



## PROJECT BRIEF

# Accelerated Variety Turnover for Open-Pollinated Crops in Tanzania – Phase 1 Key Findings

### Authors

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## Introduction

Open-pollinated varieties (OPVs), such as beans, sorghum, and groundnuts, are important for increased income, job creation, food security, and nutrition of both urban and rural households in sub-Saharan Africa (SSA). However, the main constraint is underdeveloped seed systems, which contribute substantially to dwindling productivity among small-scale farmers due to limited access to reliable and quality planting materials. In SSA, specifically in Tanzania, there are three main types of seed systems serving farmers, namely formal, semi-formal, and informal. The informal system, which supplies about 97% of the farmers' planting material requirements, includes access to farmer-saved seed, also obtained through exchanges or bartering, and seed from local markets that is heavily driven by traders determining the

## ACRONYMS AND ABBREVIATIONS

ACCELERATE	Accelerated Variety Turnover for Open-pollinated Crops project
BMGF	Bill & Melinda Gates Foundation
CIMMYT	International Maize and Wheat Improvement Center
EGS	Early-generation seeds
MSPs	Multi-stakeholder platforms
NGOs	Non-governmental organizations
OPVs	Open-pollinated varieties
PABRA	Pan-Africa Bean Research Alliance
QDS	Quality-declared seed
SSA	Sub-Saharan Africa
TARI	Tanzania Agricultural Research Institute
WFP	World Food Programme

varieties available, while the remainder is sourced from the formal and semi-formal seed systems (McGuire & Sperling, 2016; Odhiambo et al., 2016)<sup>1</sup>.

The formal seed sector is characterized by low margins, the high cost of reaching last-mile users, and erratic and uncertain demand, probably because farmers have access to low-cost alternatives from the informal

<sup>1</sup> Informal seed systems are also referred to as 'farmer,' 'local,' or 'traditional' seed systems, and seeds from these systems take similar names, while semi-formal systems are sometimes called 'intermediate'.

system (e.g., farm-saved seed or local markets). Under these conditions, there is limited incentive for the formal sector actors, specifically seed companies, to invest in additional production and sale, much less investing in a new variety inventory. This situation has contributed to the low varietal turnover of most OPVs, with old varieties not being able to meet the challenges linked to climate change and changing market demand driven by smallholder farmers and traders in SSA. Consequently, the vast majority of planting material is provided regularly at acceptable prices by local and regional vendors, who also trade in grain and shift to selling seed, often saving and recleaning superior lots of grain for sale as seed during the planting season.

This implies that 'market-sourced' seed from traders offers farmers a superior value proposition to other options and thus deserves attention as a potential pathway to scaling quality seed of new varieties (Rubyogo et al., 2019; Sperling et al., 2014). However, the seed/grain traders remain unaware of and unlinked to sources of seed of new varieties and predominantly recycle old varieties year after year leading to low varietal adoption and turnover. This presents a substantial opportunity to accelerate variety adoption and turnover by linking the efficiency and scaling power of seed/grain traders with the stream of seed of new varieties from the formal and semi-formal systems.

The proposed investment to accelerate varietal adoption and turnover for OPVs in Tanzania aims at understanding the requirements and constraints of large-scale and marketplace traders to take on new varieties and how best to enable these partnerships across the formal, semi-formal, and informal seed sectors to accelerate varietal adoption and turnover. This is based on the demand-pull approach (Figure 1), where seeds largely come from grain traders, who currently not only buy grain from small-scale producers but also supply the largest amount of planting materials (seeds) for many OPVs. Humanitarian agencies and NGOs equally create this demand-pull since they spend considerable resources on sourcing and distributing seeds to demanding and stressed areas.

## Project description

The Accelerated Variety Turnover for Open-pollinated Crops (ACCELERATE) is a four-year project funded by the Bill & Melinda Gates Foundation (BMGF) and jointly implemented by the Alliance of Bioversity International and CIAT/Pan-Africa Bean Research Alliance (PABRA) as the lead institution in collaboration with the Tanzania

Agricultural Research Institute (TARI), Tanzania Official Seed Certification Institute (TOSCI) and International Maize and Wheat Improvement Center (CIMMYT). The overall aim of the project is to develop a scalable model to accelerate new variety adoption of open-pollinated varieties (OPVs) in Tanzania by linking existing capacities of the formal and quality-declared seed (QDS) sectors with sources of demand. Furthermore, the varietal scaling model should be replicable in other crop value chains, regions, or contexts to increase productivity through enhanced use of new/improved varieties and build sustainable seed/grain businesses that transform livelihoods.

