Accelerated varietal turnover for open-pollinated crops (beans, sorghum, groundnuts) in Tanzania – seed sector stakeholders' landscaping

Baseline Report

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BASELINE REPORT

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The Accelerated Varietal Adoption and Turnover for Open-Pollinated Varieties (ACCELERATE) project in Tanzania aims at understanding the requirements and constraints of large and small/marketplace traders to catalyze the uptake of new varieties and how best to enable the needed partnerships across the formal, semi-formal, and informal seed sectors to accelerate varietal adoption and turnover. This is based on the demand-pull approach, in which seed largely comes from grain traders, who currently not only buy grain from small-scale producers but also supply the largest amount of planting material (seeds). Humanitarian agencies and non-government organizations (NGOs) equally create or catalyze this demand pull since they spend considerable resources on sourcing and distributing seeds to demanding and stressed areas.

This exploratory research was conducted in six agroecological zones, combining both quantitative and qualitative approaches to gather data from traders and humanitarian organizations, including international and local NGOs. The approach involved (i) extensive interviews with large off-takers and small/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 off-takers/traders and 659 small/marketplace traders. Lastly, a total of 112 institutions were interviewed. The study emphasizes the need for strengthened and dynamic breeding and seed systems that lead to high rates of varietal turnover as a core strategy for crops to adapt to the biotic and abiotic stresses affecting small-scale farmers. The specific findings are summarized below.

Traders are a key source of seed for farmers

- Bean traders (57%), groundnut traders (24%), and sorghum traders (20%) prepare the grain to sell it as seed by sorting out waste and bad seeds to ensure seed purity. For all the crops, involvement in seed sales is more widespread among small/marketplace traders (44%, 31%, 23%) than among large off-takers (33%, 11%, 13%) for beans, groundnut, and sorghum, respectively, although the latter might be responsible for larger volumes.
- A total of 57% of the bean traders, 47% of the groundnut traders, and 20% of the sorghum traders confirmed that their customers use the grain purchased as seed for planting.
- 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 for smallholder farmers in Africa for OPVs and this is in line with Sperling et al. (2020), who reported that local markets are the main source of seed for groundnuts (42.6%) and the second main source of seed for sorghum (24.3%).
- Both marketplace traders and large off-takers for beans, sorghum, and groundnuts have direct contact with farmers and source local seed and grain from them.

Marketing and market linkages

- As expected, large off-takers dominate bean (81,101.3 tons), sorghum (46,606.7 tons), and groundnut (33,022.5 tons) sales compared with small/marketplace traders (sorghum, 2,491.6 tons; beans, 6,836.4 tons; groundnuts, 12,184.9 tons) per year.
- Groundnut and sorghum traders differ in their prioritization of varieties. Marketplace traders sold white sorghum (1,480.1 tons) more than red/brown types (1,011.5 tons), whereas large off-takers sold white sorghum (29,974.1 tons) more than red/brown types (16,632.6 tons). Small/marketplace groundnut traders mainly sell the small red variety. The rest of the varieties are sold in much smaller volumes. Large off-takers sell the small tan and large tan varieties.
- Bean traders have similar preferences for the most and least traded varieties. 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 (2,726.6 tons), purple (1,573.4 tons), and red mottled types (1,164.2 tons). However, while mixed beans are the least sold by small/marketplace traders (335.6 tons), small reds are the least sold by large off-takers.
- Bean buyer preference is consistently driven by taste across all bean types (e.g., yellow, 91.6%; purple, 79%; white, 71.9%; red mottled, 65.5%; small red, 62.5%; sugar, 56.1%; red kidney, 51.5%; and mixed, 48.2%). In addition, cooking time (56.8%) is preferred for all types of beans while white (49.1%) and yellow (36.2%) are preferred for low flatulence. Small reds and mixed beans are preferred because of their cheaper prices. Red mottled (35.5%), dark red kidney (27.3%), and sugar (28.1%) beans are preferred for their large grain size.
- Groundnut buyer preference is driven by taste (69%) and oil content (48%). Drivers for large groundnuts (size being key) are vastly different from those for small/medium groundnuts (oil content, confectionary).
- Sorghum buyer preference overall is driven by color (52.3%), taste (50.3%), and processability in flour for beer making or porridge (40.9%). White sorghum has an outstanding appreciation for its color (71.5%). Both white and red types are appreciated for their taste. Red/brown sorghum has a much higher appreciation for processability and bird resistance than white sorghum.

Preference drivers inform pricing

- For consumers, yellow beans are the highest priced (USD 1,186 per ton), with mixed varieties attracting the lowest prices (USD 772 per ton). On average, small/marketplace traders sell beans at a higher price (USD 1,102 per ton) than large off-takers (USD 1,067 per ton). For both types of traders, female traders sell beans at a lower price (USD 1,038 per ton) than male traders (USD 1,158 per ton).
- Sold as seed, yellow beans consistently fetch the highest price (USD 1,314 per ton). Bean seed prices vary between male and female traders even within the same category of traders. Overall, male traders sell bean seed at a higher price (USD 1,295 per ton) than female traders (USD 1,142 per ton). Small/marketplace traders sell bean seed at a higher price (USD 1,225 per ton) than large off-takers (USD 1,117 per ton).
- White sorghum (USD 640 per ton) has a much higher selling price overall than red/brown sorghum (USD 501 per ton). The outstanding appreciation for its white color boosts its value.
- The overall selling prices are defined by region and by trader size, with large off-takers having much lower prices than small/marketplace traders. There were different price levels per groundnut type, but these are driven by local demand.

Contractual arrangements with suppliers

- Large traders contract more to meet target quantities. Large off-takers (26% beans, 42% groundnuts, 52% sorghum) are more likely to verbally contract farmers to supply them with varieties than smaller/marketplace traders (25% groundnuts, 24% sorghum).
- Informal traders contract suppliers for quality purposes whereas large off-takers contract for quantity. This difference can be explained by the customer types: that is, informal traders sell to the end customers (95% retail trade), while large off-takers do 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.

- More than 47% of the 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 market (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, more than 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 small/marketplace traders (>30%) indicated that they are engaged in selling seeds than large off-takers. This observation means that grain traders also serve farmers as a seed source. Further, it confirms 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 obtain seed for their range of crops.
- Buyers of seeds often inform traders that they are buying seeds (>70%) looking for pure, not mixed, and clean varieties (>70%), with a few of them asking about the origin of the variety (<10%). Thus, the traders will know that the customers are purchasing seeds carefully and advise them accordingly.
- Traders prioritize the same seed management practices for all three crops, which involve keeping each variety pure/as a single variety (61% of groundnut, 65% of bean, and 66% of sorghum traders); sorting out waste (pebbles, dirt, dust) (52% of groundnut, 46% of bean, and 42% of sorghum traders); sorting out bad grains/seed (i.e., broken, immature, or discolored) (47% of bean, 45% of groundnut, and 36% of sorghum traders); and seeking specific varieties to buy (that can be planted) (30% of groundnut, 41% of sorghum, and 50% of bean traders).

Traders' interest and support needed to promote new varieties

- More than half of the bean traders expressed willingness to participate in promoting and accelerating the adoption of new varieties and turnover. However, there was no difference between (i) small/marketplace traders and large off-takers and (ii) male and female traders. Similarly, sorghum and groundnut traders indicated discussing about new varieties with their customers and engaging in promoting those varieties.
- There is a prevalent knowledge gap in the handling and management of new seed varieties (sorghum, 61%; beans, 20%; and groundnuts, 58%). This technical support should be prioritized among female traders, for whom the knowledge gap is more widespread than for males.
- Other support needed by traders involves extension and training services (beans, 4%; sorghum, 12%; groundnuts, 16%), information on sources of varieties (beans, 18%; sorghum, 12%; groundnuts, 10%), and seed business management skills (beans, 24%; sorghum, 9%; groundnuts, 9%). The latter includes support on how to establish viable seed businesses within Tanzanian seed regulations and laws.

Digital readiness and literacy

- Overall, bean, groundnut, and sorghum traders have low digital literacy and experience. This differs by trader type, gender, and location. Men have higher digital literacy than women. Large off-takers have higher digital literacy than small/marketplace traders. Traders in urban markets have higher digital literacy than traders in rural markets. Traders with a higher level of formal education tend to have higher digital literacy.

Institutional seed buyers and their role in seed systems

- Most humanitarian (NGO) agencies working in the agricultural sector support quality declared seed (QDS) producers, promote improved varieties, train farmers, and link farmers with input suppliers and grain buyers.
- Institutional seed buyers (different classes) from TARI and seed companies help 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 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 been a challenge. Currently, TARI has the sole mandate to produce these seeds, but it cannot satisfy the demand.
- 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).

Conclusions

- This study confirms the critical role of the informal seed sector in making available seeds of open-pollinated crops such as beans, groundnuts, and sorghum to smallholder farmers across Africa.
- Traders are linked to farmers in many ways, such as linking farmers to seed producers, purchasing grains from specific farmers, selling as local/informal seed, and providing information to farmers about new varieties (traders are the major source of information for smallholders). Traders are important in creating demand and there is a need to engage them in varietal field testing as part of demand-led breeding initiatives.
- This study demonstrates the interlink between and independence of seed and grain trade. 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 from 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 points to their pivotal role not only in promoting the grain business, thus creating a derived seed demand, but also in sustaining the local seed business and moving varieties widely and fast. Essentially, these traders are central as last-mile agents to deliver quality seeds to farmers and accelerate varietal turnover.
- Notably, white sorghum still dominates the market because of its color appreciation. However, the market share of red/brown is growing and currently represents 36%. Red/brown sorghum is mainly exported in the region; thus, an opportunity exists to enhance breeding efforts to come up with more improved red/brown varieties.
- Contractual arrangements, albeit mostly verbal, are a tool for grain/seed quantity and quality assurances, thus further demonstrating efforts by informal traders to create both an 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 seed and grain sales with traceable pathways, including beyond national borders.
- Digital literacy is low among traders, with mobile phones being the most used tool for calls, SMS, and mobile money transactions. Internet-related services are rarely used as phone calls and personal meetings are the most preferred communication channels, and traders rely on other traders for relevant information about their business.
- This study confirms that trader-led multistakeholder platforms (MSP) provide space for learning and knowledge exchange where various stakeholders come together to diagnose their challenges and identify opportunities to address them for mutual benefit.
- 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 creating seed demand pull. These institutional buyers collaborate with the 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 findings confirm that there is a need for strengthened and dynamic breeding and seed systems that result in high rates of varietal turnover as a core strategy for crops to adapt to biotic and abiotic stresses and meet ever-changing consumer preferences. This can be achieved by engaging traders in varietal development and building (their staff) capacity in field testing/popularizing of new varieties and seed system initiatives as part of demand-led breeding initiatives.
- Traders (off-takers, aggregators), institutional seed buyers, and consumers indicate that traders and institutional seed buyers are pivotal in stimulating farmers' investments in the use of improved varieties. There is a need to catalyze traders' investments in the delivery of quality seeds to farmers and accelerate varietal turnover. Therefore, this provides impetus for further testing the hypothesis that traders and institutions (NGOs and humanitarian organizations) can play a significant role in accelerating varietal turnover.
- There is a need to determine clear modalities for engaging all types of traders in seed delivery proactively, openly, and in a structured manner. This might include, but not be limited to, the registration of traders as seed dealers (if they are qualified) to officially run seed businesses alongside their grain businesses and establishing sustainable seed supply channels by linking them to the Agricultural Seed Agency (ASA), seed companies, and QDS producers. Other support needs might involve enhancing their technical capacity to handle local seeds to maintain quality, which can be in the form of training to complement their current seed and variety management skills.
- The fact that bean, groundnut, and sorghum customers openly indicate to traders that they are buying seeds of specific varieties is clear evidence for the need to link these traders to better sources of improved seeds from the formal and semi-formal seed systems (e.g., certified and QDS, respectively) to ensure that farmers use quality planting material. Traders can play a role in linking farmers (customers) with sources of quality and new seeds for accelerating varietal turnover.
- Large off-takers engage in aggregation, provision of tailored extension services, messaging, and moving larger local seed volumes than small marketplace traders; thus, their involvement in an integrated seed system model would accelerate varietal adoption and turnover. It is therefore important to strengthen their capacity, including that of their staff, to provide extension training to farmers and correct information on new varieties of the three crops.
- Cross-border seed and grain movement in East and Southern Africa should be further strengthened by a regional breeding network sharing germplasm, followed by region-wide varietal promotion and seed marketing strategy.

- Given the limited digital literacy and limited ownership of smartphones, computers, and tablets among traders, it is critical to enhance peer networks that are connected by telephone chains to diffuse information on new varieties and create demand for them. Therefore, there is a need to explore other options of digitizing traders and farmers by testing innovative digital solutions that could increase varietal turnover and thus increase productivity and food and nutrition security.
- Trade-led multistakeholder platforms (MSPs) provide space for learning and knowledge and information exchange where various stakeholders converge to jointly diagnose their challenges and identify opportunities to address them. This is ideal for promoting trader-led MSPs to facilitate access to quality seeds and other complementary services needed for increased productivity and income for all value chain actors.
- The limited availability of starter seed/early-generation seed (EGS) (breeder, basic, and pre-basic), quality declared seed (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 EGS challenges through direct licensing agreements between NARS and private seed companies has had limited success because of the stringent conditions and restrictions placed on the licenses (Seed CLIR, 2013). Thus, there is a need to reverse this.
- It is essential to build the capacity of TARI in breeder seed production and of TOSCI in certification by simplifying and harmonizing varietal release processes and to motivate other partners to invest in the seed system. A review of seed licensing policy to remove restrictive conditions is a viable option to increase the availability of and access to quality seeds for farmers, seed companies, and institutional buyers.

Abbreviations and acronyms

ACCELERATE	Accelerated Varietal Turnover for Open-Pollinated Crops project
AGRA	Alliance for a Green Revolution in Africa
ASA	Agricultural Seed Agency
BMGF	Bill & Melinda Gates Foundation
CBOs	community-based organizations
CIAT	International Center for Tropical Agriculture (now part of the Alliance of Bioversity International and CIAT)
CIMMYT	International Maize and Wheat Improvement Center
DASPA	Dodoma Agricultural Seed Production Association
EGS	early-generation seed
IITA	International Institute of Tropical Agriculture
IRIs	international research institutions
MSPs	multistakeholder platforms
NGOs	non-government organizations
OPVs	open-pollinated varieties
PABRA	Pan-Africa Bean Research Alliance
QDS	quality declared seed
RALG	Regional Administration and Local Government Ministry
SMS	short message service
SSA	sub-Saharan Africa
SUGECO	The Sokoine University Graduate Entrepreneurs Cooperative
TARI	Tanzania Agricultural Research Institute
TOSCI	Tanzania Official Seed Certification Institute
TPN	Tanzania Pulse Network
WFP	World Food Programme

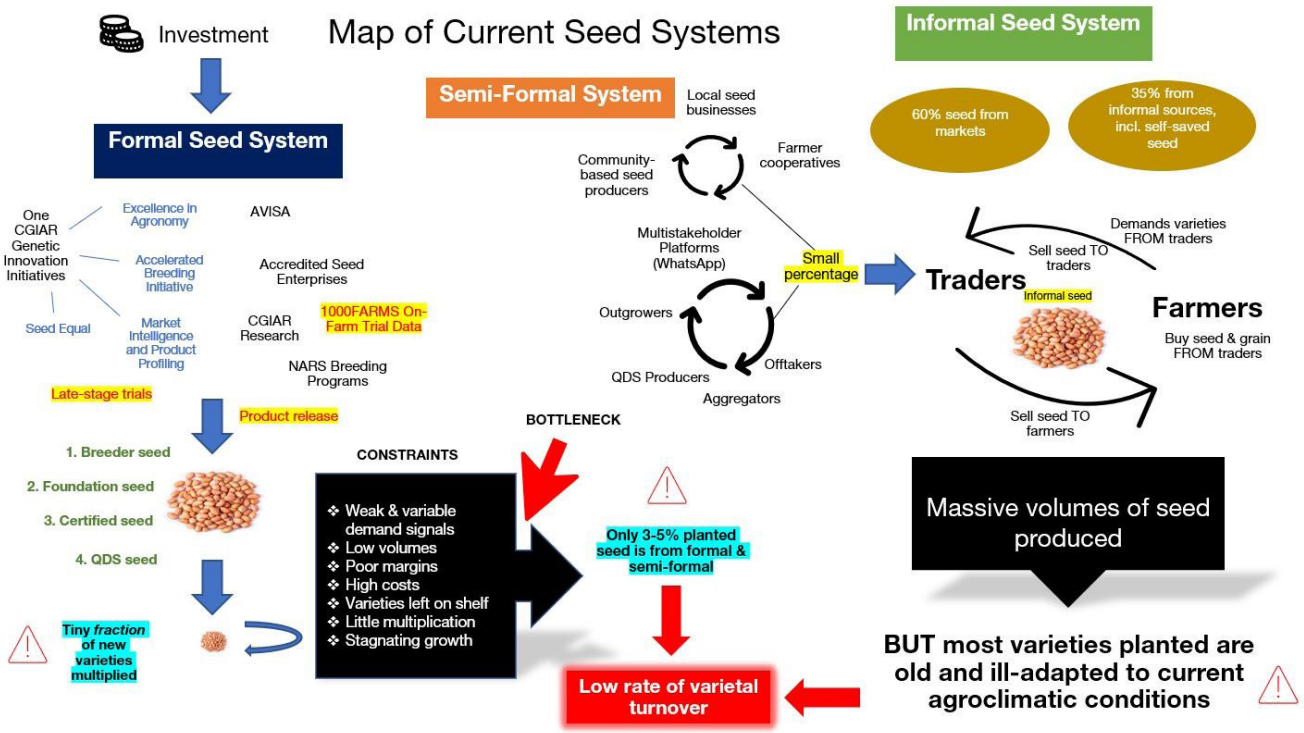
1. Background information

1.1. Introduction

Open-pollinated crops (OPVs) such as beans, sorghum, and groundnuts are vital for increasing income, job creation, and food and nutrition security of both urban and rural households in sub-Saharan Africa (SSA). However, a primary challenge has been the underdeveloped seed systems that are immensely contributing to dwindling productivity among small-scale farmers because of limited access to reliable and quality planting materials. In SSA, specifically in Tanzania, three main types of seed system serve farmers: formal, semi-formal, and informal.[1] The formal system provides farmers with quality seed verified through public (government) or private (company) seed production and delivery systems in which standardized certification systems ensure quality regulation. Nevertheless, the formal system is unable to compete in price or quality with informal sources, so scaling through this approach is not working very well.

The semi-formal system,[2] which includes community-based seed producers (such as quality declared seed, QDS, farmer cooperatives, and local seed entrepreneurs), is regulated less intensively than the formal system. The informal system includes all the other ways farmers obtain seed, such as farm-saved seeds and seed from local markets heavily driven by traders. Although past efforts by multiple programs (AGRA, AVISA, TL-III, and others) have tripled the availability of seed of improved varieties through interventions aimed at improving the performance of formal and semi-formal seed systems over the past decade, seed from these sources typically fulfills only 3% of farmers' planting need while more than 97% is obtained from the informal system (McGuire and Sperling, 2016; Odhiambo et al., 2016). The general seed flows and actors of typical formal, semi-formal, and informal seed systems of open-pollinated crops in Tanzania and other African countries are presented in **Figure 1**.

Figure 1: Generalized seed flows and actors of formal, semi-informal, and informal seed systems.



1 The informal system is also referred to as the "farmer," "local," or "traditional" seed system, and seeds from this system assume similar names.

2 The semi-formal system is also called intermediate.

The formal seed sector is characterized by low margins, high costs of reaching last-mile users, and erratic and uncertain demand, probably because farmers have affordable alternatives from the informal system (e.g., farm-saved seed or local markets). Under these conditions, the formal sector actors such as companies have little incentive to invest in additional production and sales, much less to take on 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 arising from climate change and evolving market demand, as experienced by smallholder farmers and traders in SSA. Consequently, the vast quantity 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 high-quality grain lots for sales as seed during the planting season.

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

The proposed investment to accelerate varietal adoption and turnover for OPVs in Tanzania (see details in Section 1.2) aims at understanding the requirements and constraints of large and marketplace traders to take on new varieties and how best to enable the needed partnerships across the formal, semi-formal, and informal seed sectors to accelerate varietal adoption and turnover. This is based on a demand-pull approach, in which seeds largely come from grain traders, who currently not only buy grain from small-scale producers but also supply the largest amount of planting material (seed) for many OPV crops. Humanitarian agencies and NGOs equally create this demand pull since they spend considerable resources on sourcing and distributing seeds to stressed areas.

