growth. Examples such as the increased business demands in threshing services shows how initiatives such as this can increase agribusiness growth in selected intervention areas.
- The project benefited from the partnership created on ensuring improved seed varieties are promoted in the project areas to enhance yields. For future initiative, project developers and implementers are encouraged to partner with national agricultural research bodies, private seed companies and distributors to ensure an end-to-end process in technology adoption.

- Demo plots enhanced adopting the promoted good farming practices through increase expert to farmer learning and peer-to-peer learning.
- Strengthened aggregation centres through assured markets and provision of postharvest handling equipment eliminate market uncertainty.
- Due to the need for increased, multiple and repeated interaction with farmers the project did not reach all its intended target farmer numbers. There was need for increased time and project resources for reaching ambitious target numbers such as those set on this project. 90% of the farmers were reached.

Based on the key lessons learned from the project, the following suite of recommendations are further provided to build resilience in a crop value chain under smallholder rain-fed farming systems in developing countries like Tanzania:

- Increased effort to out-scaling of the drought-tolerant seed varieties and organic inputs.
- The government to enhance availability certified seeds to farmers through free seed packs.
- The government to look into policies hindering private sector from participating in seed systems development.
- Policymakers to consider establishing agricultural financial kits and investment packages to enhance climate change response.
- Gender mainstreaming/inclusion and integrating other technologies such as small-scale irrigation where possible other yield-enhancing technologies.

For more information, contact:

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