ACCELERATE is expected to accelerate varietal turnover in Tanzania by tapping into the power of large/small-scale or marketplace traders, and institutional seed buyers. It emphasizes sources of demand-pull as the impetus for seed systems growth and is hinged on three hypotheses:

- Increasing information flow to and from large-scale traders, grain producers, and formal/semi-formal seed producers will increase demand-pull for quality seed of improved varieties.
- Involving small-scale/marketplace traders in greater numbers and earlier will boost the adoption of new varieties through demand-pull.
- Increasing institutional buyer awareness of and access to improved varieties will accelerate varietal turnover rates in climate-stressed areas and improve income/nutrition outcomes.

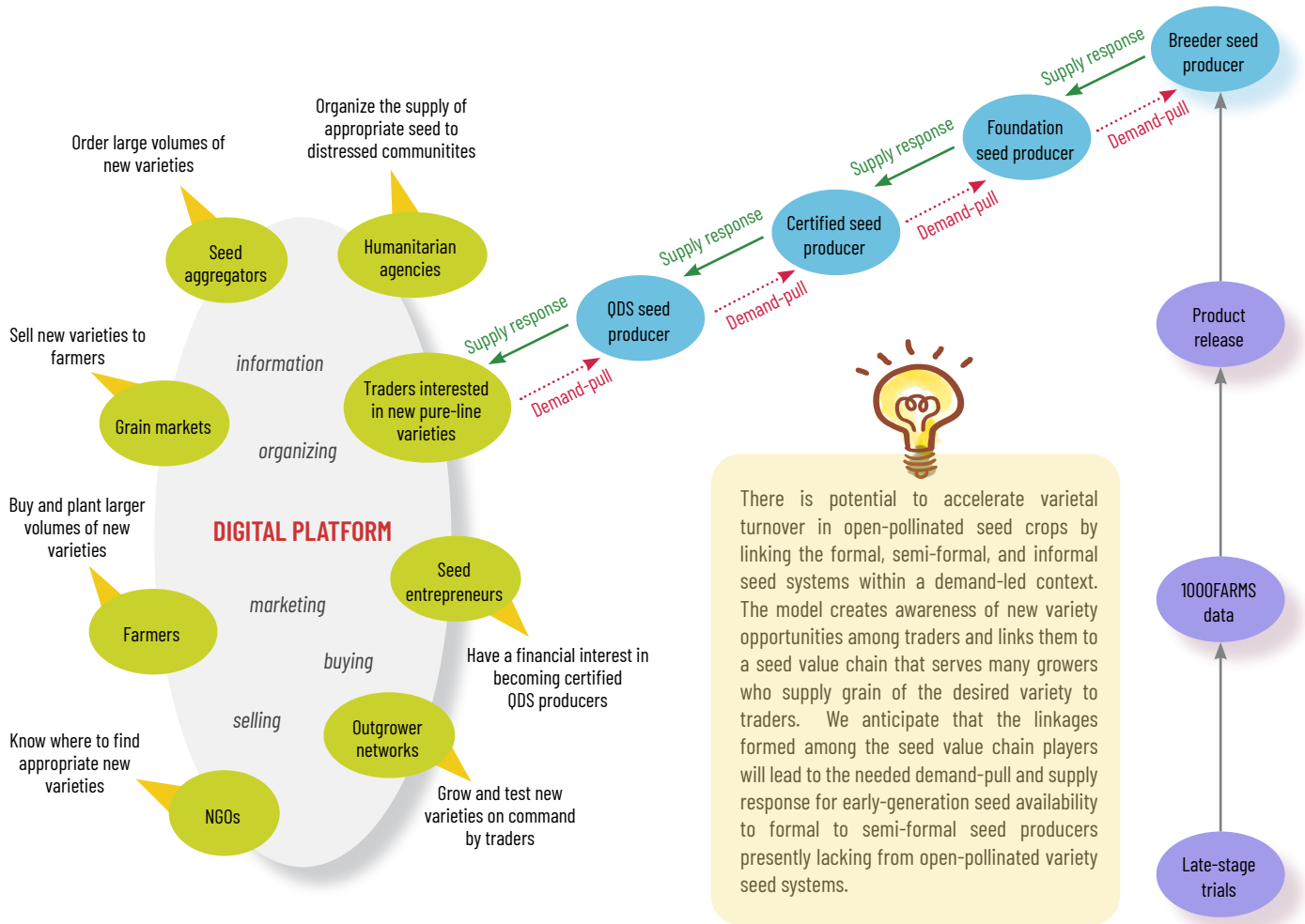
Figure 1 presents the demand-pull hypothesis and how it is expected to work throughout the project lifecycle.