1.2 Accelerated Varietal Turnover for Open-Pollinated Crops

Accelerated Varietal 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/PABRA in collaboration with Tanzania Agricultural Research Institute (TARI), Tanzania Official Seed Certification Institute (TOSCI), and the International Maize and Wheat Improvement Center (CIMMYT). The overall aim of the project is to develop a scalable model to accelerate new varietal adoption of open-pollinated crop varieties in Tanzania by linking the existing capacity of the formal and QDS sectors with sources of demand. In addition, the varietal scaling model should be replicable in other crop value chains, regions, or contexts to not only increase productivity through enhanced use of new/improved varieties but also build sustainable seed/grain businesses that transform livelihoods.

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

a. *Increasing the information flow to and from large traders, grain producers, and formal/semi-formal seed producers will increase demand pull for quality seed of improved varieties*. Under this hypothesis, varietal replacement can be rapidly accelerated through demand pull from grain markets and traders, including aggregators, and some semi-formal QDS producers, provided new climate-resilient, farmer- and market-demanded varieties are known and exceed the utility of existing varieties. It is anticipated that this pull will create a demand signal to formal seed and EGS system actors, and that demand for specific varieties by commodity traders will provide a powerful incentive for farmers to adopt new varieties as they must meet their grain quality standards and have an adequate/reliable supply.

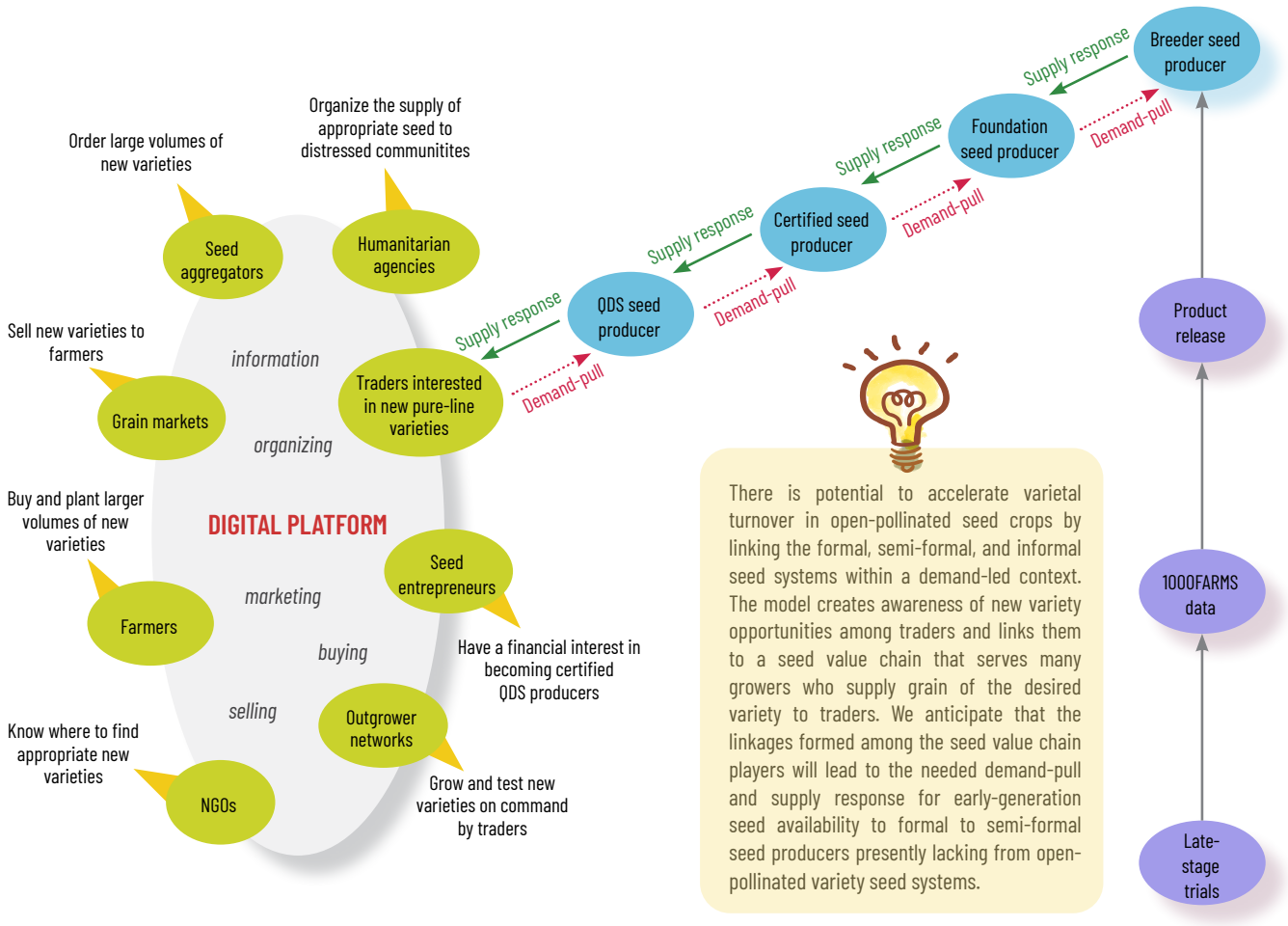
b. *Involving small/marketplace traders in greater numbers and earlier will boost the adoption of new varieties through demand pull.* By actively involving marketplace traders, especially

women, in local demand creation activities for recently released varieties with increased genetic gains, the project will leverage on the ability to scale much more quickly than supply-push approaches.

c. *Increasing institutional buyer awareness of and access to improved varieties will accelerate varietal turnover rates in stressed areas and improve income/nutrition outcomes*. Development agencies, governments, and NGOs spend considerable resources on sourcing and distributing seeds to achieve development goals such as hunger and poverty reduction, relief in climate-stressed areas, and improved nutritional outcomes. Institutional buyers tend not to buy seeds of the last generation of varieties.

The project integrates digital tools to bring efficiency by connecting stakeholders across the seed and commodity value chains, helping users to see new opportunities for win-win relationships. Coordination among stakeholders (including e-commerce buying and selling) will help seed system actors to predict seed demand through pre-orders and respond in a timely manner. The project also assumes enhanced distribution of technical information on new varieties and related crop management methodologies, messaging through interactive radio programming and digital media, tracking seed lots through production stages, and so on. **Figure 2** shows how the demand-pull model is expected to work throughout the project life cycle.

Figure 2: Demand-pull approach.



Finally, the project focuses on farmer- and consumer-demanded climate-resilient varieties of bean, sorghum, and groundnut crops mostly produced by smallholder farmers in Africa. The project is implemented in three phases: *Phase 1: Landscaping and hypothesis validation (the current report details this); Phase 2: Demand-pull learning by market segment; and Phase 3: Cross-learning and model building*. As part of the implementation of Phase 1, a baseline survey was conducted specifically focusing on the hypothesis on stimulating demand pull in the three commodity markets and landscaping of men, women, and youth actors, interests, and capacity in the three seed market segments.

1.3. Objectives of the baseline survey

The baseline survey was conducted with the aim of identifying the interests, drivers, constraints, and opportunities for large traders, small/marketplace traders, and institutional seed markets to adopt improved varieties of sorghum, beans, and groundnuts.

The specific objectives:

1. Identify the demographics and types of traders, including large off-takers, small/marketplace traders, institutional buyers, and humanitarian agencies, engaged in common bean, sorghum, and groundnut seed value chains.
2. Identify the interest of government institutions, humanitarian agencies, and large traders in helping to promote new varieties and engaging with formal (foundation, certified, QDS) seed actors for beans, sorghum, and groundnuts.
3. Identify the interest of small/marketplace traders and other informal actors in offering new varieties and, in a transparent way, ope rating along bean, sorghum, and groundnut seed value chains.
4. Determine the number and type of bean, sorghum, and groundnut seed producers, volumes of seed produced, varieties supplied, sources, and market destinations.
5. Determine the bean, sorghum, and groundnut grain and seed suppliers' interests, drivers, and market destinations for different varieties.
6. Assess the digital literacy of large off-takers and small/marketplace traders engaged in common bean, sorghum, and groundnut seed value chains.

This report is structured to capture elements of beans, sorghum, and groundnuts each distinctly. Section 2 describes the methodology of the scoping survey, including the development of survey tools, training of the survey team, survey planning, pretesting and review of tools, and development of a sampling strategy and size. Section 3 presents the results for beans while Sections 4 and 5 present the results for sorghum and groundnuts, respectively. The last section draws conclusions and recommendations based on the results.

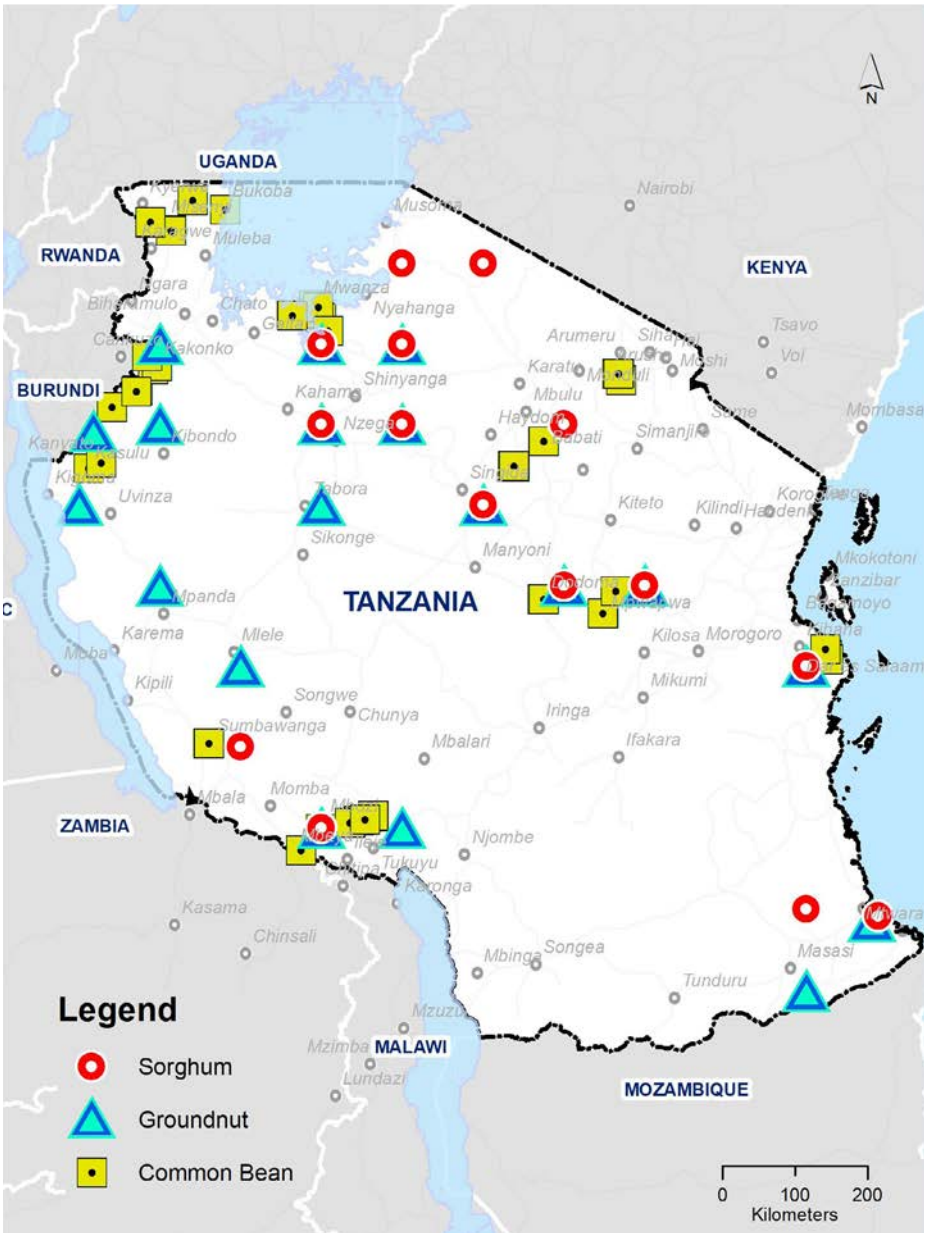
2. Methodology

2.1 Study design

A survey was conducted in all six agroecological zones and 18 regions in Tanzania (**Figure 3**). An exploratory research design was employed, combining both quantitative and qualitative approaches to gather data from traders and humanitarian organizations, including international and local NGOs. The approach involved (i) extensive interviews with large off-takers and small/marketplace traders using a structured questionnaire and (ii) interviews with government institutions and humanitarian agencies (including NGOs) using a short semi-structured questionnaire. The questionnaires were administered in-person and follow-up questions were added through phone calls, email, and online interviews.

This survey focused on the three project commodities (beans, sorghum, and groundnuts). The project partners have extensive experience with the three value chains, thus understanding that the concept of demand pull is a springboard for seed system growth. Although the survey covered all the zones in Tanzania, the regions were selected based on the relative dominance of the commodities in terms of traded volume, production, and availability of large off-takers/traders, small/marketplace traders, government agencies, and humanitarian agencies/NGOs.

Figure 3: Surveyed regions.



2.2 Development of survey tools

The questionnaires were developed following an iterative process involving all the project partners (CIMMYT, TARI, TOSCI, and the Alliance Bioversity-CIAT/PABRA). The questionnaires had seed and grain traders, government and humanitarian agencies, and digital literacy modules. The digital module was for assessing the digital capacity of seed and grain value chain actors. It captured data for determining ownership and use of digital tools and identifying the digital features and operability most desired by seed system actors in information sharing, production planning, partnership, buying/selling opportunities, pricing, and user interface, among others. On the other hand, the government and humanitarian agency tool was developed to capture information about engagement in formal, semi-formal, and informal seed systems, whereas the traders' tool elicited traders' engagement in grain and seed business and challenges that they experience.

2.3 Survey preparations

2.2.1 Training of survey team

The survey team was composed of 20 enumerators drawn from collaborating partners: TARI (17) from Naliendele, Uyole, Maruku, Ilonga, and Selian centers; the Alliance (2); and TOSCI (1). All the survey team members were selected based on commodity specialization, location, and availability to participate in the survey. Following the successful selection of the survey team, a training activity was organized in Arusha from 11 to 14 April 2023 (see the participants' list in Annex 1). The training aimed at consolidating and reviewing the data collection tools; training the survey team on the process of administering those tools; conducting a pre-market visit and appreciating the existing trade modalities for beans, groundnuts, and sorghum in Arusha Town; conducting random interviews with grain traders and collating reflections to inform any adjustments to the tools and overall survey approach; identifying key regions to focus on for the survey in relation to relevant commodities; and developing a sampling design.

2.2.2 Pretesting and review of tools

Pretesting of the survey tools was conducted from 14 to 17 April in select markets across four zones: Northern (Kilombero, Central, and Mbauda), Southern Highlands (Sido and Uyole), Lake, and Western (Bukoba). In the Northern zone, the tools of all three commodities (beans, sorghum, and groundnuts) were pretested for both large off-takers and small/marketplace traders, while in the Southern Highlands and Lake and Western zones small/marketplace bean traders were interviewed. In all the zones, the seed/grain questionnaire and the digital module were pretested. The reflections and feedback from the pretesting exercise were used to adjust the tools, refine the questions, and review the timing and plan of the survey.

2.4 Sampling strategy and size

The major commodity corridors for beans, groundnuts, and sorghum were identified. In total, seven corridors were identified: Southern Highlands, Northern, Central, Western, Eastern, Lake, and Southern zones (which were spread across all the corridors). A multi-stage sampling approach was employed to sample the bean, sorghum, and groundnut traders. First, a purposive approach was applied in selecting the regions and markets, followed by a random selection of a minimum of 5 to 10 small/marketplace and large traders for each crop from those markets. The research team visited the market leader, who randomly selected bean, sorghum, and groundnut traders to be interviewed in the selected markets. The selection of regions and markets was largely based on the production and trade regimes for the three commodities. On the other hand, with the help of the commodity leads from TARI, government and humanitarian organizations were purposively selected based on their engagement in bean, sorghum, and groundnut research and development activities. Combining all the approaches, a sampling matrix was developed. A sample size of 976 was determined covering 18 regions, disaggregated by commodity (beans, 421; groundnuts, 300; sorghum, 255) and by type of trader (large off-takers/traders, 247; small marketplace traders, 659). The survey targeted a sample size of 1,018 traders, but 976 were reached, indicating a response rate

of 96%. Lastly, a total of 112 institutions were interviewed (humanitarian agencies/NGOs, 58, and government agencies, 54, of which 29 were District Agricultural Offices).

2.5 Data collection

The exercise was conducted from 17 May to 9 June 2023 in all six zones across Tanzania. The zones were paired and the survey team was divided into three sub-teams, with each covering a pair of zones for ease of coordination and to increase efficiency. Each sub-team was led by a TARI researcher who coordinated the survey in liaison with the regional and local authorities as well as selected market and institution leaders. The team leader provided feedback to the project leadership as needed and managed and directed the enumerators. A total of 19 enumerators collected data, 7 in Lake and Western, 6 in Southern and Southern Highlands, and 6 in Northern, Central, and Eastern zones (see Annex 1). The final data collected were sent to an online cloud server hosted on the SurveyCTO platform to improve data quality and decrease the time spent in data processing. STATA statistical packages were used to process the range of basic descriptive statistics.

2.6 Grain and seed sample collection

The grain/seed samples were collected during the baseline survey from May to June 2023. The survey also collected information on varieties of beans traded, type of traders (small/marketplace and large traders/off-takers), experience, sources of grains, prices, seasonality of the business, volumes, constraints, opportunities, GPS coordinates, and contacts. At the end of the interview, each trader was requested to share a sample of 50–100 g of grain for each variety traded by the respondent for the past one year. Each sample was then packed in a separate small Ziploc bag and labeled with the following information: trader ID, trader's first name, sample number, variety name, and unique sample ID (a combination of all the above).

Team leaders were responsible for collecting all the samples from all enumerators every day after the field work and storing them in a special bag. A total of 1,836 samples were collected for the three commodities across all the zones and regions surveyed. **Table 2.1** summarizes the number of samples of grain/seed collected from different zones.[3]

Table 2.1 Summary of number of grain samples collected in Tanzania.

Zones	Commodities			Total
	Bean	Groundnut	Sorghum	
Lake & Western	309	106	143	558
Southern & Southern Highlands	401	232	117	750
Northern & Central & Eastern	307	135	86	528
Total	**1,017**	**473**	**346**	**1,836**

3 DNA fingerprinting analysis is ongoing and results are not available in this report.

3. Beans

This study was conducted among 421 traders (208 females and 213 males) in eight regions – Arusha, Manyara, Dodoma, Dar es Salaam, Kagera, Kigoma, Mbeya, Mwanza, Rukwa, and Songwe – targeting large off-takers and small/marketplace traders of common bean (**Table 3.1**). Out of all the sampled traders, 126 were large off-takers and 295 were small/marketplace traders from assorted markets in the target regions. In this study, large off-takers refer to those who handled larger volumes and mainly sold beans to other traders, while traders were those who handled small volumes, engaged in retail business, and mostly sold beans to individual consumers/farmers. Mbeya region had the most (16%) of all traders sampled as well as the highest number of female and marketplace traders (61 and 49), respectively. This is probably because Mbeya region is both a production and distribution hub and comparatively a higher consumption hub as well. On the other hand, Dar es Salaam had the highest number (26%) of all large off-takers and the lowest number (0.02%) of small/marketplace traders, indicating that the region is predominantly a distribution hub, possibly with more bean export/import activities.