The project is being implemented in three phases:

- 1** Landscaping and hypothesis validation (the current report details this);
- 2** Demand-pull learning by market segment; and
- 3** Cross learning and model building.

As part of Phase 1 implementation, a baseline survey was conducted in all six agro-ecological zones and eighteen regions of Tanzania, focusing on the above hypotheses of stimulating demand-pull in three seed system markets and mapping men, women, and youth actors, their interests, and capacity in the three seed market segments presented in Figure 1.

An exploratory research design was employed, combining both quantitative and qualitative approaches to gather data from traders and humanitarian



**Figure 1:** Model of the demand-pull approach hypothesis.

organizations, including international and local non-governmental organizations (NGOs). The approach included: (i) extensive interviews with large off-takers and small-scale/marketplace traders using a structured questionnaire, and (ii) interviews with government institutions and humanitarian agencies, including NGOs, using a short semi-structured questionnaire. The survey collected information from 976 traders (beans 421; groundnuts 300; sorghum 255) comprising 247 large-scale off-takers and 659 marketplace traders. Lastly, a total of 112 institutions were interviewed (58 humanitarian agencies/NGOs and 54 government agencies, of which 29 were District Agricultural Offices). The questionnaires were administered in person between 17 May and 9 June 2023, and follow-up questions were addressed through phone calls, email, and online interviews.



Bean market in Mandela market in Sumbawanga © CIAT/R. Kessy



# Key findings

## Traders are a key source of seed for farmers

- Bean traders (57%), groundnut traders (24%), and sorghum traders (20%) prepare the grain to sell as seed. For all the crops, involvement in seed sales is more widespread amongst small-scale/marketplace traders (44%, 31%, 23%, respectively) than large off-takers for beans, groundnut, and sorghum (33%, 11%, 13%, respectively), but the latter is responsible for larger volumes traded.
- More than half the bean (57%), nearly half the groundnut (47%), and 20% of sorghum traders confirmed that their customers use the grain purchased as seed for planting.
- Traders mainly source grains from farmers (sorghum 52%, beans 42%, and groundnuts 34%), fellow traders (beans 33%, groundnuts 27%, and sorghum 19%), and collectors/aggregators (beans 42%, sorghum 28%, and groundnuts 36%) with no significant differences between men and women traders. Less than 5% of traders produced their own grain, while imports were completely uncommon (<1%). These findings are corroborated by Sperling et al. (2021) who pointed out that the informal seed sector is widely recognized as the major source of seed to smallholder farmers in Africa for OPVs and in line with Sperling et al. (2020), which reported that local markets are the main source of seed for groundnuts (42.6%) and common bean (47%) and the second-main source of seed for sorghum (24.3%).
- Traders of beans, sorghum, and groundnuts have direct contact with farmers and predominantly source local seed and grain from them.



Groundnut traders © CIAT/R. Kessy

## Marketing and market linkages

- As expected, large-scale off-takers dominate bean sales (81,101.3 tons), sorghum sales (46,606.7 tons), and groundnut sales (33,022.5 tons) compared to small-scale/marketplace traders (sorghum 2,491.6 tons, beans 6,836.4 tons, and groundnuts 12,184.9 tons) per year.
- Groundnut and sorghum traders differ in their prioritization of the two crop varieties. Marketplace traders sold white sorghum (1,480.1 tons) more than the red/brown type (1,011.5 tons). Small-scale/marketplace groundnut traders mainly sell the small red variety. The rest of the varieties are sold in much smaller volumes. Large-scale off-takers mainly sell the small and large tan varieties, which are highly demanded in neighboring countries such as Kenya, Rwanda, and Uganda.
- White sorghum accounts for 64% of the sorghum traded in Tanzania. This is mainly dominated by large-scale off-takers who sell about 29,974.1 tons compared with the red/brown types (16,632.6 tons per year). Red/brown sorghum share is growing rapidly, with an increase from 30% in 2020 (Akpo et al., 2022) to 36% in 2023. This may be driven by increasing demand for red sorghum varieties in the regional markets.

## Preference drivers

- Bean traders have similar preferences for the most- and least-traded bean types. Yellow, red-mottled, and purple beans are the most traded by large off-takers (44,487.0 tons, 17,649.0 tons, and 10,419.4 tons, respectively). Similarly, small marketplace traders mostly sell yellow beans (2,726.6 tons), purple (1,573.4 tons), and red-mottled type (1,164.2 tons). However, while mixed beans are the least sold by small-scale/marketplace traders (335.6 tons), small reds are the least sold by large-scale off-takers.
- Bean buyer preference is consistently driven by taste (77.3%) across all bean types followed by cooking time (56.8%), low flatulence, price, and grain size. However, these results varied across bean types.
- Groundnut-buyer preference is driven by taste (69%), oil content (48%), grain size (37%), and color (29%), indicating that taste and oil content should be prioritized in breeding efforts.
- Sorghum-buyer preference is driven by color (52.3%), taste (50.3%), and processability (40.9%) overall. White sorghum has an outstanding appreciation rate for its color (71.5%). Both varieties are equally

appreciated for taste 50.3%. Red/brown has a much higher appreciation for processability, and bird resistance compared to white.

### Informal grain flows

- Generally, there is heavy traffic/flow of all major bean varieties towards the Eastern part of the country, perhaps an indication that this is a major bean market and consumption destination, as well as a transit point to Kenya.
- The primary production regions for sorghum are Central, Lake Zone, and the Southern highlands for white and red varieties. Lesser/Light flows are observed in the Mtwara region with the main markets being in the Central region and Dar es Salaam. Sorghum grain is exported to Burundi, Democratic Republic of Congo (DRC), Kenya, Malawi, Rwanda, Southern Sudan, Uganda, and Zambia.
- Major market classes for groundnuts are red and white varieties with red varieties being more popular in Dodoma and Dar es Salaam. The major export markets dominated by tan-color types are Burundi, Kenya, Malawi, Rwanda, and Uganda.

### Preference drivers inform/determine pricing

- For consumers, yellow beans are the highest priced (US\$1,186 per ton) with mixed varieties attracting the lowest prices (US\$772 per ton). On average, marketplace traders sell beans at a higher price (US\$1,102 per ton) than large-scale off-takers (US\$1,067 per ton). For both types of traders, women traders sell beans at a lower price (US\$1,038 per ton) than men traders (US\$1,158 per ton).
- Sold as seed, yellow beans consistently fetch the highest price (US\$1,314 per ton). Bean seed prices vary between men and women traders, even within the same category of traders. Overall, men traders sell bean seed at a higher price (US\$1,295 per ton) than women traders (US\$1,142 per ton). Small-scale/marketplace traders sell bean seed at a higher price (US\$1,225 per ton) than large-scale off-takers (US\$1,117 per ton).
- White sorghum (US\$640 per ton) has a much higher selling price than red/brown sorghum (US\$501 per ton). Outstanding appreciation for its white color promotes its value.
- The overall selling prices were mainly defined by region and by size of the trader, with large-scale off-takers applying much lower prices than small-scale traders. We found different price ranges

per groundnut type, but these were driven by local demand.

### Contractual arrangements with suppliers

- Large-scale traders use contracts to meet quantity targets. Large-scale off-takers (26% beans, 42% groundnuts, 52% sorghum) are more likely to verbally contract farmers to supply them with varieties than are small-scale traders (25% groundnuts and 24% sorghum).
- Informal traders mainly make contractual arrangements for to ensure quality, while large-scale off-takers mainly contract for quantity. This difference can be explained by the customer types i.e., informal traders sell to the end consumers (95% retail trade), while large-scale off-takers mainly work through wholesaling (81%), aggregating (45%), and retail trade (35%).