Table 3.1 Bean trader sample distribution

Region	Sex of trader		Type of bean trader		Total
	Females	Males	Small/marketplace traders	Large off-takers	
Dodoma	6	41	28	19	47
Dar es Salaam	2	37	6	33	39
Kagera	19	37	40	16	56
Mwanza	25	19	38	6	44
Arusha	15	28	38	5	43
Manyara	13	14	22	5	27
Mbeya	61	7	49	19	68
Rukwa	28	2	27	3	30
Songwe	15	15	17	13	30
Kigoma	24	13	30	7	37
Total	**208**	**213**	**295**	**126**	**421**

3.1 Socioeconomic characteristics of bean traders

The results show that the sample was gender balanced as 49.4% of the traders were females and 50.6% were males (**Table 3.2**). A majority of the women traders (76%) were engaged in small or marketplace trade while the men dominated large off-taking bean businesses. Handling larger volumes of beans requires aggregation and larger capital investments, which can be more challenging to female traders than to their male counterparts. Limited financial resources are a major constraint faced by women entrepreneurs aspiring to grow their businesses. A majority of the women traders combined their bean business with other food items. This confirms the findings from previous studies indicating that a majority of the women entrepreneurs in Tanzania engage in multiple informal, micro, low-growth, and low-profit trade activities, including food vending and charcoal selling (Mori, 2014). About half of the female traders (49.5%) were aged from 30 to 45 years, 33.7% were aged from 46 to 65 years, while the rest were above 65 years. Similarly, 51.6% of the male traders fell in the age group of 30 to 45, while 34.7% were 46 to 65 years old. Overall, 50.6% of the sampled traders were in the age group of 30 to 45 years while 34.2% were in the age group of 46 to 65 years. A total of 63% of the traders had attained primary education, 24.2% had completed O-level education, 3.6%

had completed high school, 5.9% had attained tertiary education, and 3.3% had had no formal education. Overall, 32.8% of the bean traders had 1 to 4 years of experience, 30.9% had 5 to 9 years of experience, 18.5% had 10 to 14 years of experience, while 17.8% reported having been in business for 15 years or more.

Table 3.2 Socio-economic characteristics of bean traders, March 2022 – March 2023

	Sex of trader		Type of bean trader		
	Females (n=208)	Males (n=213)	Marketplace traders (n=295)	Large off-takers (n=126)	Total (n=421)
Sex of traders (%)					
Small/marketplace traders	60.7	39.3			100.0
Large off-takers	23.0	77.0			100.0
Overall	49.4	50.6			
Age (%)					
15 to 29	15.4	11.7	17.0	5.6	13.5
30 to 45	49.5	51.6	51.5	48.4	50.6
46 to 65	33.7	34.7	29.5	45.2	34.2
66 and above	1.4	1.9	2.0	0.8	1.7
Education level attained (%)					
No formal	4.8	1.9	4.4	0.8	3.3
Primary	73.1	53.1	62.0	65.1	63.0
O-level	18.3	30.1	24.4	23.8	24.2
High school	3.4	3.8	4.4	1.6	3.6
Tertiary	0.5	11.3	4.8	8.7	5.9
Number of years in bean business (%)					
1-4 years	37.0	28.6	37.6	21.4	32.8
5-9 years	28.9	32.9	32.5	27.0	30.9
10-14 years	16.4	20.7	16.6	23.0	18.5
15 and over	17.8	17.8	13.2	28.6	17.8

Use of beans by customers

Beans purchased from traders were mainly used for food (91.7%), seed (45.8%), and re-selling (46.3%) to other customers such as retailers and consumers (**Table 3.3**). As expected, small marketplace traders sold more to final consumers (96.9%) than did large off-takers (83.7%). The proportion of customers who were reported to buy and re-sell was higher for large off-takers (74.7%) than for marketplace traders (27.8%). This could be attributed to large off-takers' capacity to handle larger volumes of beans, thus creating additional opportunities for them to sell to other smaller traders and institutions such as schools, prisons, and universities. Both marketplace traders and large off-takers sold grains to farmers as seed (47.1% and 44%, respectively), which confirms that farmers largely rely on the market as the major source of seed. This implies that customers often purchase "informal seeds"[4] from traders, making them important agents for accelerating new varietal adoption and turnover.

4 Seeds bought from traders assume different names: local, traditional, or informal seed.

Table 3.3 What customers use the beans for as reported by traders, March 2022–March 2023

By sex of trader				
	Females	Males	Total	P-value
Food	95.7	87.8	91.7	0.003
Planting	55.8	36.2	45.8	0.000
Re-selling	38.5	54.0	46.3	0.001
By type of trader				
	Small/marketplace traders	Large off-takers	Total	
Food	94.9	84.1	91.7	0.000
Planting	48.8	38.9	45.8	0.061
Re-selling	34.9	73.0	46.3	0.000

Type of bean business

Overall, 74% of the traders engaged in retail trade, 42% in wholesale trade, and 23% in aggregation. There was a higher proportion of female traders in retail trade (86%) than male traders (60%), while in wholesaling male traders dominated (**Table 3.4**). As expected, most large off-takers engaged in wholesale trade while small/marketplace traders were retailers. Small/marketplace traders and large off-takers/traders have direct contact with farmers and even sell seeds to them using different channels. It is important to note that some large off-takers/traders sell seeds to the farmers they have contracted to produce grains and recover the cost during harvest (when purchasing grains) while others sell to farmers the same grains as seeds, particularly after sorting and grading (see details in seed management practices).

Table 3.4 Type of bean business, March 2022–March 2023

	Sex of trader			Type of trader			
	Females	Males	P-value	Small/marketplace traders	Large off-takers	P-value	Total
Retail trade	88.5	59.6	0.000	88.8	38.9	0.000	73.9
Collector/ aggregator/ broker	19.7	25.4	0.166	15.3	39.7	0.000	22.6
Wholesaler	31.7	51.2	0.000	25.8	78.6	0.000	41.6
Producer-trader	0.5	0.9	0.576	0.7	0.8	0.897	0.7
Exporter	0.0	1.4	0.086	0.0	2.4	0.008	0.7

The number of employees refers to all people bound by an agreement, working in the business, and receiving compensation for their work. The results show that 67.7% of the traders had no or one employee, 20.2% had two to five employees, and 3.1% had more than five employees (**Table 3.5**). Overall, more male traders (33.3%) had more than two employees, perhaps because more males were large off-takers handling larger bean volumes, therefore requiring additional personnel to manage the business and run errands. As expected, most (92.2%) of the marketplace traders had one or no employee compared with 53% of the large off-takers with a similar number of employees. More (39.2%) large off-takers had two to five employees compared to 7.8% for marketplace traders with a similar number of employees. A total of 7.8% of the large off-takers had more than five employees while none of the marketplace traders had this number of employees.

Table 3.5 Number of employees in bean business, March 2022–March 2023

Number of employees	Sex of trader		Type of bean trader		
	Females	Males	Small / marketplace traders	Large off-takers	Total
1 or none	87.0	66.7	89.2	47.6	76.7
2–5 employees	12.5	27.7	10.5	42.9	20.2
> 5 employees	0.5	5.6	0.3	9.5	3.1

3.2 Sources of varieties

3.2.1 Varieties/market class of beans traded

On average, traders sold two to three bean types in the year, with a range of one to nine bean types being sold per trader. Yellow, red mottled, and purple varieties were the main varieties sold by traders, with no significant differences between men and women traders (**Table 3.6**). Purple types were common in all the regions except Kigoma, where less than 2% of the traders sold this type. Both male and female traders consider yellow, purple, red mottled, and dark red kidney as their most important bean types in terms of volume traded. Mixed types, however, are traded only by small/marketplace female traders, whereas large off-takers/traders do not sell mixed types at all. It appears that sugars are important to small/marketplace traders.

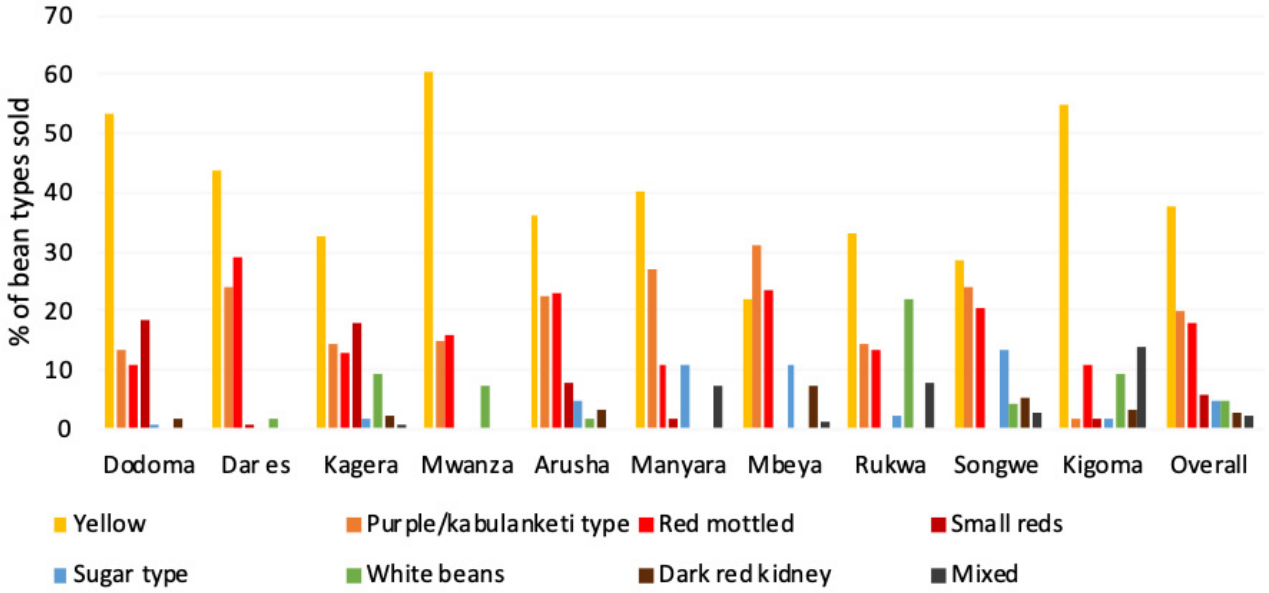
Table 3.6 Type/market class of beans traded, March 2022–March 2023

Bean type	Females		Males		Small / marketplace traders		Large off-takers		Overall	
	n	%	n	%	n	%	n	%	n	%
Yellow	**187**	**34.5**	**241**	**40.7**	**281**	**38.6**	**147**	**36.2**	**428**	**37.7**
Purple	**120**	**22.1**	**108**	**18.2**	**148**	**20.3**	**80**	**19.7**	**228**	**20.1**
Red mottled	**86**	**15.9**	**120**	**20.3**	**110**	**15.1**	**96**	**23.7**	**206**	**18.2**
Small reds	11	2.0	53	9.0	39	5.4	25	6.2	64	5.6
Sugar type	37	6.8	20	3.4	38	5.2	19	4.7	57	5.0
White beans	39	7.2	18	3.0	43	5.9	14	3.5	57	5.0
Other*	22	4.1	12	2.0	26	3.6	8	2.0	34	3.0
Dark red kidney	17	3.1	16	2.7	20	2.8	13	3.2	33	2.9
Mixed	23	4.2	4	0.7	23	3.2	4	1.0	27	2.4
Total	**542**	**100.0**	**592**	**100.0**	**728**	**100.0**	**406**	**100.0**	**1,134**	**100.0**

*Other market classes include cream-coloured beans with the name Uyole, Chapukonza soya, Chababikira, Kamoshi, Kinule, cream coloured maharagwe maini, Rujuta, and two observations of black coloured beans.

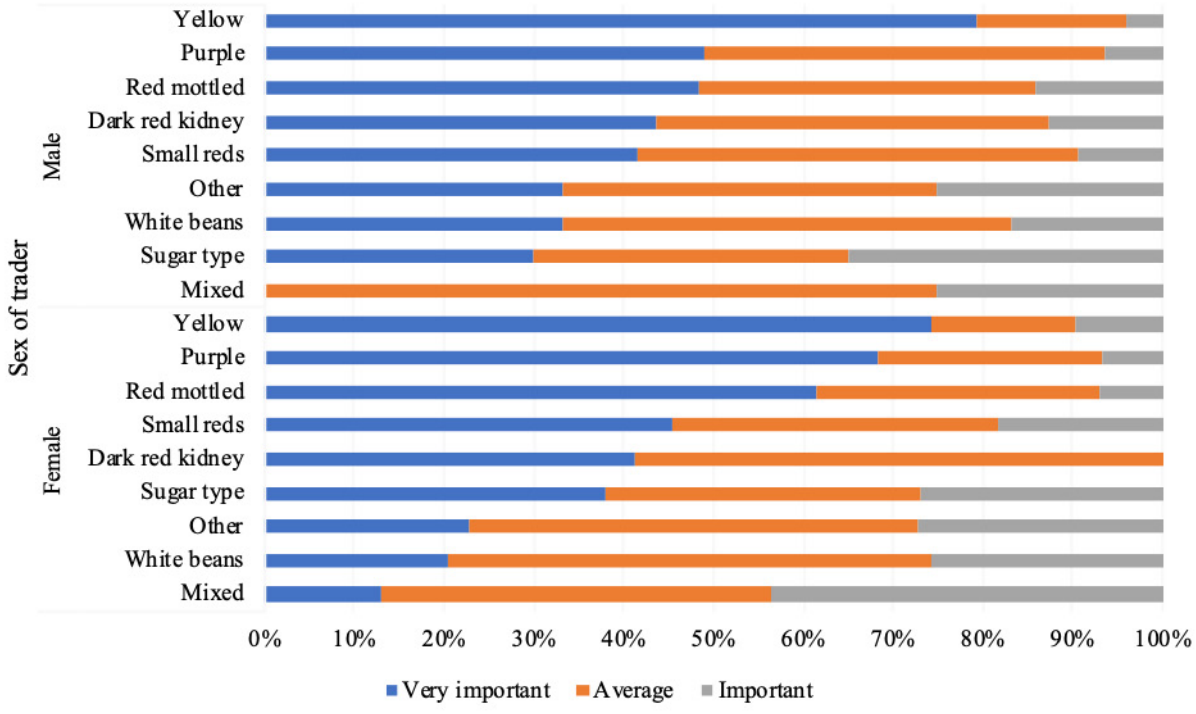
Figure 4 shows the bean types traded by region. Overall, yellow, purple (kabulanketi), and red mottled dominate all across the regions. In Kagera, Arusha, and Kigoma, all eight bean types are traded, whereas Mwanza has the least, where only four bean types are traded.

Figure 4: Bean types traded by region



This study sought to understand which bean market classes are most important in the regions surveyed. The results show that male traders considered yellow, purple, red mottled, and dark red kidney as their most important bean market classes in terms of volumes traded, whereas female traders ranked yellow, purple, red mottled, and small reds as their most important market classes (**Figure 5**). Like male traders, large off-takers indicated that yellow, purple, red mottled, and small reds were very important market classes, whereas small/marketplace traders considered yellow, purple, and red mottled market classes as very important in their bean business (Figure 5).

Figure 5: Relative importance of bean types/market class to the traders' business by sex of trader



3.2.2 Sources of varieties and destination (including types of varieties sold, pure, mixed, etc.)

Sources of beans sold

Traders indicated three major sources of bean grains (farmers, fellow traders, and collectors/aggregators), with no differences between male and female traders (**Figure 6**), with slightly varying amounts of beans sourced, particularly from collectors/aggregators and fellow traders. For small/marketplace traders, the main source of beans sold were the farmers and, to a lesser extent, fellow traders and collectors/aggregators.

As expected, large off-takers mainly sourced beans directly from farmers and collectors/aggregators. Own production was the lowest source of beans for all traders. Collectors/aggregators reported sourcing mainly from farmers with whom they are directly linked and through agents who go around the villages and buy from farmers on their behalf and benefit from commissions. Most of these agents do not have capital, so they are facilitated with money to pay farmers. Once they have substantial volumes (a full truck), these are transported to the collector/aggregator for further handling.

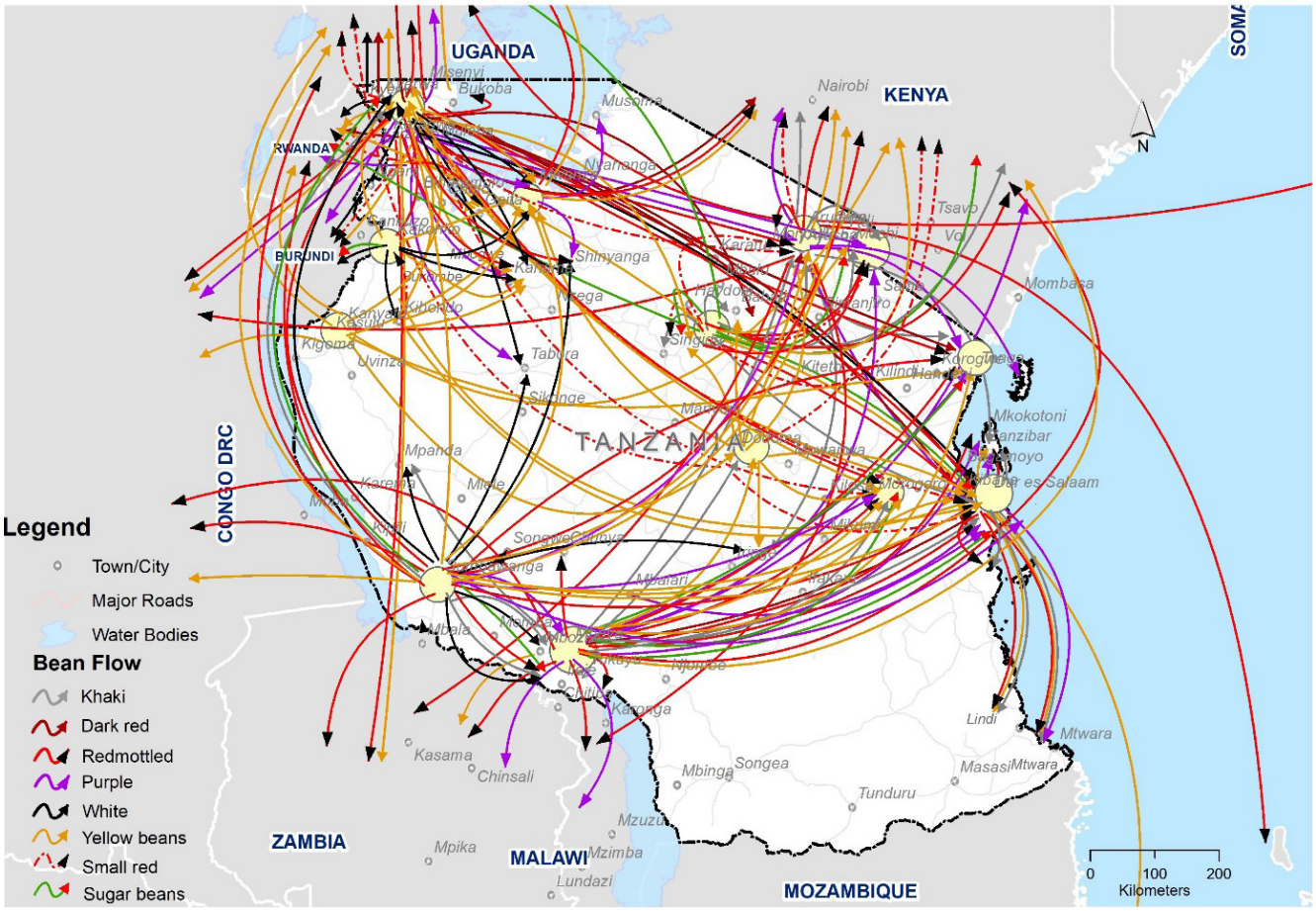
Figure 6: Sources of beans sold

Destinations by bean variety

To understand the informal seed flows and destinations for different bean varieties, maps were generated to trace the movement of specific varieties from their respective sources to where they were relatively highly traded (**Figure 7**). There is usually heavy traffic of all major bean varieties toward 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. It is also evident that some varieties are highly traded within and outside the country, which was less anticipated, especially for the purple type.

Further, these movements depict high concentration of certain bean varieties in certain regions: dark red is more prominent in Kagera region, white beans are more concentrated in the Western region, while small reds are mainly found in the Western and Eastern regions. Interestingly, sugar beans are not as highly traded in the Southern Highlands as was expected. On the contrary, this bean type is highly concentrated in the Hanang-Manyara region. Finally, a key feature of bean trade observed is the long-distance movement of beans (e.g., from Sumbawanga to Kenya and Uganda). This is perhaps an indication of specificity in bean sourcing (i.e., traders prefer beans from certain regions) as well as a potentially huge market for beans beyond national consumption.