### Access to seed and seed management practices

- Practices to prepare grain as seed for selling are similar for beans, sorghum, and groundnuts.
- Over 47% of traders indicated that their customers purchase local/informal seeds from them and openly declare that they are purchasing seeds. However, sorghum had the highest proportion of customers purchasing local seed from the markets (80% of the traders indicated selling local seed). This observation implies that customers often purchase 'informal seeds' from traders, potentially making them important agents for accelerating new varietal adoption and turnover.
- Notably, over 56%, 20%, and 47% of bean, sorghum, and groundnut traders, respectively, confirmed knowingly selling grains for planting without applying any seed management practices to retain purity. Overall, more marketplace traders (>30%) indicated they are engaged in selling seeds than large-scale traders. This observation means that bean grain traders also act as a seed source for farmers. Further, our data confirms the findings by Sperling et al. (2021) who pointed out that the informal seed sector should be widely recognized as a critical node that smallholder farmers in Africa use to access seed for their range of crops.
- Generally, buyers of seeds often inform traders that they are buying seeds (>70%) looking for pure, not mixed, and clean varieties (>70%), with some of them asking for the origin of the variety (<10%). Thus, the traders will know that the customer is purchasing seeds and advise them accordingly.

- Traders prioritize the same seed management practices for all three crops, which include: keeping each variety pure/as a single variety (61% groundnut, 65% bean, 66% sorghum traders); sorting for 'waste' (pebbles, dirt, dust) (52% groundnut, 46% bean, 42% sorghum traders); sorting for 'bad grains/seed' (that is broken, immature, or discolored) (47% bean, 45% groundnut, 36% sorghum traders) and seeking out specific varieties to buy (which can be planted) (30% groundnut, 41% sorghum, 50% bean traders).

#### Traders' interest in promoting improved varieties

- More than half of the bean traders expressed a willingness to participate in promoting and accelerating the adoption and turnover of new varieties with no difference expressed between a) small-scale marketplace traders and large-scale off-takers, and b) men and women traders. Similarly, sorghum and groundnut traders confirmed discussing and promoting new varieties with their customers.

#### Digital readiness and literacy

- Overall, bean, groundnut, and sorghum traders have low digital literacy and experience. This differs by trader type, gender, and location. Our survey results indicate that men have a higher digital literacy than women. Large-scale traders have a higher digital literacy than small-scale or marketplace traders. Traders in urban markets have a higher digital literacy than traders in rural markets. Traders with a higher level of formal education tend to have a higher digital literacy.
- Most bean, groundnut, and sorghum traders own a mobile phone and mostly use the radio. Less than half own a smartphone, with a significant difference between small- and large-scale traders. Ownership of phones and radio is widespread, while computers are generally uncommon.

#### Institutional seed buyers and seed systems

- Most humanitarian (NGO) agencies working in the agricultural sector support farmers to produce quality-declared seed (QDS), promote improved varieties, train farmers, and link farmers with input suppliers and grain buyers.
- Institutional seed buyers purchase seeds (different classes) from TARI and seed companies to distribute to farmers producing seeds and grains. They also link farmers and traders to institutional grain buyers such as the World Food Programme (WFP) and beer

processing companies (Tanzania Breweries Limited and Serengeti Breweries Limited).

- Institutions predominantly use demonstration plots and block farms in communities to deliver information about improved varieties and create demand for increased varietal adoption, replacement, and turnover. However, the availability of starter seeds (basic and certified seeds) for QDS production has also been a challenge.
- All the humanitarian organizations and government agencies confirmed their willingness to engage in efforts to accelerate the varietal turnover of OPVs (sorghum, beans, and groundnuts).

#### Support needed by traders to actively engage in delivering seed

- There is a prevalent knowledge gap on seed variety handling and management (sorghum 61%, beans (20%), and groundnuts 58%). This technical support should be prioritized among women traders, among whom the knowledge gap is more widespread compared to men traders. Other support needed by traders includes extension and training services (beans 4%, sorghum 12%, and groundnuts 16%), information on variety sources (beans 18%, sorghum 12%, and groundnuts 10%), and seed business management skills (beans 24%, sorghum 9%, and groundnuts 9%). The latter includes support on how to establish viable seed businesses within Tanzania seed regulations or laws.