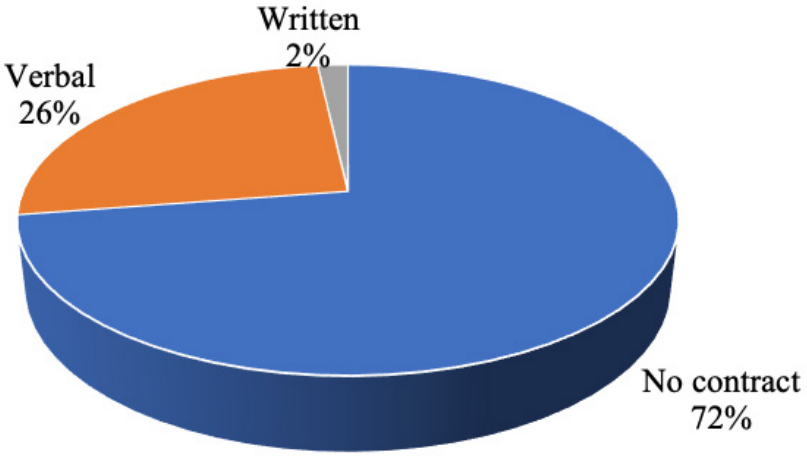
Figure 7: Bean variety flow in Tanzania.



3.2.3. Nature of engagement with suppliers

While all categories of traders obtained beans from various sources, the study established that more than 72% had no contracts with their suppliers identified in Section 3.2.2. The results show that, for traders who had contracts with suppliers, only 2% had written contracts (formal agreements), while 26% had verbal (informal) agreements (**Figure 8**). For traders, contracts helped to ensure the supply of required bean quantities and quality – the agreements are normally made before the season to allow for better planning by farmers on how much to produce and effectively manage their produce for better quality. On the other hand, farmers who had contracts lauded the move as these provided market assurance and encouraged investment in bean production (i.e., an incentive for the adoption and use of improved technologies such as seed to increase productivity and quality of their produce). However, those without contracts indicated that the nature of their businesses did not necessitate prior agreements since they purchased stocks only when they needed to, often in relatively small quantities that did not require quantity and quality assurance. Also, traders preferred meeting sellers in person and seeing the product. This afforded them the opportunity to select what to buy based on their customers' demand and negotiate for a reasonable purchase price based on prevailing market dynamics.

Figure 8: Type of contracts with bean suppliers



3.3 Sales of beans

3.3.1 Volumes for different buyers, prices, and revenues

Small/marketplace traders handled 6,836.4 tons (7.8%) of all beans traded across all markets surveyed. Overall, yellow beans recorded the highest volume sold per year, accounting for 40% (2,726.6 tons) of total bean sales (6,836.4 tons) by marketplace traders. Purple and red mottled were second at 23.02% (1,573.4 tons) and third at 17.03% (1,164.2 tons), respectively, while mixed beans were the least sold at 0.05% (335.6 tons) across all traders interviewed (**Table 3.7**). It is worth noting that women dominated marketplace traders and sold higher volumes (3,759 tons) than what male traders sold (3,077 tons) across all market classes except small reds (Table 3.7). However, the average volume sold across all market classes was higher (10.9 tons) for males than for females (8.4 tons), given that male traders were fewer (n = 283) than female traders (n = 445).

Table 3.7 Average and total volume of beans sold (tons per year) by small marketplace traders, March 2022 – March 2023

Bean type	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	159	7.1	1,129.1	122	13.1	1,597.5	281	9.7	2,726.6
Purple	94	12.2	1,149.1	54	7.9	424.3	148	10.6	1,573.4
Red mottled	65	10.8	700.2	45	10.3	464.0	110	10.6	1,164.2
Sugar type	29	6.2	178.9	9	22.4	201.9	38	10.0	380.7
White beans	36	7.6	271.9	7	2.1	14.8	43	6.7	286.7
Small reds	11	2.2	24.2	28	6.3	177.6	39	5.2	201.8
Mixed	20	4.2	83.5	3	35.8	107.5	23	8.3	191.0
Dark red kidney	12	11.6	139.6	8	5.7	45.5	20	9.3	185.1
Other	19	4.3	82.6	7	6.3	44.3	26	4.9	126.9
Total	**445**	**8.4**	**3,759.0**	**283**	**10.9**	**3,077.3**	**728**	**9.4**	**6,836.4**

Large off-takers handled 81,101.3 tons (92.2%) of all beans traded across all markets surveyed. Yellow beans were the most sold (54.85%), while red mottled and purple were second and third (21.76% and 12.85%, respectively) of the total volume sold by large off-takers (**Table 3.8**). However, unlike the small/marketplace traders, for large off-takers, men dominated bean trade, accounting for more than 80% of the total bean volumes sold for all varieties except mixed

beans. This might be because large off-takers handle large volumes that require larger resource (financial and time) investments, which may not be available to their women counterparts. Such huge investments also require greater presence, longer travel distances to source beans, clientele management, and networking capacity that might be untenable for women traders. Other than resource constraints, women's role in households and reproductive burdens can hinder their ability to start and manage larger business activities.

Table 3.8 Average and total volume of beans sold (tons per year) by large off-takers, March 2022–March 2023

Bean type	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	28	201.1	5,630.8	119	326.5	38,856.2	147	302.6	44,487.0
Red mottled	21	168.1	3,530.0	75	188.3	14,119.0	96	183.8	17,649.0
Purple	26	119.9	3,118.4	54	135.2	7,301.0	80	130.2	10,419.4
Small reds	-	-	-	25	128.5	3,212.0	25	128.5	3,212.0
Sugar type	8	170.6	1,364.4	11	65.0	715.0	19	109.4	2,079.4
Dark red kidney	5	28.2	140.8	8	196.6	1,573.0	13	131.8	1,713.8
White beans	3	32.8	98.4	11	81.0	891.4	14	70.7	989.8
Other	3	2.9	8.6	5	75.2	376.0	8	48.1	384.6
Mixed	3	35.4	106.2	1	60.0	60.0	4	41.6	166.2
Total	**97**	**144.3**	**13,997.7**	**309**	**217.2**	**67,103.6**	**406**	**199.8**	**81,101.3**

Overall, male traders outnumbered female traders, with the former selling more volume (70,181 tons) than females (17,757), accounting for 80% and 20%, respectively, of the total volume sold (87,938 tons). On the other hand, among marketplace traders, females (61%) outnumbered males; however, on average, male traders sold more volume (26.5 tons per trader) than females (21 tons per trader). In contrast, more large off-takers were males (n = 97) than females (n = 29), which was also reflected in the average volume sold: 691.8 tons and 482.7 tons for male and female large off-takers, respectively (**Table 3.9**). As explained earlier, the large off-taking/trading business is male dominated because male traders have a comparative advantage over their female counterparts in access to resources for bean business establishment and expansion. The volumes traded are also presented by agroecological zone (**Table 3.10**).

Table 3.9 Total volume (tons) sold per trader past one year (March 2022–March 2023)

	Small / marketplace traders			Large off-takers			Overall		
	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)
Females	179	21.0	3,759	29	482.7	13,998	208	85.4	17,757
Males	116	26.5	3,077	97	691.8	67,104	213	329.5	70,181
Combined	295	23.2	6,836	126	643.7	81,101	421	208.9	87,938
pr (|T|>|t|)		**0.2956**			**0.3808**			**0.0002**	

Table 3.10 Total volumes (tons) sold by agroecological zone, March 2022–March 2023

Bean type	Central zone	Coastal zone	Lake zone	Nothern zone	Southern Highlands	Western zone	Total
Yellow	5,018.9	26,274.8	4,116.8	3,816.7	4,724.9	3,261.5	47,213.6
Red mottled	880.3	6,591.4	2,535.2	3,469.8	4,831.9	504.6	18,813.2
Purple	611.6	4,781.5	1,401.9	410.3	4,778.9	8.6	11,992.8
Small reds	1,374.7	42.0	1,880.1	113.4		3.6	3,413.8
Sugar type	0.1		5.4	249.7	2,204.4	0.6	2,460.1
Dark red kidney	20.6		1,054.0	2.3	447.0	375.0	1,898.9
White beans		300.0	590.3	1.2	381.1	4.0	1,276.5
Others	8.5		397.2	5.8	99.1	0.9	511.5
Mixed			0.2	76.7	220.3	60.0	357.2
Total	**7,914.6**	**37,989.7**	**11,981.1**	**8,145.8**	**17,687.5**	**4,218.8**	**87,937.6**

Sales to different buyer types

Results from this study show that 69,554.9 tons were sold to other traders (**Table 3.11**), equivalent to 80.81% of all traded beans (87,938 tons). More males than females sold to other traders, also reflecting higher total volumes of 56,806.9 tons and 12,748 tons as well as mean sales of 130.9 tons and 40.5 tons sold by males and females, respectively, for all market classes. This was expected because traders often buy beans for re-selling from large off-takers, dominated by males. However, exceptionally, female traders sold more (1,014.9 tons) sugar beans to other traders than males (840 tons). The bean volumes sold to traders varied across market classes, with yellow, red mottled, and purple beans being the most purchased by traders at 40%, 26%, and 19% of the total beans sold to traders, respectively, while mixed beans were the least purchased by all traders.

Table 3.11 Grain sale volumes to traders (tons/year), March 2022–March 2023

Bean type	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	92	56.0	5,156.2	181	185.5	33,578.0	273	141.9	38,734.1
Red mottled	62	52.0	3,222.5	98	127.8	12,525.2	160	98.4	15,747.8
Purple	77	37.9	2,917.4	72	85.0	6,117.2	149	60.6	9,034.6
Sugar type	27	37.6	1,014.9	17	49.4	840.0	44	42.2	1,855.0
Small reds	4	1.7	6.6	37	47.9	1,772.8	41	43.4	1,779.4
Dark red kidney	12	12.7	152.1	9	106.9	962.3	21	53.1	1,114.4
White beans	19	8.5	160.7	11	44.1	485.0	30	21.5	645.7
Other	13	1.7	21.7	6	62.4	374.3	19	20.8	395.9
Mixed	9	10.6	95.7	3	50.7	152.2	12	20.7	247.9
Total	**315**	**40.5**	**12,748.0**	**434**	**130.9**	**56,806.9**	**749**	**92.9**	**69,554.9**

A total of 13,378.9 tons of beans were sold to consumers, equivalent to 15.54% of all beans (87,938 tons) sold across all markets (**Table 3.12**). The bean volumes sold to consumers were dominated by yellow, red mottled, and purple beans accounting for 45.61% (6,102.1 tons), 17.95% (2,401.5 tons), and 16.7% (2,234.2 tons) of the total beans sold to consumers, respectively, while mixed beans were the least purchased at 0.005% (80 tons). Interestingly, females sold less (4,039.2 tons) to consumers than males (9,339.6 tons). This might be because the females who dominated the marketplace trading sold smaller packs than their male counterparts. It might be possible that the large off-takers (mostly men) also sold part of their stocks to consumers.

Table 3.12 Grain sold to consumers (tons/year), March 2022–March 2023

Bean type	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	171	7.8	1,339.9	171	27.8	4,762.2	342	17.8	6,102.1
Purple	106	9.5	1,011.5	77	18.1	1,390.0	183	13.1	2,401.5
Red mottled	74	10.3	762.8	72	20.4	1,471.4	146	15.3	2,234.2
Small reds	11	1.6	17.2	41	26.7	1,093.0	52	21.3	1,110.2
White beans	37	5.1	189.8	15	25.0	374.8	52	10.9	564.6
Sugar type	32	15.5	496.2	9	7.0	62.9	41	13.6	559.2
Dark red kidney	13	6.9	90.1	10	13.3	132.7	23	9.7	222.8
Other	22	2.8	60.6	8	5.4	43.3	30	3.5	103.9
Mixed	20	3.6	71.2	3	3.1	9.3	23	3.5	80.5
Total	**486**	**8.3**	**4,039.2**	**406**	**23.0**	**9,339.6**	**892**	**15.0**	**13,378.9**

A total of 3,139.7 tons (3.65%) of all traded beans (87,938 tons) were sold to institutional buyers such as schools, universities, prisons, WFP, and other bulk buyers. Like other market segments, yellow beans were the most sold at 54.2% (1,701.8 tons), while dark red kidney and red mottled were second and third at 17.29% (542.7 tons) and 12.51% (392.8 tons), respectively, of the total volumes sold (**Table 3.13**). Interestingly, the purple beans consistently preferred by other traders and consumers were replaced by dark red kidney beans, which might be linked to their nutritional value given that one of the objectives of institutional buyers is to distribute beans to vulnerable households to meet their food and nutrition security needs. Male traders dominated sales to institutions in terms of both number of traders (82) and bean volume traded (1,888.9 tons). Yellow beans maintained the lead in consumer preference.

Table 3.13 Grain sale volumes to institutions (tons/year), March 2022 – March 2023

Bean type	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	6	0.9	5.3	29	58.5	1,696.5	35	48.6	1,701.8
Dark red kidney	1	19.2	19.2	5	104.7	523.5	6	90.5	542.7
Red mottled	0		-	19	20.7	392.8	19	20.7	392.8
Small reds	0		-	16	22.1	353.2	16	22.1	353.2
Purple	1	0.0	0.0	9	11.3	101.6	10	10.2	101.7
White beans	1	0.1	0.1	2	9.3	18.5	3	6.2	18.6
Mixed	2	7.6	15.2	1	3.0	3.0	3	6.1	18.2
Sugar type	1	6.0	6.0	1	4.8	4.8	2	5.4	10.8
Total	**12**	**3.8**	**45.9**	**82**	**37.7**	**3,093.9**	**94**	**33.4**	**3,139.7**

Sale prices

The overall highest price was reported for yellow beans (USD 1,150/ton), followed by purple (USD 1,082/ton) and red mottled (USD 1,008/ton) (**Table 3.14**). On average, small/marketplace traders reported a higher average price (USD 1,060/ton) than large off-takers (USD 1,032/ton), possibly because most of them sold beans directly to final consumers in small quantities while large traders sold mostly to small and other large traders, including retailers and institutions such as WFP, schools, prisons, universities, etc. Across the two categories of traders, males reported higher prices than females, a trend that was consistent across bean types with the exception of small reds, sugar beans, and mixed beans.

Table 3.14 Average grain sale prices (mean USD/ton) for all traders, March 2022–March 2023

Bean type	Small / marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Yellow	1,127	1,204	1,161	1,029	1,155	1,131	1,113	1,180	1,150
Purple	1,062	1,146	1,092	982	1,100	1,062	1,044	1,123	1,082
Red mottled	979	1,068	1,016	900	1,028	1,000	960	1,043	1,008
Small reds	980	999	993	-	919	919	980	961	964
Dark red kidney	907	1,013	950	765	916	858	866	965	914
Other	836	1,110	910	1,013	858	916	860	1,005	911
White beans	847	1,118	891	895	948	937	851	1,014	902
Sugar type	943	961	947	751	770	762	901	856	886
Mixed	740	658	729	611	819	663	723	698	719
All types	1,018	1,128	1,060	934	1,062	1,032	1,003	1,094	1,050

*USD 1 = TZS 2,319.

The price offered by other traders was reported to range from USD 712 to USD 1,100/ton across all market types available at the time of the survey (**Table 3.15**). Yellow beans were sold to other traders at USD 1,100/ton, while purple, red mottled, and small red were sold at USD 1,029/ton, USD 968/ton, and USD 960/ton, respectively. Male traders sold beans at higher prices across all bean types except small reds.

Table 3.15 Sale price to traders (mean USD/ton/year) by market class, March 2022–March 2023

Bean type	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Yellow	1,127	1,204	1,161	1,029	1,155	1,131	1,113	1,180	1,150
Purple	1,062	1,146	1,092	982	1,100	1,062	1,044	1,123	1,082
Red mottled	979	1,068	1,016	900	1,028	1,000	960	1,043	1,008
Small reds	980	999	993	–	919	919	980	961	964
White beans	907	1,013	950	765	916	858	866	965	914
Other	836	1,110	910	1,013	858	916	860	1,005	911
Sugar type	847	1,118	891	895	948	937	851	1,014	902
Dark red kidney	943	961	947	751	770	762	901	856	886
Mixed	740	658	729	611	819	663	723	698	719
All types	1,018	1,128	1,060	934	1,062	1,032	1,003	1,094	1,050

Bean prices for consumers ranged from USD 772 for mixed varieties to USD 1,186 per ton for yellow beans (**Table 3.16**). Like for other clients, yellow beans were the highest priced at USD 1,186/ton, while purple, small red, red mottled, and sugar beans cost consumers USD 1,103/ton, USD 1,078/ton, USD 1,056/ton, and USD 1,009/ton, respectively. Mixed beans were the lowest priced at USD 772/ton.

As expected, marketplace traders reported higher prices per ton across all major market types vis-à-vis large off-takers. However, for both categories of traders, females sold beans to consumers at a lower price per unit than male traders across the bean market types, perhaps because females are more flexible in bargaining and often adopt a pricing strategy to keep and expand their market share.

Table 3.16 Sale prices for consumers (mean USD/ton/year) by market class, March 2022–March 2023

Bean type	Small / marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Yellow	1,154	1,255	1,195	1,069	1,187	1,160	1,144	1,229	1,186
Purple	1,081	1,172	1,114	1,027	1,101	1,071	1,071	1,146	1,103
Small reds	1,125	1,102	1,109	-	1,009	1,009	1,125	1,066	1,078
Red mottled	1,024	1,122	1,062	880	1,119	1,044	993	1,121	1,056
Sugar type	1,035	1,261	1,076	673	827	730	978	1,116	1,009
Dark red kidney	938	1,063	989	870	977	924	922	1,037	972
White beans	864	1,214	924	827	976	935	861	1,087	926
Other	809	1,154	892	985	1,013	996	833	1,118	909
Mixed	789	625	773	862	647	755	792	632	772
All types	1,051	1,188	1,102	961	1,113	1,067	1,038	1,158	1,093

Large off-takers, especially male traders, reported a higher number (more than nine) of bean market types sold to institutional buyers than small marketplace traders (**Table 3.17**). Bean prices for institutional buyers ranged from USD 747 to USD 1,191/ton, probably the highest for yellow beans. Overall, small/marketplace traders reported higher prices for beans sold to institutional buyers than large off-takers across different market classes. The highest price was USD 1,191/ton for yellow beans, while red mottled and purple beans were sold at USD 1,085/ton and 1,069/ton, respectively. Mixed beans were the lowest priced at USD 747/ton. Women traders reported higher prices for beans sold to institutional buyers than their male counterparts, especially for yellow, purple, and white beans.

Table 3.17 Sale prices for institutional buyers (mean USD/ton/year) by market class, March 2022–March 2023

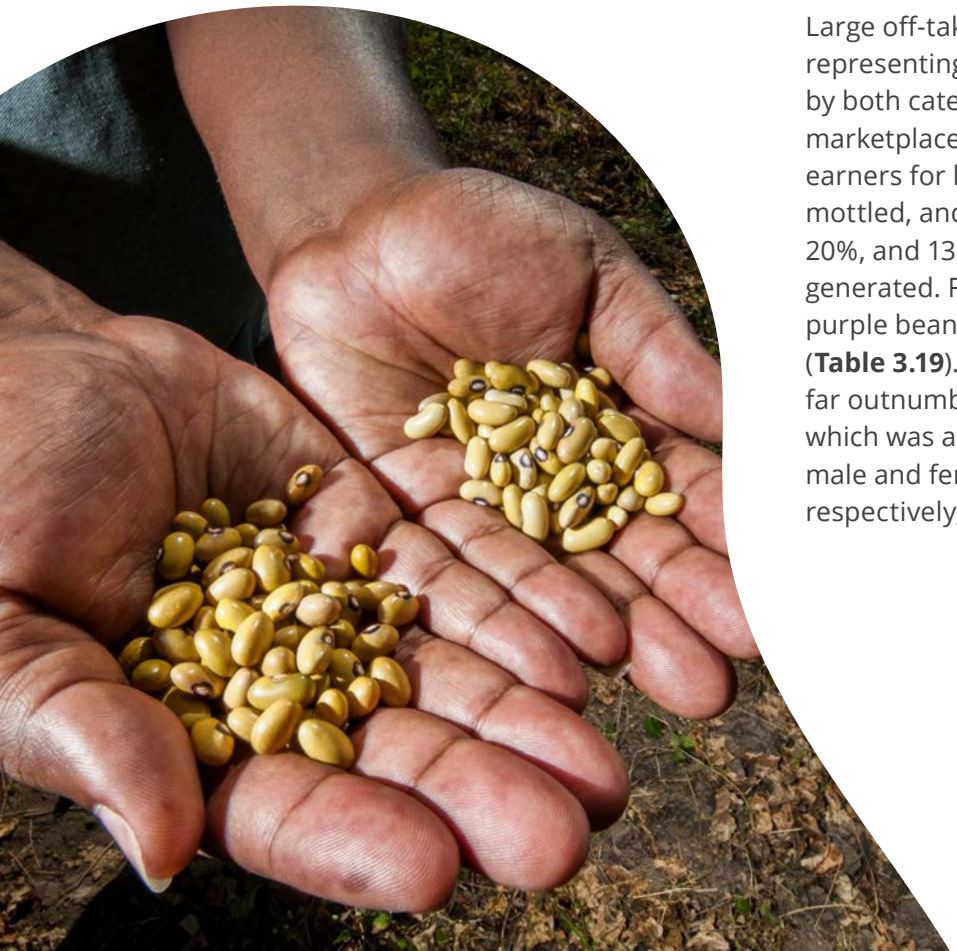
Bean type	Small / marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Yellow	1,358	1,240	1,285	1,078	1,139	1,136	1,312	1,167	1,191
Red mottled	-	1,024	1,024	-	1,101	1,101	-	1,085	1,085
Purple	1,337	1,013	1,078	-	1,061	1,061	1,337	1,040	1,069
Small reds	-	992	992	-	977	977	-	981	981
Dark red kidney	-	-	-	776	966	934	776	966	934
White beans	1,078	-	1,078	-	686	686	1,078	686	817
Sugar type	-	-	-	625	992	809	625	992	809
Mixed	1,078	-	1,078	517	647	582	798	647	747
Other	1,286	1,102	1,154	749	1,053	1,035	1,107	1,065	1,070

Revenue

The results show that small marketplace traders earned a total of USD 6,814,192, representing 6.9% of the total revenue earned (USD 98,696,255) by both categories of traders. As expected, yellow, purple, and red mottled bean types fetched the highest revenue, accounting for 44%, 24%, and 16%, respectively, of the total revenue generated by small/marketplace traders across all market classes (**Table 3.18**). Female traders generated 52% of the total revenue from bean sales while their male counterparts generated 48% cumulatively. However, the larger number of female traders than male traders resulted in lower average revenue generated per female trader (USD 7,994) than per male trader (USD 11,508). This variance could also be explained because male small/marketplace traders generally sold beans at a higher average price than female traders as explained earlier.

Table 3.18 Revenue by market class (USD per year) for small/marketplace traders, March 2022–March 2023

Bean type	Females			Males			Total		
	n	Mean USD	Total USD	n	Mean USD	Total USD	n	Mean USD	Total USD
Yellow	159	7,378	1,173,030	122	15,083	1,840,115	281	10,723	3,013,146
Purple	94	11,878	1,116,515	54	9,085	490,600	148	10,859	1,607,116
Red mottled	65	9,582	622,802	45	9,911	445,993	110	9,716	1,068,795
Sugar type	29	5,497	159,423	9	16,582	149,234	38	8,123	308,656
White beans	36	6,192	222,923	7	2,408	16,855	43	5,576	239,779
Small reds	11	2,116	23,271	28	6,281	175,871	39	5,106	199,142
Dark red kidney	12	9,532	114,383	8	4,778	38,220	20	7,630	152,604
Mixed	20	2,977	59,531	3	18,841	56,522	23	5,046	116,054
Other	19	3,453	65,610	7	6,185	43,292	26	4,189	108,903
Total	**445**	**7,994**	**3,557,490**	**283**	**11,508**	**3,256,702**	**728**	**9,360**	**6,814,192**



Large off-takers earned a total of USD 91,882,063, representing 93.1% of the total revenue earned by both categories of traders. Like for the small/marketplace traders, the top three revenue earners for large off-takers were yellow, red mottled, and purple beans, accounting for 59%, 20%, and 13%, respectively, of the total revenue generated. For this category of traders, however, purple beans were third after red mottled beans (**Table 3.19**). As expected, male off-takers/traders far outnumbered their female counterparts, which was also reflected in the total revenue, with male and female traders generating 85% and 15%, respectively, of the total revenue.

Table 3.19 Revenue (USD per year) by market class for large off-takers, March 2022 – March 2023

Bean type	Females			Males			Total		
	n	Mean USD	Total USD	n	Mean USD	Total USD	n	Mean USD	Total USD
Yellow	28	211,293	5,916,198	119	401,789	47,812,879	147	365,504	53,729,073
Red mottled	21	168,124	3,530,604	75	199,395	14,954,595	96	192,554	18,485,203
Purple	26	125,733	3,269,061	54	161,128	8,700,907	80	149,625	11,969,968
Small reds	0		-	25	114,025	2,850,633	25	114,025	2,850,633
Sugar type	8	159,584	1,276,675	11	51,786	569,642	19	97,175	1,846,317
Dark red kidney	5	21,389	106,943	8	185,142	1,481,134	13	122,160	1,588,077
White beans	3	25,226	75,679	11	82,252	904,776	14	70,033	980,455
Other	3	2,875	8,624	5	61,492	307,460	8	39,511	316,085
Mixed	3	22,359	67,076	1	49,159	49,159	4	29,059	116,235
Total	**97**	**146,916**	**14,250,862**	**309**	**251,234**	**77,631,182**	**406**	**226,310.5**	**91,882,063**

Overall, as depicted in **Table 3.20**, the total volume traded by both small/marketplace traders and large off-takers across all the bean market classes was 87,938 tons, generating revenue amounting to USD 98,696,238. Consistent with the cases in the respective categories of traders, yellow beans were the most traded and the highest revenue earner, accounting for 54% (47,214 tons) of the total traded volume (87,938 tons) and 58% (USD 56,742,228) of the total revenue (USD 98,696,238). Mixed beans were the least sold for both categories of traders, possibly because of consumers' demand for pure varieties as noted during the survey.

Table 3.20 Total volume traded (tons) and revenue (USD) per market class, March 2022–March 2023

Bean type	Total volume traded (tons)	Total revenue (USD)
Yellow	47,214	56,742,228
Red mottled	18,813	19,553,996
Purple	11,993	13,577,083
Small reds	3,414	3,049,775
Sugar type	2,460	2,154,973
Dark red kidney	1,899	1,740,680
White beans	1,276	1,220,234
Other	512	424,987
Mixed	357	232,289
Total	**87,938**	**98,696,238**

Overall, male traders outnumbered female traders, with male traders generating 82% (USD 80,887,900) of the total revenue (USD 98,696,251). Similarly, for small/marketplace traders, the males generated more revenue (USD 28,075) than the females (USD 19,874) even though the males were fewer (39%) than the females (61%). As explained earlier, this could be attributed to male traders selling beans at higher prices than females. In contrast, the male large off-takers generated nearly six times more revenue (USD 77,631,195) than the females (USD 14,250,861) (**Table 3.21**), attributable to larger volumes traded and higher prices charged by male traders as discussed earlier.

Table 3.21 Total revenue per trader (USD) for the past one year, March 2022–March 2023

	Small / marketplace traders			Large off-takers			Overall		
	n	Mean USD per year	Total USD	n	Mean USD per year	Total USD	n	Mean USD per year	Total USD
Females	179	19,874	3,557,489	29	491,409	14,250,861	208	85,617	17,808,351
Males	116	28,075	3,256,702	97	800,322	77,631,195	213	379,755	80,887,900
Combined	295	23,099	6,814,193	126	729,223	91,882,048	421	234,433	98,696,251
pr (|T|>|t|)		**0.112**			**0.2877**			**0.0002**	

3.3.2 Main buyers of grain (gender, type of institutional buyer)

Overall, there were more female (51.3%) than male (48.7%) bean buyers across all categories of traders (**Table 3.22**). However, considering trader gender, female traders sold more to female buyers (54.3%) than to male buyers (45.7%), whereas male traders sold more to male buyers (51.7%) than to female buyers (48.3%). Although the percentages suggest a near-even split in buyers' gender, they are indicative of the influence of the sellers' gender on bean buyers' behavior. The differences in the results could be because the percentage of female traders engaged in retail business is higher than that of men who sell directly to individual consumers and most of the time women are responsible for purchasing food items for the household. The higher proportion of large off-takers was males who could handle larger volumes and sell to other traders in a larger proportion than female traders, as explained in other sections.

Table 3.22 Gender of bean buyers, March 2022 – March 2023

Sex of bean customers	Sex of trader			Type of trader			Overall
	Females	Males	P-value	Market place traders	Large off-takers	P-value	
Men	45.7	51.7	0.0003	46.0	55.2	0.0000	48.7
Women	54.3	48.3	0.0003	54.0	44.8	0.0000	51.3

Bean traits preferred by buyers

Table **3.23** presents important traits that influence buyers' preferences for certain bean types. The traits can be differentiated as *consumption-oriented* (taste, cooks faster, no gas, color), *production-oriented* (high yield, disease resistance), and *market-oriented* (grain size), with some traits being cross-cutting (readily available, good price). Overall, taste (77.3%), cooking time (56.8%), and less gas (flatulence) stood out as the key traits that guide bean buyers' preferences across all the varieties under survey. Good taste was reported as relatively the most sought-after trait across all bean types under study: yellow (91.6%), purple (79%), white (71.9%), red mottled (65.5%), small reds (62.5%), sugar (56.1%), red kidney (51.5%), and mixed (48.2%).

Across market classes, yellow (73.6%), purple (70.6%), and white (52.6) beans were preferred because of their short time cooking, while white (49.1%) and yellow (36.2%) beans were preferred because of low flatulence. Small red (59.4%) and

mixed (51.9%) beans were preferred because they were sold at cheaper prices. Red mottled (35.5%), dark red kidney (27.3%), and sugar (28.1%) beans were preferred because of their large grains. The results are similar for traders who sold local seed and those who did not sell local seed (Annex **Tables 3.24** and **3.25**). These traits are important in establishing feed-forward and feedback loops among seed system stakeholders. For instance, if traders are clear on what consumers want, they will ask suppliers to obtain specific bean types with those traits and suppliers will push farmers to produce those varieties. If the varieties available in the market do not have those traits, then researchers will obtain feedback and either improve the existing varieties by embedding the desired traits or develop new varieties.

Table 3.23 Bean type/market class preference by buyers, March 2022–March 2023

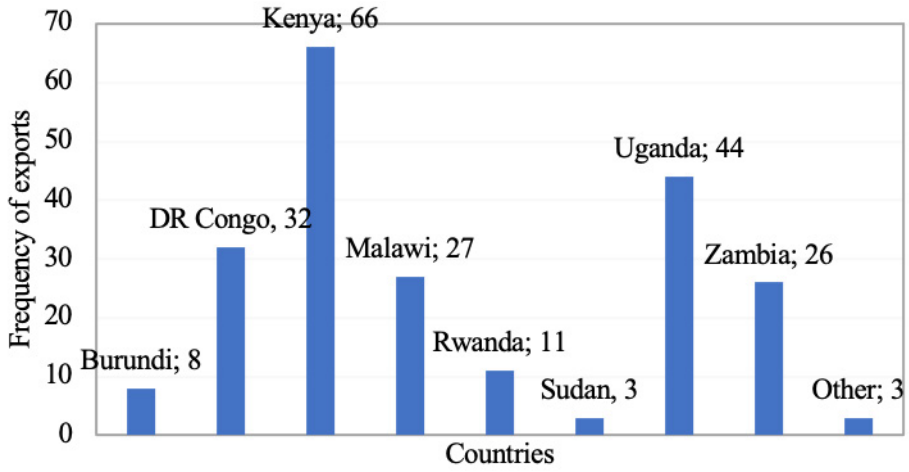
Preference	Red mottled (n=206)	Sugar type (n=57)	White (n=57)	Purple (n=228)	Dark red kidney (n=33)	Small reds (n=64)	Mixed (n=27)	Yellow (n=428)	Others (n=34)	Overall (n=1134)
Taste/ palatable/ delicious	65.5	56.1	71.9	79.0	51.5	62.5	48.2	91.8	73.5	77.3
Cooks faster	35.4	36.8	52.6	70.6	30.3	20.3	25.9	73.6	41.2	56.8
No gas (flatulence)	9.2	31.6	49.1	19.7	6.1	7.8	0.0	36.2	8.8	24.3
Color	19.9	19.3	21.1	18.0	18.2	25.0	3.7	18.5	11.8	18.6
Cheap	19.4	17.5	19.3	13.2	30.3	59.4	51.9	6.5	23.5	16.7
Large size	33.5	28.1	3.5	15.8	27.3	0.0	0.0	8.4	5.9	15.0
Readily available	17.0	1.8	7.0	14.5	18.2	14.1	3.7	9.4	2.9	11.5
High yield	16.5	26.3	14.0	11.8	24.2	6.3	0.0	6.1	14.7	11.2
Good price	11.7	7.0	12.3	4.8	12.1	9.4	18.5	7.5	14.7	8.6
Disease resistance	1.5	0.0	0.0	1.8	3.0	1.6	3.7	2.3	5.9	1.9
Others*	5.8	10.5	5.3	2.2	3.0	20.3	7.4	4.4	23.5	6.1

*Others include thick broth, suitability for accompanying with other foods (e.g., bananas, maize).

3.3.3 Traders' engagement in the export market

Traders reported bean exports outside Tanzania (**Figure 9**). Some exports were to multiple countries. Kenya is the leading destination, accounting for 66 (30%) cases, followed by Uganda (44 cases, 20%) and DR Congo (32 cases, 15%), Malawi, and Zambia.

FIGURE 9: Frequency of bean export



In total, 10,749.6 tons of beans were exported in the last 12 months during the survey (**Table 3.24**). Yellow and red mottled beans recorded the highest and second highest exported volumes of 4,495.3 tons (41.82%) and 4,004.2 tons (37.25%), respectively. More male traders (82) than female traders (62) were engaged in the bean export business. Similarly, male traders exported more beans (7,260.1 tons) than female traders (3,489.5 tons) across all varieties except purple type. This was expected because the export business is associated with high financial and time investment and handling large bean volumes, both of which limit the participation of females, particularly small/marketplace traders, while enhancing the participation of male traders, particularly large off-takers.

Table 3.24 Volumes exported (mean tons/year) by market class, March 2022–March 2023

Bean type	Females			Males			Total		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	15	114.1	1,711.4	27	103.1	2,783.9	42	107.0	4,495.3
Red mottled	17	74.7	1,270.6	22	124.3	2,733.6	39	102.7	4,004.2
Dark red kidney	3	26.2	78.6	1	640.0	640.0	4	179.7	718.6
Sugar type	12	8.7	103.9	8	50.5	403.9	20	25.4	507.8
Small reds	0		-	10	50.4	504.1	10	50.4	504.1
Purple	8	32.9	263.5	10	10.1	100.9	18	20.2	364.4
White beans	2	28.8	57.6	3	23.2	69.7	5	25.5	127.3
Mixed	3	1.3	3.9	1	24.0	24.0	4	7.0	27.9
Other	1	0.0	0.0	0		-	1	0.0	0.0
Total	**61**	**57.2**	**3,489.5**	**82**	**88.5**	**7,260.1**	**143**	**75.2**	**10,749.6**

3.4 Trader involvement in bean seed sales

Traders were asked whether they sold bean grain for planting in the past one year (March 2022–March 2023). The results showed that bean grain traders also served as a source of local seed for farmers (**Table 3.25**). Overall, 240 traders (57% of all bean traders) sold local seed either during the period under study (170; 40.4%) or in past seasons (70; 16.6%). 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 for smallholder farmers in Africa for a wide range of crops. However, 181 traders (43%) did not sell local seed (Table 3.25). Based on gender, 107 female traders (51.4%) and 63 male traders (29.6%) sold local seed during the period under study. In the previous season, 30 female traders (14.4%) and 40 male traders (18.8%) sold local seed, meaning that women traders were more involved in selling local seed than men. Also, 71 female traders (34.1%) and 110 male traders (51.6%) were not involved in selling local seed, possibly because many customers did not indicate what they intended to use the beans they bought for. However, some traders directly linked to farmers pointed out that limited access to seed by farmers impeded the supply of grain, hence constraining their bean business. To bridge this gap, traders sort, treat, and store grains, which they routinely sell to farmers at planting time, either for cash or as credit to be recovered from harvests. A trader in Manyara mentioned that he sometimes buys grains of better quality from other regions (e.g., Mwanza) purposely to sell as local seed to his farmers.

Table 3.25 Does the trader sell local seed[5] (including in the past one year, March 2022–March 2023)?

	Sex of trader				Type of trader				Overall	
	Females		Males		Small/marketplace traders		Large off-takers			
	n	%	n	%	n	%	n	%	n	%
Yes, within past one year	107	51.4	63	29.6	129	43.7	41	32.5	170	40.4
Yes, but not within past year	30	14.4	40	18.8	50	17.0	20	15.9	70	16.6
No	71	34.1	110	51.6	116	39.3	65	51.6	181	43.0

3.4.1 Bean trader seed management practices and willingness to engage in promotion of new improved varieties

Overall, 240 traders (137 females) responded regarding major management practices employed in attaining or enhancing the quality of bean grains that were sold for planting (**Table 3.26**). To prepare local seed, 65% of the traders kept the variety pure (as a clean single variety), 50% sorted out specific varieties that could be planted, 47% sorted/cleaned the grain by removing dirt and bad grains, and 46% reported sorting out waste (pebbles, dirt, and dust). However, few traders (5.8%) did germination tests or even asked growers (ahead of time) to multiply select varieties based on preferences of different segments of clients (females, males, youth, etc.).

5 Local seed is seed bought from traders. It assumes different names: local, traditional, or informal seed.

Table 3.26 Bean seed management practices by traders in the past one year, March 2022–March 2023

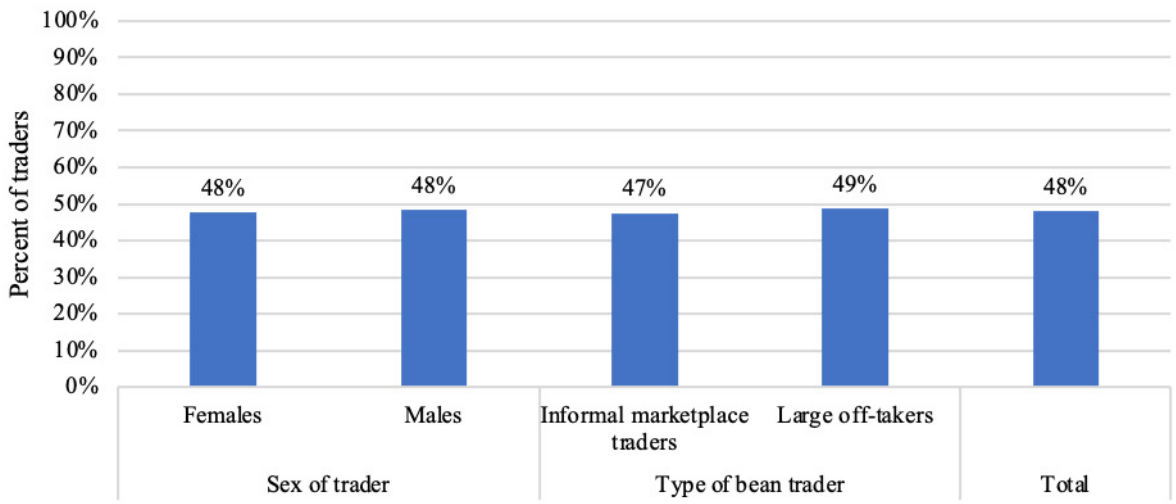
	Sex of trader		Overall (n=240*)	P-value
	Females (n=137*)	Males (n=103*)		
Keep each variety pure, as single variety	62.0	68.0	64.6	0.343
Seek out specific varieties to buy (that can be planted)	58.4	39.8	50.4	0.004
Sort out 'bad grains/seed (i.e., broken, immature, or discolored)	47.5	45.6	46.7	0.780
Sort out waste (pebbles, dirt, dust)	48.9	42.7	46.3	0.341
Grade stocks (which grain/which seed)	22.6	28.2	25.0	0.328
Get grain from specific areas/regions believed to have grain that will grow in local area (adapted)	20.4	28.2	23.8	0.164
Sell seed and grain separately, at different prices	18.3	25.2	21.3	0.190
Have special storage conditions (to help with seed viability)	19.0	21.4	20.0	0.648
Buy from specific growers who are known for high-quality seed	13.9	17.5	15.4	0.444
Keep freshly harvested stocks apart	12.4	11.7	12.1	0.858
Do germination tests	2.9	9.7	5.8	0.026
Ask growers (ahead of time) to multiply select varieties based on preferences of different segmented clients (females, males, youth, etc.)?	0.7	2.9	1.7	0.191
Others	2.2	3.9	2.9	0.440

* Percentages are based on number of traders that indicated they have ever sold grain as seed.