## Conclusions

- This study confirms the critical role of the informal seed sector in availing seeds of open-pollinated crops such as beans, groundnuts, and sorghum to smallholder farmers across Africa.
- Both the interlink between and independence of seed and grain trade are demonstrated. Grain traders consciously sell seed and are mostly clear on what farmers' varietal and seed trait preferences are and when they need seed. Traders manage seeds differently to grains, and customers openly declare that they are buying seeds and are willing to pay premium prices relative to grain prices – so the seed business is lucrative even in the informal sector. The informal grain/seed traders' robustness and dynamism point to their pivotal role not only in promoting the grain business – thus creating a derived seed demand – but also in sustaining local seed businesses and moving varieties widely and

quickly. Essentially, these traders are central as last-mile agents to deliver quality seeds to the farmers and accelerate varietal turnover.

- Taste has emerged as an essential trait since it is the main driver for bean, sorghum, and groundnut preference. Hence, it should be prioritized in breeding efforts.
- Notably, white sorghum still dominates the market due to strong appreciation of its color. However, the market share of red/brown varieties is growing and currently represents about 36%. Red/brown sorghum is mainly exported within the region. Hence, there is an opportunity to enhance breeding efforts towards developing more improved red/brown varieties.
- Contractual arrangements, albeit mostly verbal, are a tool for grain/seed quantity and quality assurance – further demonstrating efforts by informal traders to create both effective and sustainable grain/seed supply with functional quality control measures such as traceability.
- Varietal attributes drive the prices, trade volumes, and revenues generated from seeds and grains sales with traceable pathways, including beyond the national borders.
- There is low digital literacy among traders, with mobile phones being the most used tool for calls, SMS, and mobile money transactions. Internet-related services are rarely used, phone calls and personal meetings are the most preferred communication channels, and traders rely on other traders for relevant information for their business.
- This study confirms that multistakeholder platforms provide learning and knowledge exchange spaces, where stakeholders come together to discuss their challenges and identify opportunities to address them for mutual benefits.
- Institutional buyers such as humanitarian agencies play a key role in the seed sector through seed production, varietal promotion, farmers' training, and linking farmers to input suppliers and grain buyers with significant grain demand levels creating seed demand-pull. These institutional buyers collaborate with national research institutes.
- Traders, government agencies, and humanitarian agencies are willing to engage in efforts to accelerate the varietal turnover of OPVs (sorghum, beans, and groundnuts).

## Recommendations

- The direct link between traders, institutional seed buyers, and consumers is indicative that traders and institutional seed buyers are pivotal as last-mile agents to deliver quality seeds to farmers, thus providing an impetus for further testing the hypothesis that they can accelerate varietal adoption and turnover of OPVs.
- The fact that bean, groundnut, and sorghum customers openly indicate that they are buying seeds of specific varieties is clear evidence of the need to link the traders to better sources of improved varieties from the formal and semi-formal seed systems (e.g., certified and QDS seed, respectively). Through the Tanzania seed law, traders can deliver seeds to farmers by linking farmers to seed companies and QDS producers, deliver seeds from seed companies to farmers supplying grains, and provide information about new varieties.
- Large-scale off-takers engage in aggregation, provision of tailored extension services, messaging, and move larger seed volumes than small-scale/marketplace traders for the three crops, thus their involvement in an integrated seed system model would accelerate varietal adoption and turnover.
- Cross-border seed movement should be further explored to help develop wider varietal promotion and a seed marketing strategy.
- Given the limited digital literacy and limited ownership of smartphones, computers, and tablets among traders, it is critical to enhance existing peer networks that are connected by telephone chains to diffuse information on new varieties and create demand for them. Therefore, there other options should be explored for digitizing traders and farmers by testing innovative digital solutions that would increase varietal turnover, productivity, and food and nutrition security.
- Since multistakeholder platforms (MSPs) provide stakeholders with spaces for information flow, learning, and knowledge exchange, it would be ideal to promote trader-led MSPs to facilitate access to quality seeds and other complementary services needed for increased productivity and incomes for all value chain actors.
- Limited availability of starter seed (basic, pre-basic, and early-generation seeds (EGSs), quality-declared



seeds (QDS) and certified seed production emerged as a key constraint to varietal adoption and turnover for the three crops. A ministerial circular designed to alleviate the challenges of EGS availability through direct licensing agreements between the national agricultural research system and private seed companies has had limited success due to stringent conditions and restrictions placed on the licenses (SeedCLIR, 2013). Thus, there is a need for policy research and advocacy to influence reforms aimed at complementing current efforts by TARI, TOSCI, and other partners. A review of the seed licensing policy to remove conditions is a viable option to increase the availability and access to quality seeds for farmers, seed companies, and institutional buyers.

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