Trader willingness to participate in dissemination of new improved varieties

The study sought to understand the possibilities of integrating grain traders in promoting newly released bean varieties based on their extensive experience in supplying farmers with local seed. Overall, 48% of the traders involved in bean grain/local seed business showed willingness to participate in promoting new varieties (see **Figure 10**). Disaggregated by trader category, 49% of the informal traders and 45% of the large off-takers were willing to participate in promoting new varieties. Interestingly, male and female traders were equally (48% each) willing to engage in promoting new bean varieties, a show of enthusiasm with expectation that such engagement might have a positive impact on their bean business.

Figure 10: Proportion (%) of traders interested in contributing to promote new bean varieties



3.4.2 Farmer seed purchase patterns

Traders who had sold local bean seeds to farmers in the past one year were asked to state the signals that customers gave when they wanted to buy local seed, and indicate whether those signals varied among male, female, and youth customers. On average, 74.8% of the bean customers across all gender groups searched for a specific variety by name while 73.2% were keen to buy pure varieties (not mixed), 68.5% openly said they wanted to buy seed, and 57.3% of the buyers searched for clean stocks (without dirt or debris). On the other hand, buyers asked less about the maturity of the grains (12.1%), how the stocks were stored (9.9%), or the origin of the stocks (6.4%), among others. Female customers tended to more frequently provide signals when buying grain for seed (for all signals except the search for pure varieties and a particular quantity), perhaps because they were also the most bean buyers, as indicated earlier (Table 3.22). However, these signals did not vary significantly across gender groups as shown in **Table 3.27**.

Table 3.27 When buyers are aiming to buy bean seed, what signals do they give?

	Sex of bean seed buyer			Mean
	Males (n=169*)	Females (n=169*)	Youth (n=169*)	
Search for pure varieties, not mixed	79.3	75.7	72.0	73.2
Search for stocks which are clean (no debris)	52.7	59.8	56.0	57.3
Search for a specific variety by name	77.5	80.5	72.0	74.8
Ask about the origin (place) where the stocks are from	3.0	7.1	6.0	6.4
Ask how the stocks were stored/conserved	6.5	11.8	8.9	9.9
Ask for a particular quantity	13.6	9.5	13.7	12.3
Say they are buying seed	69.2	72.2	66.7	68.5
Ask for well-matured grain from past seasons	10.7	14.8	10.7	12.1
Other**	0.6	2.4	0.6	1.2

*Percentages are based 170 traders that sold bean grain as seed in the past one year, less one case of missing data.

**Other includes asking for non-climbers, asking for well-matured grain from previous seasons as opposed to grain harvested in the immediate past season, and selecting large grains.

3.4.3 Sales of local bean seeds and prices

A total of 1,945.8 tons were sold as local seed in the past one year. However, these quantities varied across the market classes, with yellow beans accounting for 58% of the seeds sold (1,114.7 tons), followed by purple (300.3 tons) and red mottled (295.3 tons), while mixed type and others accounted for the least amount (24.8 tons) cumulatively (**Table 3.28**).

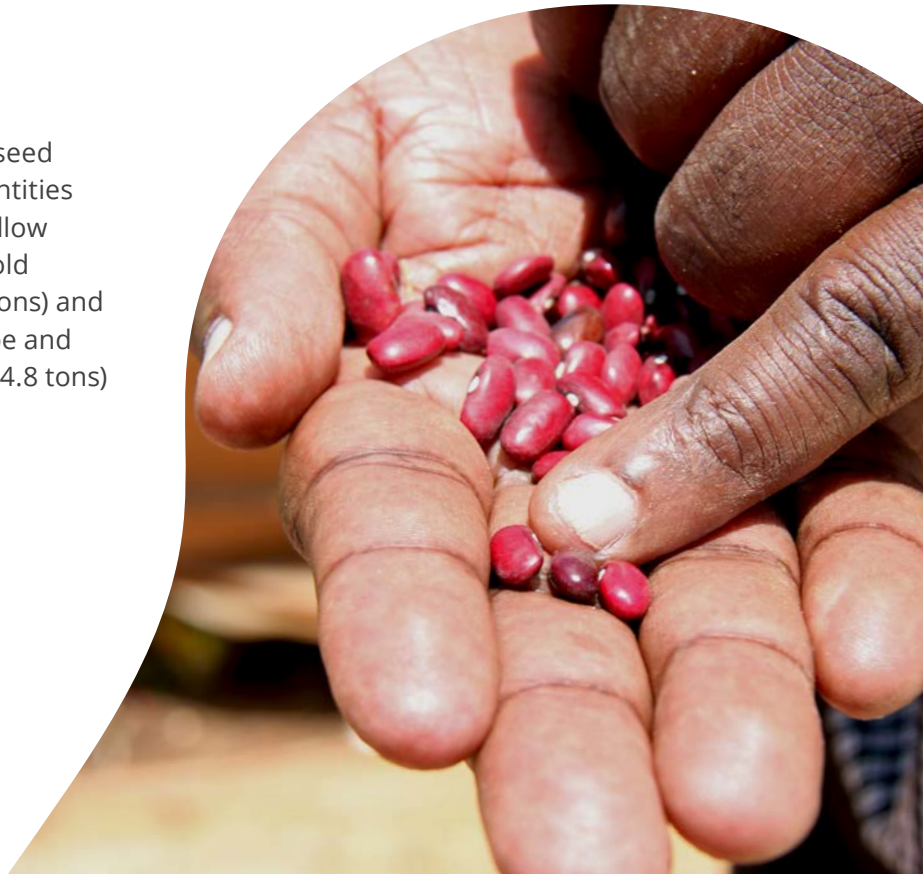


Table 3.28 Quantity of informal seed sold (tons) per market class, March 2022–March 2023)

Bean type	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Yellow	94	2.4	228.1	57	15.6	886.7	151	7.4	1,114.7
Purple	68	2.9	199.7	24	4.2	100.7	92	3.3	300.3
Red mottled	45	5.2	232.7	23	2.7	62.6	68	4.3	295.3
Sugar type	21	2.4	50.9	3	5.2	15.5	24	2.8	66.4
Small reds	3	0.1	0.3	15	3.8	57.6	18	3.2	58.0
White beans	20	0.9	18.0	4	6.7	26.7	24	1.9	44.6
Dark red kidney	10	4.2	41.7	0		0.0	10	4.2	41.7
Other	12	1.1	13.4	4	0.8	3.2	16	1.0	16.6
Mixed	7	1.1	7.9	1	0.3	0.3	8	1.0	8.2
Total	**280**	**2.8**	**792.6**	**131**	**8.8**	**1,153.2**	**411**	**4.73**	**1,945.8**

Overall, male traders sold more local seed (1,153.2 tons) than their female counterparts (792.6 tons) for all bean market classes. Similarly, mean seed sales were lower (7.4 tons per year) for females than for males (18.3 tons per year), given the higher number of female (107) than male (63) bean traders. However, differentiated by trader type (**Table 3.29**), female marketplace traders (90) outnumbered males (39), as also reflected in the higher total seed sales by females (342.1 tons) than males (119 tons) and mean seed sales of 3.8 tons and 3.1 tons per year for females and males, respectively. As expected, male large off-takers (24) outnumbered females (17). Similarly, male large off-takers sold more (1,034.2 tons) bean seeds than females (450.5 tons), with mean sales of 18.3 tons and 7.4 tons per year, respectively.

Table 3.29 Total volume (tons) of informal bean seed sold, March 2022-March 2023)

	Small / marketplace traders			Large off-takers			Overall		
	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)
Females	90	3.8	342.1	17	26.5	450.5	107	7.4	792.6
Males	39	3.1	119.0	24	43.1	1,034.2	63	18.3	1,153.2
Combined	129	3.6	461.1	41	36.2	1,484.7	170	11.4	1,945.8
pr (|T|>|t|)		**0.532**			**0.6918**			**0.2913**	

Overall, yellow beans fetched the highest price (USD 1,314) and mixed beans the lowest price (USD 887) per ton. Interestingly, prices varied between male and female traders even within the same category of traders. Overall, male traders sold at a higher price per ton (USD 1,295) than female traders (USD 1,142). This variation was consistent within each of the categories of bean traders. However, comparatively, small/ marketplace traders sold bean seed at a higher price per ton (USD 1,225) than large off-takers (USD 1,117) on average. This was expected, given that large off-takers often sell to other traders for resale, providing for retail markup. Also, large off-takers often buy in bulk and hence have a comparative advantage to negotiate for a lower purchase price, thus giving them flexibility to sell at a lower price with less compromise on profit margins. Interestingly, seed prices did not vary significantly, especially across the six main bean market classes (yellow, purple, small reds, red mottled, sugar type, and white beans) (**Table 3.30**).

Table 3.30 Average local bean seed prices (mean USD/ton), March 2022–March 2023

Bean type	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Yellow	1,275	1,456	1,331	1,228	1,284	1,260	1,267	1,390	1,314
Purple	1,171	1,340	1,206	1,199	1,210	1,204	1,177	1,286	1,205
Small reds	1,251	1,218	1,227	-	1,146	1,146	1,251	1,184	1,195
Red mottled	1,092	1,242	1,125	998	1,159	1,089	1,071	1,195	1,113
Sugar type	1,060	1,617	1,113	809	755	791	1,036	1,330	1,073
White beans	976	1,401	1,018	1,240	992	1,116	1,002	1,197	1,034
Other	935	1,279	1,014	852	1,078	927	921	1,229	998
Dark red kidney	997	-	997	755	-	755	949	-	949
Mixed	931	-	931	862	647	755	921	647	887
All types	1,149	1,375	1,203	1,112	1,191	1,155	1,142	1,295	1,191

The results show that large off-takers (n = 41) earned a total USD 1,749,629 while small/marketplace traders (n = 129) earned USD 536,788, representing 77% and 23%, respectively, of the total revenue earned (USD 2,286,417) by both categories of traders from the sale of bean grains as seed (**Table 3.31**). Male traders (n = 107) generated 56% (USD 1,286,417) while their female counterparts generated 44% (USD 999,756) of the total revenue from bean seed sales. For small/marketplace traders, the larger number of female traders (90) than male traders (39) resulted in lower average revenue generated per female trader (USD 4,141) than per male trader (USD 4,209). This variance could also be explained because male small/marketplace traders sold beans at a higher average price than female traders, as explained earlier. For large off-takers, male traders (24) outnumbered female traders (17), which was also reflected in the total revenue of USD 1,122,525 and USD 627,105 for male and female traders, respectively.

Table 3.31 Total revenue from bean seed sales (mean USD), March 2022–March 2023

	Small / marketplace traders			Large off-takers			Overall		
	n	Mean USD per year	Total USD	n	Mean USD per year	Total USD	n	Mean USD per year	Total USD
Female	90	4,141	372,652	17	36,889	627,105	107	9,344	999,756
Male	39	4,209	164,136	24	46,772	1,122,525	63	20,423	1,286,661
Combined	129	4,161	536,788	41	42,674	1,749,629	170	13,450	2,286,417
pr (|T|>|t|)		**0.3401**			**0.9597**			**0.8334**	

For all bean market classes, traders reported higher selling prices for local seed than for grain (**Table 3.32**). Overall, there was a difference of USD 141 per ton between local seed and grain, with local seed fetching an average of USD 1,191 per ton while grain fetched USD 1,050 per ton during the year. The price difference for seed and grain ranges from USD 35 to USD 231/ton, but varies significantly by variety/market class (Table 3.32). Second, informal marketplace traders sell beans at relatively higher prices than large off-takers because they have lower volumes and may not benefit from economies of scale. Marketplace traders sell yellow beans at USD 1,185/ton and large off-takers sell at USD 1,150/ton. Similar trends are observed in yellow, purple, and red mottled varieties.

Table 3.32 Comparison between bean grain and local seed prices (USD/ton), March 2022–March 2023

Bean type	Grain (Mean USD/ton)	Local seed (Mean USD/ton)	Difference (Local seed-grain)	P-value t-test
Red mottled	1,008	1,113	105	0.002
Sugar type	886	1,073	187	0.009
White beans	902	1,034	132	0.029
Purple	1,082	1,205	123	0.000
Dark red kidney	914	949	35	0.645
Small reds	964	1,195	231	0.000
Mixed	719	887	167	0.007
Yellow	1,150	1,314	163	0.000
Other	911	998	87	0.186
Overall	1,050	1,191	141	0.000

3.5 Challenges and opportunities in bean production and marketing, during and post-COVID-19

Traders reported the challenges they faced in their bean business during and after the COVID-19 pandemic. Overall, 86% of the respondents faced some challenges while 14% reported no challenges during the pandemic (**Table 3.33**). The most constraining challenge faced was inadequate demand (28.3%). As expected, nearly all traders reported that they operated normally, with just 0.2% indicating that they closed their business during COVID-19. This is not surprising because, in Tanzania, although there were mobility restrictions (5.5%) in some areas, the then-government did not make it a requirement to have businesses closed as a strategy for curbing the spread of COVID, and so businesses were running normally. However, closed borders limited exports (2.4%) and imports (0.7%), thus causing an inadequate supply (10.7%) and market instability (18.5%). Female traders were more constrained than their male counterparts, considering the major challenges: inadequate demand, lack of a stable market, inadequate supply, and low prices. As expected, large off-takers were more constrained than small/marketplace traders by inadequate demand, market instability, and low prices, possibly because of the closed borders, which might have interfered with their import and export operations.

Table 3.33 Most constraining challenge faced in bean business during COVID

Challenge	Sex of trader		Type of bean trader		Total
	Females	Males	Marketplace traders	Large off-takers	
Inadequate demand	30.3	26.3	27.1	30.1	28.3
Lack of a stable market	24.5	12.7	18.4	18.7	18.5
Inadequate supply	11.1	10.3	12.2	8.4	10.7
Low prices	11.1	8.0	9.0	10.2	9.5
Mobility restrictions imposed by government	2.9	8.0	5.1	6.0	5.5
Credit constraints	2.4	5.6	3.9	4.2	4.0
Closed borders that limited sales to other countries	1.4	3.3	1.6	3.6	2.4
Delayed payments	0.0	1.9	0.8	1.2	1.0
Inadequate market information	0.5	1.4	1.6	0.0	1.0
Closed borders that limit imports	1.0	0.5	1.2	0.0	0.7
Costly &/or inadequate transportation	1.0	0.0	0.8	0.0	0.5
High taxes/levies	0.0	0.9	0.4	0.6	0.5
Poor grading	0.5	0.5	0.8	0.0	0.5
Buyers are not trustworthy	0.5	0.5	0.8	0.0	0.5
Inadequate/poor storage	0.0	0.5	0.0	0.6	0.2
Mixed beans	0.5	0.0	0.4	0.0	0.2
Weather/climate-related challenges (e.g., rains)	0.0	0.5	0.0	0.6	0.2
Business closed during COVID	0.5	0.0	0.4	0.0	0.2
Others	2.4	0.9	1.2	2.4	1.7
No challenges	9.6	18.3	14.5	13.3	14.0

Traders were also asked about the challenges they faced in their bean business during post-COVID-19 pandemic. Overall, 90.5% of the respondents (compared with 86% during COVID) faced some challenges while 9.5% reported no challenges after the pandemic (**Table 3.34**). The most constraining challenge faced post-COVID was inadequate supply (25.2%), followed by persistent market instability (16.2%). Inadequate demand, which ranked highest during COVID, was third (10.7%). With businesses returning to normal and no border or shop closures, while other challenges remained like those during COVID, a new challenge set in: theft. Although mentioned only by male small/marketplace traders, it is an interesting twist that might point to the impact of COVID on households. People lost jobs and income and with that came desperation and the push to survive by whatever means. Small/marketplace traders often display their stocks in open markets with poor security, especially at night, exposing them to theft, as opposed to large off-takers. Female traders were more constrained than their male counterparts by the lack of a stable market and inadequate demand, as reflected among small/marketplace traders, largely females. These two challenges are associated with low-income earners, who were the most affected by COVID, with the ripple effects extending well beyond the pandemic. The major constraint among male traders and large off-takers was inadequate supply, which was expected because the pandemic caused a disruption not only in production but also in bean distribution channels and networks, which will take much longer to restore.

Table 3.34 Challenges in bean business post-COVID

Challenge	Sex of trader		Type of bean trader		Overall
	Females	Males	Marketplace traders	Large off-takers	
Inadequate supply	22.6	27.7	22.4	31.8	25.2
Lack of a stable market	17.8	14.6	18.6	10.3	16.2
Inadequate demand	14.4	7.0	12.2	7.1	10.7
Credit constraints	7.2	8.0	7.1	8.7	7.6
Poor grading	4.3	10.3	6.8	8.7	7.4
Low prices	5.8	4.2	4.8	5.6	5.0
Inadequate market information	4.8	4.2	4.8	4.0	4.5
High taxes/levies	4.8	1.9	4.1	1.6	3.3
Mixed beans	1.4	1.9	2.4	0.0	1.7
Delayed payments	1.4	0.9	1.0	1.6	1.2
Inadequate/poor storage facilities	1.4	0.9	1.4	0.8	1.2
Weather/climate-related challenges	1.4	0.9	1.4	0.8	1.2
Buyers are not trustworthy	1.0	0.9	1.0	0.8	1.0
Costly &/or inadequate transportation	0.0	0.5	0.3	0.0	0.2
Thefts	0.0	0.5	0.3	0.0	0.2
Others	3.9	4.2	4.4	3.2	4.0
No challenges	7.7	11.3	7.1	15.1	9.5

Coping strategies are the approaches and mechanisms that traders use to adjust to changes that occur in the business ecosystem (**Table 3.35**). These approaches/mechanisms are diverse and variously effective depending on the nature of the constraint, type, and gender of the trader. To cushion themselves from financial shocks, traders joined informal savings groups (28.7%), borrowed from relatives and friends (23.5%), or took out loans from banks (13.1%). Informal trust-based credit from suppliers (19.5%) is an in-kind form of credit for which the supplier provides stock to the trader and allows the trader to sell the stock and pay for it later. This not only cushions the trader from financial shock but also helps to level out the supply deficit.

Often, the only collateral is the trust between the trader and the supplier. Also, 5.7% of the traders indicated that sometimes they had to reduce staff to lower the cost of operating their bean business. This is a common practice, especially when the business is season oriented with peaks, linked to hiring more staff, and troughs, requiring lean or no staff. Other strategies included responding to market dynamics by increasing or decreasing bean prices due to shifts in bean demand and supply, especially during COVID, or waiting until market forces stabilized bean prices. Also, to beef up low supply, traders resorted to sourcing stocks from other traders rather than their usual suppliers. However, in worst-case scenarios, traders responded to low demand and supply by shifting to other products or closing their bean business altogether when they had nothing to do – closing a business is often the last resort when there is a negative return on investment or inability to access credit, and therefore inability to restock.

Table 3.35 Coping strategies adopted by bean traders to reduce impacts of challenges (including COVID-19) on bean businesses.

Coping strategy	Sex of trader			Type of trader			Total
	Females	Males	P-value	Small traders	Large off-takers	P-value	
Membership in informal savings groups	29.3	28.2	0.793	27.5	31.8	0.373	28.7
Borrowing from relatives and friends	23.1	23.9	0.834	22.7	25.4	0.552	23.5
Informal trust-based credit from suppliers	18.3	20.7	0.536	13.6	33.3	0.000	19.5
Loans from commercial banks	8.7	17.4	0.008	7.1	27.0	0.000	13.1
Reduced staff	5.3	6.1	0.718	4.8	7.9	0.196	5.7
Hiring more staff	0.0	0.5	0.322	0.3	0.0	0.513	0.2
Others	43.3	55.9	0.010	49.2	50.8	0.758	49.6

Opportunities

Despite the challenges, respondents identified opportunities along the bean value chain that individuals can capitalize on, including at production, distribution/retailing, value addition, and consumption nodes. These opportunities are not unique to males, females, or youth. At the production node, incentive exists to engage in commercial-oriented bean farming as a form of employment (particularly for youth) and to meet the increasing bean demand, given the upward trends in bean consumption by both rural and urban households. Bean per capita consumption in East Africa (50–60 kg) (Buruchara et al., 2011) is perhaps the highest in the world, and will continue to increase because of more recognition of the crop's health benefits (PABRA, 2014; Katungi et al., 2009; Leterme, 2002).

Production is linked to distribution (increased bean production implies more distribution activities as the beans must be moved to the market where consumers can obtain them), so more actors will be required and that translates into more employment opportunities for all gender groups. Increased distribution activities would also mean closing the supply-demand gap, a key challenge cited by traders. Another opportunity is bean retailing, which creates demand pull for distributors and not only allows consumers to have physical access to beans but also provides diverse options to meet varied consumer preferences, while also creating an avenue for affordable access to bean seed by farmers.

Finally, at the transformation node, opportunities abound for bean value addition. Common beans have not only been transformed from a subsistence to a highly commercialized crop, but also to a highly nutritious crop. They are no longer just a "poor man's meat" but one of the most consumed legumes among individuals of all income groups. The diverse products from beans (cakes, biscuits, flour, etc.) not only create employment opportunities but also provide consumers with various forms in which to consume beans. Pre-cooked beans are increasingly being preferred by urban dwellers as they are instantly consumed, requiring only warming, which diminishes cooking time and energy use. In urban informal settlements, bean stew and rice/chapati are the most affordable delicacies, giving food vendors an opportunity to generate income while meeting the health and nutrition needs of individuals who cannot afford other sources of protein such as meat.

3.6 Sources of market information

The results show that bean traders source market information variously, with the dominant sources being fellow traders, farmers' groups, and social media as reported by 38.0%, 29.5%, and 24.9% of the respondents, respectively (**Table 3.36**). Interestingly, male traders use social media more (29.6%) than female traders (20.2%), as do large off-takers (28.3%) vis-à-vis small/marketplace traders (22.8%), which might signal the variation in digital literacy among the gender groups and categories of traders. As expected, extension agents, seed companies, and agro-dealer shops were ranked low as sources of market information. Both informal traders and large off-takers deal in grain and not formal seed per se.

Table 3.36 Sources of market information for bean traders, March 2022–March 2023

Source	Sex of trader			Type of trader			Total
	Females	Males	P-value	Marketplace trader	Large off-takers	P-value	
Social media	20.2	29.6	0.026	22.4	31.0	0.062	24.9
Extension agents	14.4	16.0	0.660	14.6	16.7	0.584	15.2
Farmer groups	33.2	25.8	0.098	32.9	21.4	0.018	29.5
Seed companies	1.9	2.4	0.763	2.0	2.4	0.822	2.1
Agrodealer shops	6.7	5.6	0.640	6.8	4.8	0.431	6.2
Traders	45.7	30.5	0.001	38.0	38.1	0.980	38.0
Farmers	12.0	8.9	0.299	10.9	9.5	0.684	10.5
Customers	4.8	5.2	0.867	5.4	4.0	0.530	5.0
Others*	3.9	11.3	0.004	6.1	11.1	0.076	7.6

*Others include general marketplace, family and friends, agricultural shows, radio, and television.

3.7. Technical support required by bean traders to promote new varieties

Bean traders indicated that they needed support in handling and management of varieties (38%) and business management skills (24%) (**Table 3.37**). Business management skill support should be prioritized among female traders, for whom the knowledge gap is more widespread. The knowledge gap is also more extensive among marketplace traders than among large off-takers. Other technical support needed by traders is listed in Table 3.37.

Table 3.37 Type of support traders need to participate in promotion of new bean seed varieties

Type of support required	Females (n=75)	Males (n=74)	Small traders (n=110)	Large off-takers (n=39)	Total (n=149)
Training on business management skills	27.16	20.63	24.07	25	24.31
Information about the varieties (handling, seed management, good agricultural practices and agronomy skills, traits)	37.04	39.33	42.41	37.78	38.20
Linkages to seed suppliers	4.94	14.29	6.48	16.67	9.03
Storage and post-harvest handling	6.17	9.52	9.26	2.78	7.64
Credit and capital	7.41	6.35	7.41	5.56	6.94
Extension services	2.47	6.35	2.78	8.33	4.17
Training and information to differentiate seed from grain	7.41	0	4.63	2.78	4.17
Seed promotion services	3.7	1.59	1.85	5.56	2.78
Seed business registration and certification	3.7	1.59	1.85	5.56	2.78

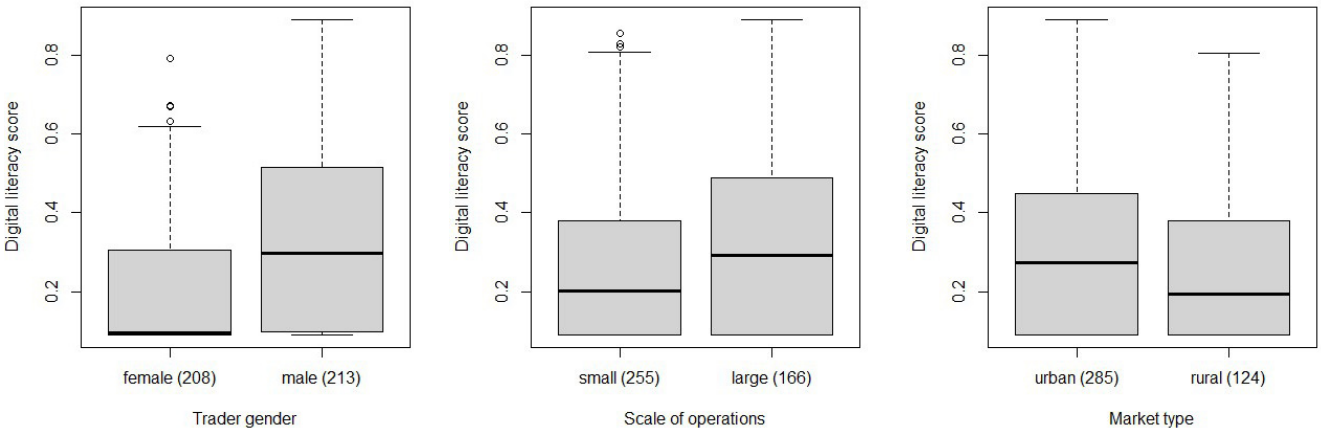
3.8 Digital readiness of bean traders

Bean traders hardly use advanced digital tools, with more than a third of them having no access to smartphones. Bean traders seek relevant information primarily from other traders, but also from agrovets and retailers. Personal meetings and phone calls are, by far, the most important communication channels. Consequently, to diffuse information on new varieties and create demand for them, the project might experiment with enhancing peer networks that are connected by telephone chains. The challenge might consist of (a) helping individual traders grow their personal network of trusted other trader colleagues and (b) incentivizing variety information to flow accurately from trader to trader and not be held back out of a feeling of competition.

3.8.1 Level of traders' digital skills

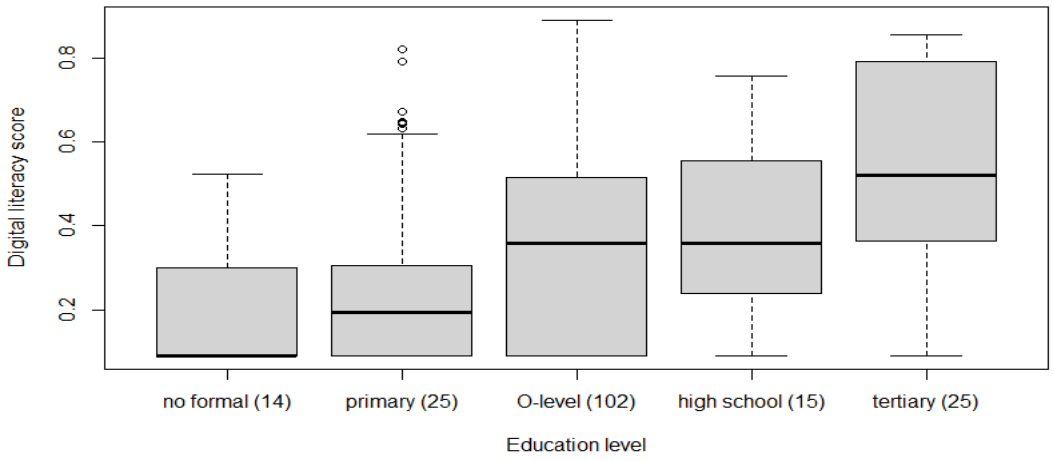
Digital literacy refers to practical skills related to using digital tools and services, such as mobile phones, smartphones, and the internet. The level of digital literacy of bean traders was assessed using a survey format developed by Ali et al. (2023). Digital literacy is expressed by a score from 0 to 1. Overall, the digital literacy of bean traders is relatively low, with a mean = 0.29 (SD = 0.21). On average, bean traders had low digital skills and experience, but there were important significant differences within the group of traders. Male traders had higher digital literacy than female traders and large off-takers had higher digital literacy than small/marketplace traders. Traders operating in urban markets had relatively higher digital literacy than traders in rural markets (**Figure 11**).

Figure 11: Level of digital literacy among bean traders.



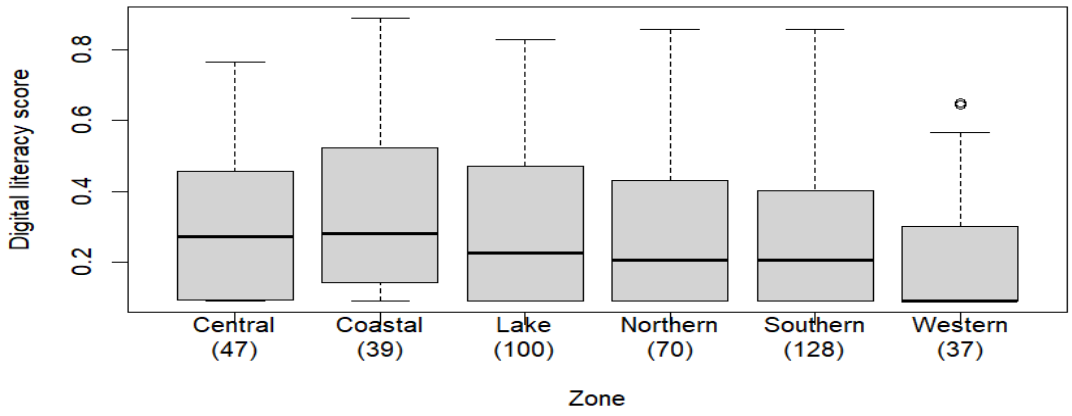
In addition, traders with a higher level of formal education tended to have higher digital literacy (**Figure 12**).

Figure 12: Digital literacy score by educational level of bean traders



On average, digital literacy among traders is relatively low everywhere, but it is highest in the Central, Coastal, and Lake zones and lowest in the Western zone (**Figure 13**).

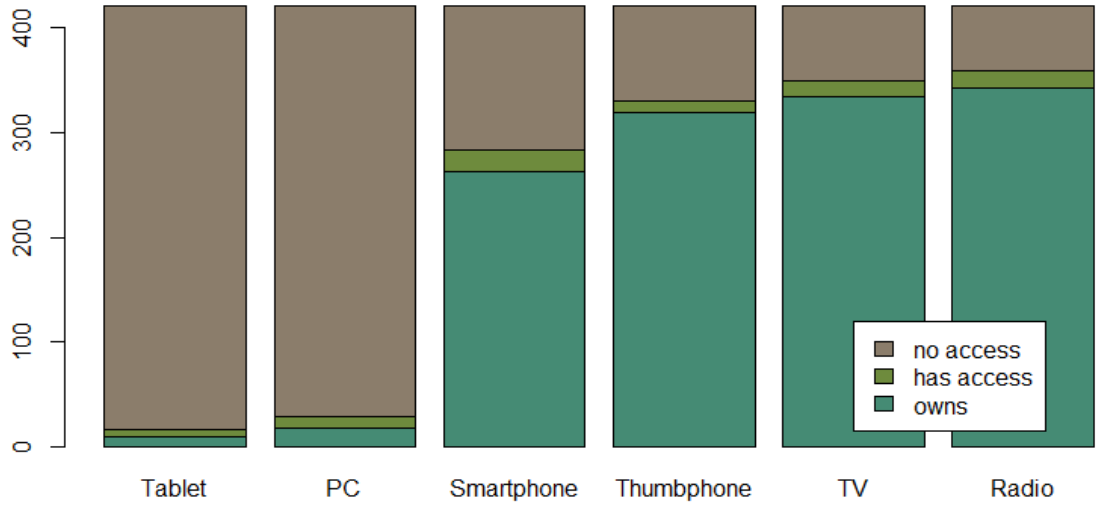
Figure 13: Digital literacy by region



3.8.2 Digital devices traders use

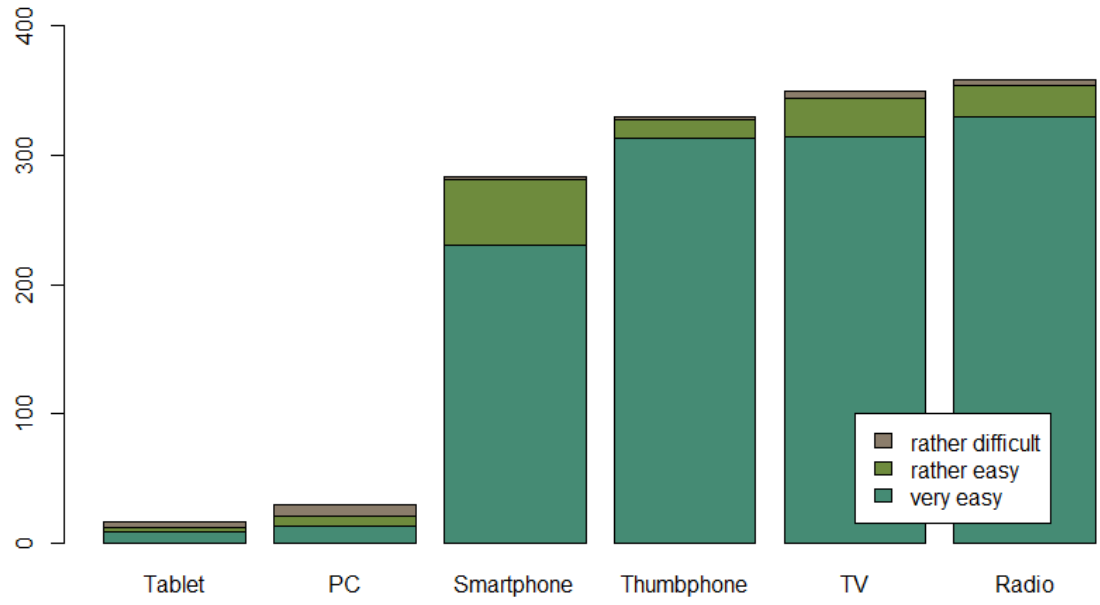
Most bean traders do own television sets and radio and virtually all own a mobile phone; however, less than two-thirds own a smartphone (**Figure 14**). Ownership of computers is uncommon. For traders who do not own a device, it is uncommon to access devices owned by friends or family members. More than 95% of all traders own either a conventional mobile phone (76%) or a smartphone (62%). Many own both (43%). But there is a gender difference in smartphone ownership, which is significantly less common among women (60%) than among men (75%). There is also a (less pronounced) difference between small and large traders (58% vs. 69% in smartphone ownership).

Figure 14: Bean traders' access to digital services



For all types of devices, traders perceive little difficulty in using them (**Figure 15**). The only exception is computers, which play a negligible role in traders' business.

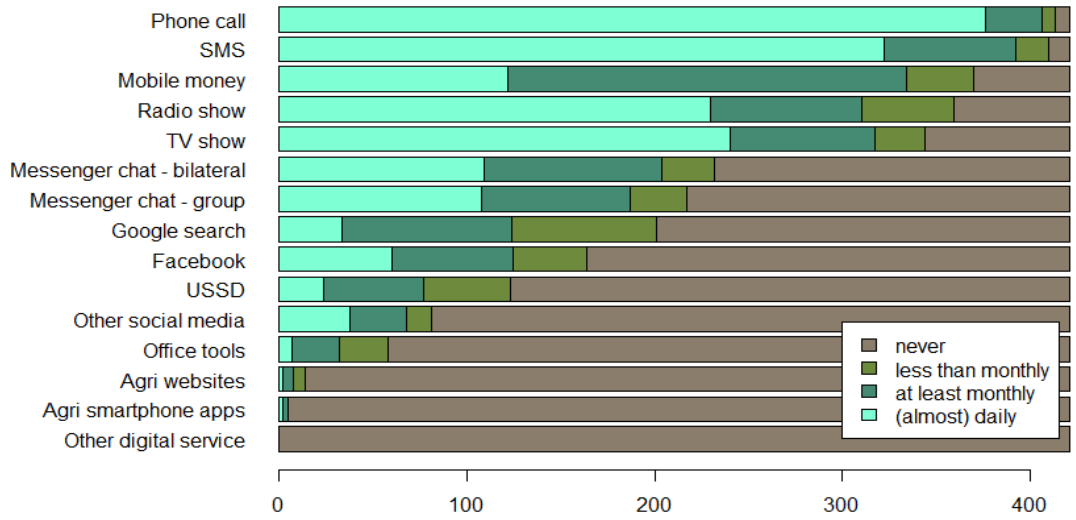
Figure 15: Perceived ease of using digital devices by bean traders



3.8.3 Digital services used by bean traders

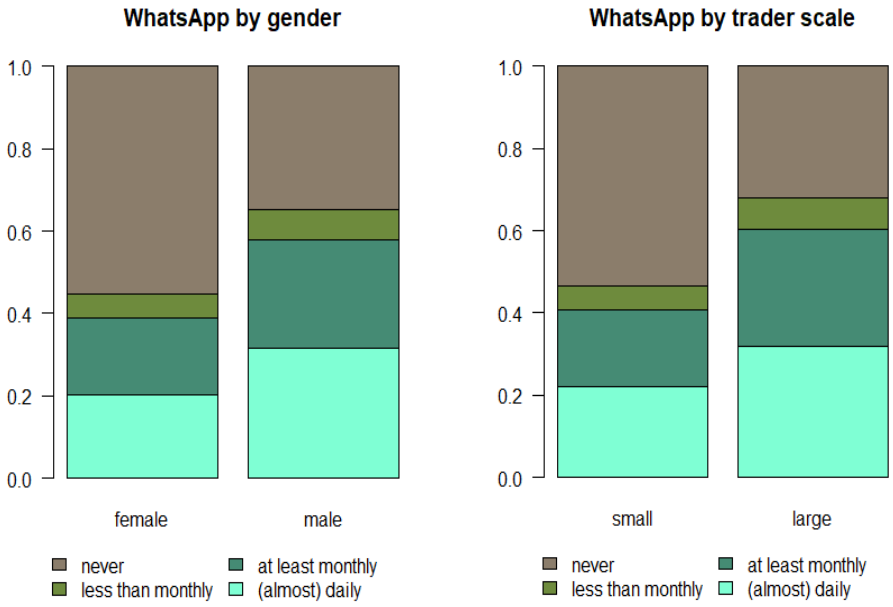
Apart from TV and radio, bean traders commonly use phone calls and SMS (**Figure 16**). Only about half of the traders use WhatsApp. Traders widely use basic phone functionalities: phone calls and SMS. The use of mobile money (such as M-Pesa, Airtel Money, Tigo Pesa, and Halo Pesa) is quite common too, with 88% of all traders using it at least sometimes. Radio and TV are still relatively common. Fewer traders use more advanced digital services that require internet (e.g., social media, Google, or Facebook). Messenger chats, such as WhatsApp, are used by just over half of all traders. This is surprising given that more than 60% own a smartphone. It might suggest that some traders do not regularly maintain internet bundles for their smartphone. Possibly, they use a conventional phone for calls and SMS and an additional smartphone for offline activities (taking pictures, listening to music, calculator, etc.). These general patterns are the same for both men and women, and for both small and large traders. In line with the observed differences in smartphone ownership (bigger traders and male traders are more likely to own one), there are small differences in the use of internet-related services between genders and business sizes.

Figure 16: Bean traders' use of digital services



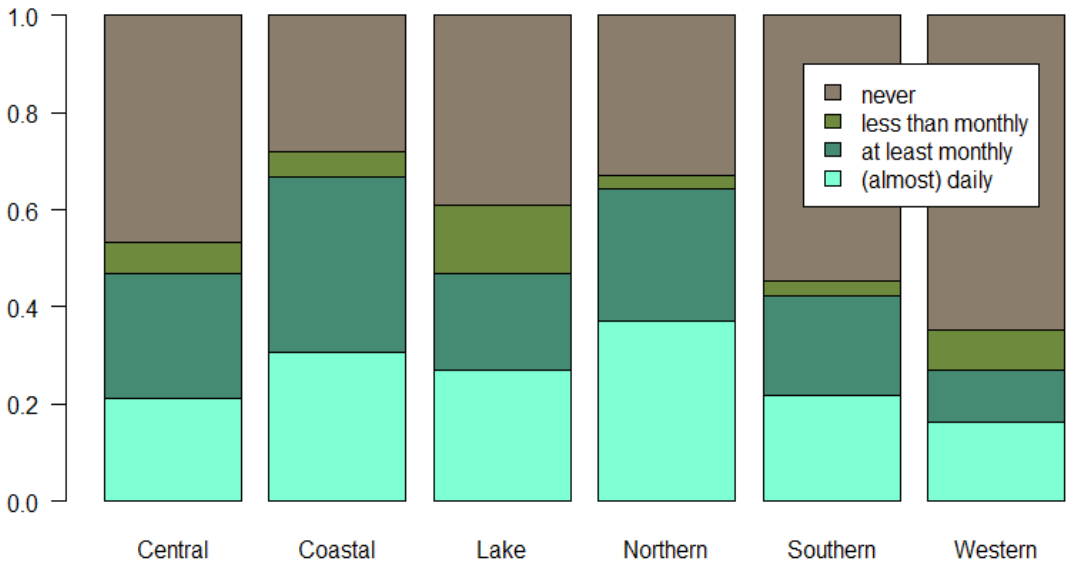
Gender differences exist in the use of internet-related services; for example, 61% of male traders use a Messenger app (such as WhatsApp) almost daily, while this is true for only 39% of female traders. The difference between small and large traders is similar (**Figure 17**).

Figure 17: WhatsApp use disaggregated by gender and type of the bean trader



In line with digital literacy, digital messengers such as WhatsApp are commonly used by bean traders in the Coastal and Northern zones and less frequently in the Western zone (**Figure 18**).

Figure 18: Bean traders use of WhatsApp by zone



3.8.4 Digital services traders prefer to use in their business

Apart from phone calls, the use of digital tools and services in bean traders' business is limited. Digital tools can be used to find new customers, to grow their business, and to decrease costs. Traders did not strongly use digital services for any of their business activities but would appreciate using digital tools to find new customers to grow their business and decrease costs. Some are aware of digital services, but mention that they are hindered by a lack of smartphones. Those who do use digital tools mention phone calls, WhatsApp, M-Pesa, and social media. Among all activities, the task of finding customers is the most digitalized one (mostly phone calls and WhatsApp), with ACCELERATE anticipating to further strengthen this activity. Traders have clear expectations about what purposes digital services should serve. Those who answered, "I wish there was a digital tool," explained that such tools would help them to decrease costs/increase cost efficiency, help grow the business by reaching new customers and retailers, and simplify business activities (**Figure 19**). In addition, such tools would help to track and anticipate price fluctuations and demand.

Overall, patterns of digital service use are similar between small and large traders, with one exception: large traders are keener than small/marketplace traders on using digital tools for estimating demand (**Figure 20**). Although female traders are overall (slightly) less digital-ready than male traders, they more frequently use digital services in their business. They also have higher hope for the future use of digital services.

Figure 19: Reasons for using digital tools and services in bean value chain

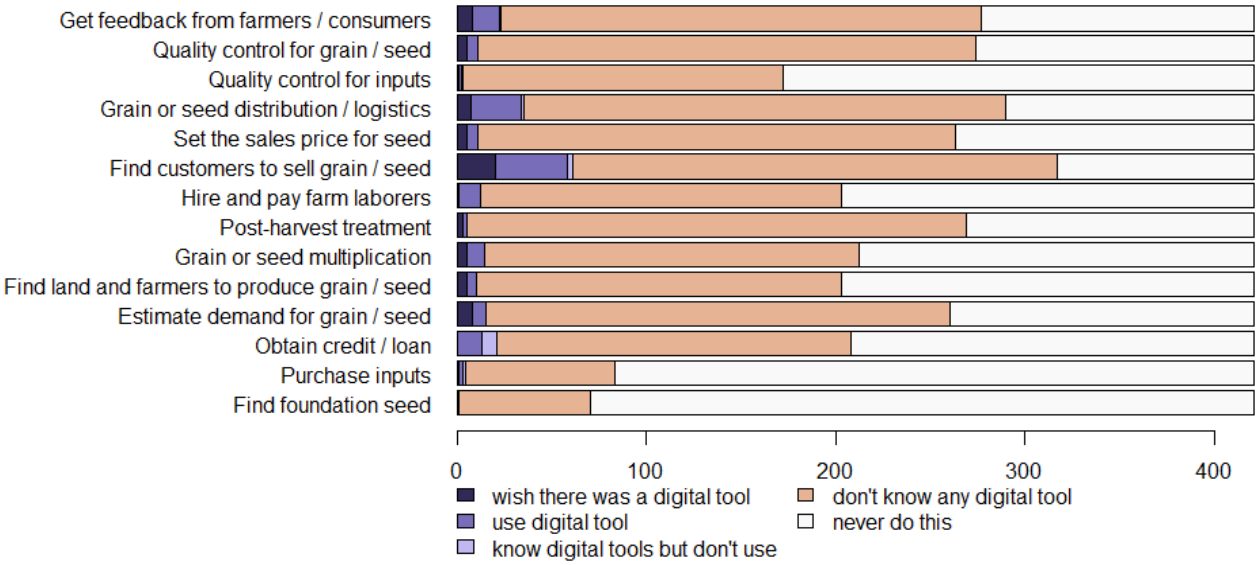
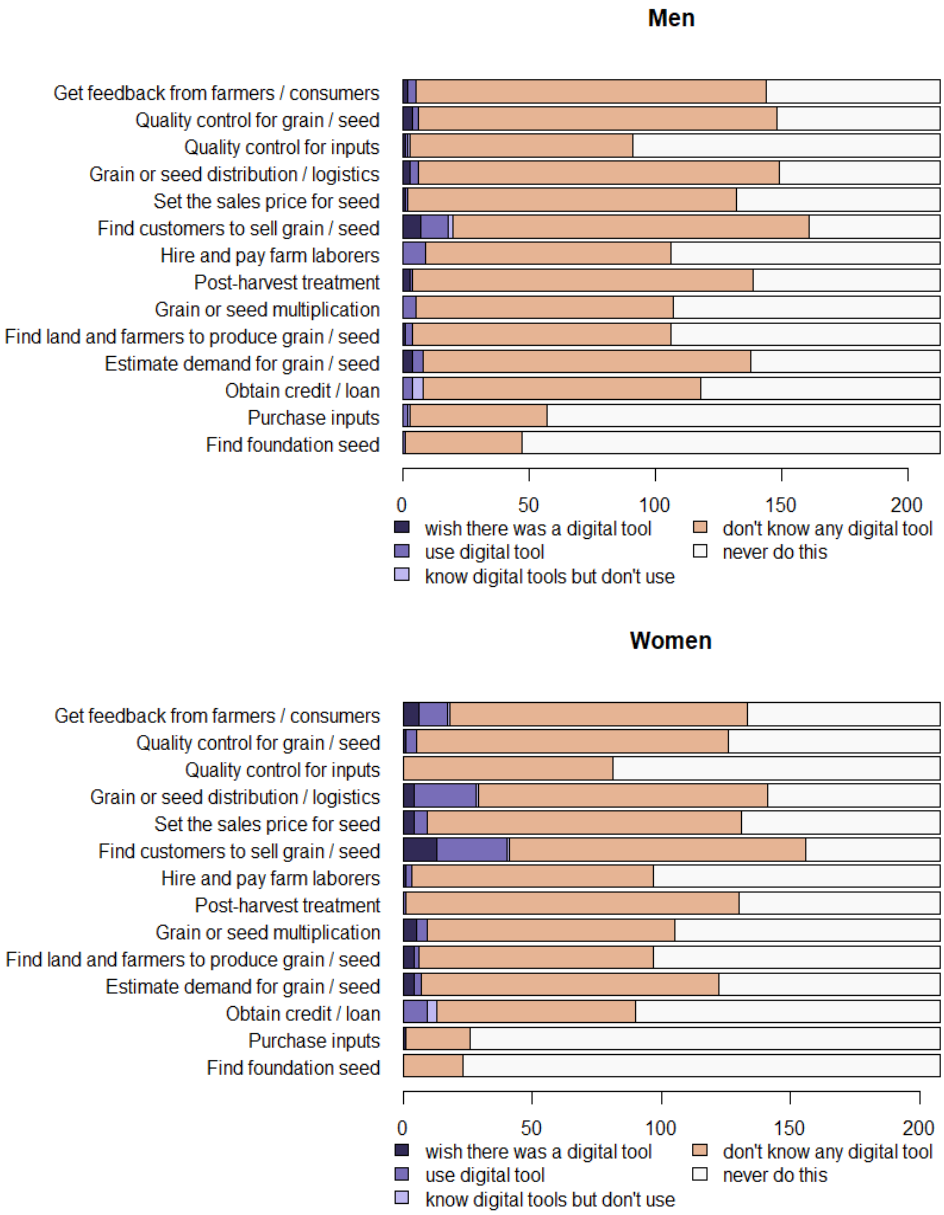


Figure 20: Reasons for using digital tools and services by gender of bean trader

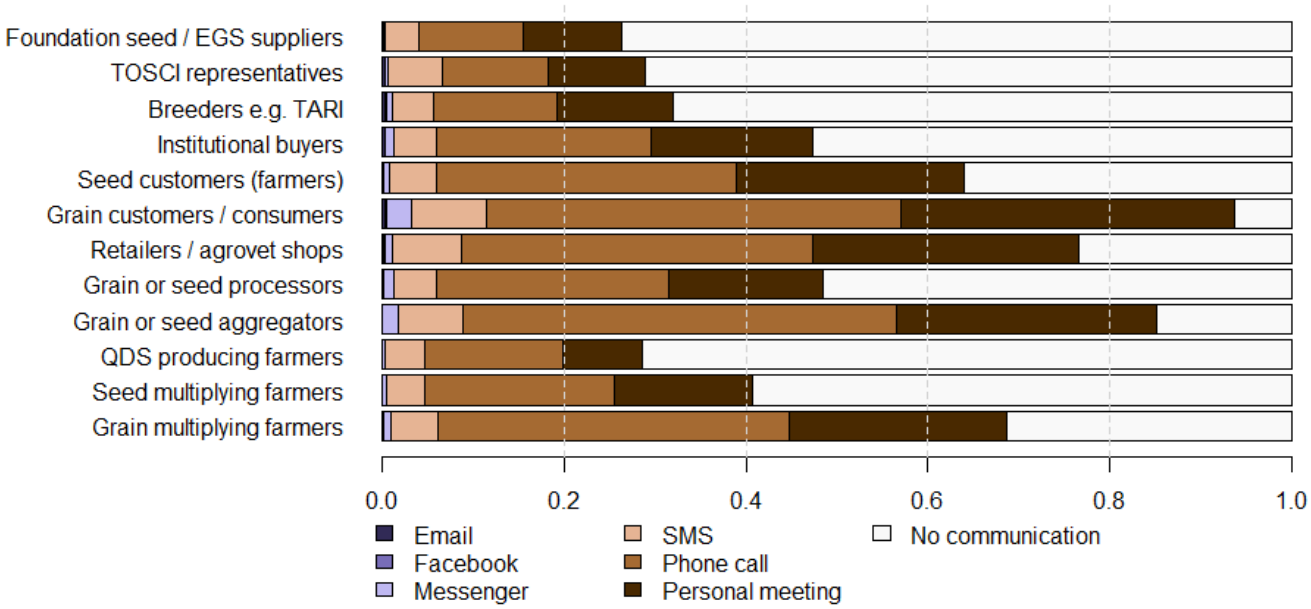


3.8.5 Traders' communication with other stakeholders

Verbal communication (meetings or phone calls) is by far the most common way of communicating (**Figure 21**). Overall, traders do not communicate much with upstream stakeholders of the breeding pipeline, such as breeders or foundation seed suppliers. Traders do not equally communicate with all seed sector stakeholders. Most traders speak with their customers (consumers for grain and farmers for seed), other retailers and aggregators, and the farmers who supply grain for sale. There is little, though not negligible, communication with upstream stakeholders of the breeding process, including foundation seed providers (26%) and breeders (32%).

The only important difference between small and large traders refers to institutional buyers, with whom 60% of large traders communicate vis-à-vis only 38% of small/marketplace traders. It seems that men generally communicate more than women. This difference is especially pronounced for institutional buyers and grain/seed processors. Personal communication (through meetings or phone calls) absolutely dominates information exchange with all types of stakeholders. SMS is also somewhat common, but internet-based digital communication (email, Messenger, Facebook) is mostly irrelevant.

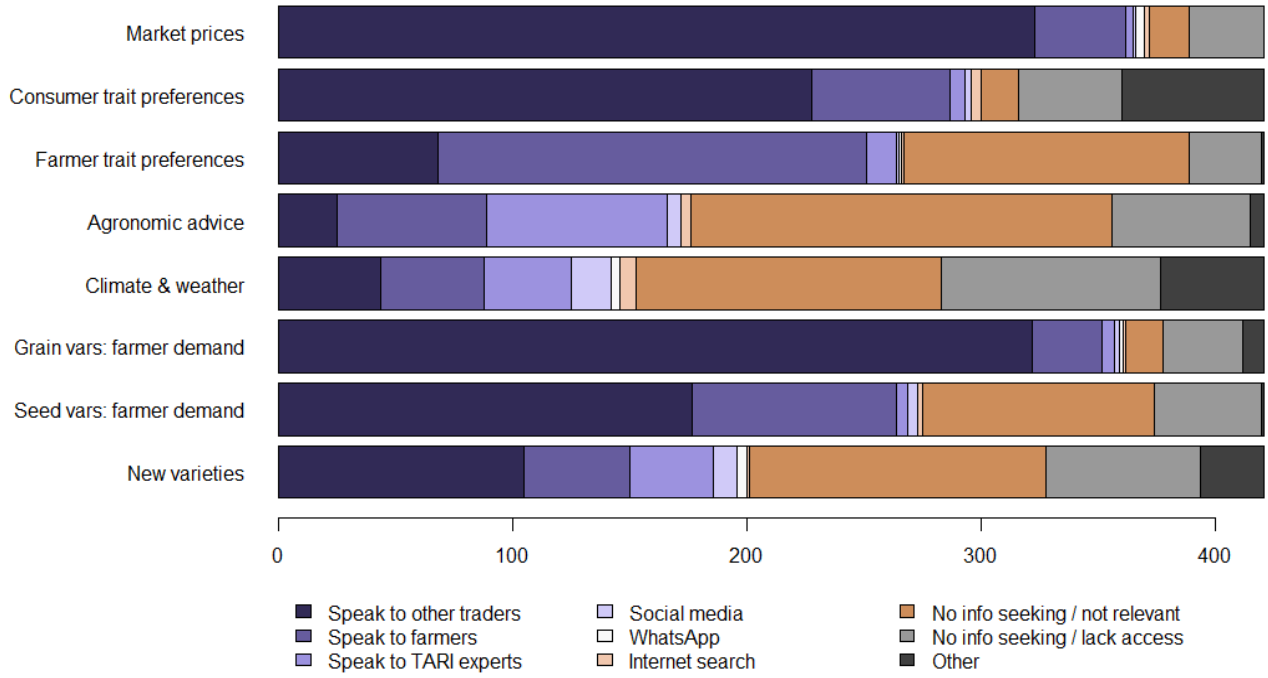
Figure 21: Bean traders' preferred communication channels



3.8.6 Traders' information-seeking behavior and preferences

Traders primarily rely on other traders for important information. For the seed business, farmers are also an important source of information. Agrovets and retailers provide information on customer demand. **Figure 22** indicates the ways in which traders seek information about different aspects of the grain and seed business.

Figure 22: Bean traders' information-seeking behaviors.



Direct exchange through peer networks with other traders (word of mouth) is the most important source of information for the topics that matter most to traders: market prices, consumer trait preferences, and farmer demand for varieties. Only for farmers' trait preferences were farmers considered an important source of information. Possibly, this is because, for many traders, the grain business is more important than the seed business. Therefore, consumer preferences are more important than farmer preferences. Traders do not widely seek information on agronomic advice, climate, and weather, and on new varieties. For learning about new varieties, exchange with agrovets and other retailers as well as radio and TV are additional sources of information. For consumer preferences, direct interaction with customers as well as agrovets and retailers are further sources of information. Digital tools such as social media, WhatsApp, and internet search are not meaningful sources of information for traders.

3.9 Government involvement in the bean seed value chain

The seed sector in Tanzania is made up of a wide range of actors, including public, private, and civil society organizations and farmers, with the government at the center providing support through policy framework formulation and implementation to guide the operations of the actors. The public sector is strongly involved in primary chain functions such as genetic resource management, varietal development, and breeder seed production (mainly TARI centers and universities), while the Agricultural Seed Agency (ASA) is responsible for basic and certified seed multiplication. The Tanzania Official Seed Certification Institute (TOSCI) oversees varietal release and quality control. The public sector also provides support services across the seed value chain, such as extension services under the Regional Administration and Local Government (RALG) ministry. TOSCI is mandated to ensure seed quality control through inspection and certification services. Also, several district extension officers in Tanzania under RALG are trained to support and supervise the production of quality declared seed (QDS). Other district extension officers have also been trained as authorized district seed inspectors on behalf of TOSCI. Seed chain support services are largely provided by the public sector, such as extension services by district agricultural officers.

Government institutions, agriculture departments, and agencies were also interviewed, with only TARI being engaged in bean varietal improvement, while ASA supports seed multiplication. TARI indicated the presence of active distribution channels for new varieties, with some indicating that the traders they worked with spread information to farmers on what types

of grain were demanded in the market and where they could obtain improved seed of new varieties. In addition, information was mainly sourced from seed companies and extension officers, and conveyed through physical or virtual meetings, WhatsApp groups, and digital platforms such as M-Kilimo, which is managed by the government through the Ministry of Agriculture. In the Lake zone (Bariadi and Simiyu regions), for example, there is a forum composed of agricultural officers, agro-dealers, grain traders, individual farmers, and farmers' groups through which traders reach different actors with relevant information. The district councils in Dar es Salaam, Songwe, Mbeya, and Rukwa and TARI worked with bean seed producers. Moreover, several joint efforts are employed to reach farmers with improved seed from new varieties using different approaches such as demonstration plots, farmer field days, training activities, communication materials (such as leaflets), TV and radio programs, social media, stakeholders' meetings, and participation in agricultural fairs. This was reported by representatives from Kyerwa, Karagwe, Kasulu, Kibondo, Kakonko, and Kishapu district councils.

3.10 Institutional seed buyers

In this study, institutional seed buyers are defined as public or private organizations that purchase bean seed or engage in seed production to support target communities' bean production activities. These can involve humanitarian agencies, CBOs such as farmers' associations, as well as international research institutions (IRIs). The activities can range from routine technical facilitation and input supply to response to seed emergency situations.

3.10.1 Engagement in seed-related activities

The institutions/organizations involved in this study were mostly humanitarian agencies, IRIs, and CBOs implementing projects aimed at building farmers' capacity and enhancing access to improved technologies. Most organizations were involved in facilitating the production of QDS, promoting improved varieties, training farmers, and linking farmers with input suppliers (**Table 3.38**). All the organizations involved in bean seed-related activities have been engaging with farmers often or very often. Some agencies worked with both farmers and traders, including Empowering Farmers Foundation, Tanzania Pulse Network (TPN), International Institute of Tropical Agriculture (IITA), and Sokoine University Graduate Entrepreneurs Cooperative (SUGECO). These agencies work in collaboration with TARI and ASA as major sources of EGS as well as resource personnel to build farmers' capacity in grain and QDS production within farmers' areas. To increase awareness for farmers on the use of quality improved seed, humanitarian organizations (such as SNV, AMDT, ADP Mbozi, Save the Children, FARM AFRICA, IITA) facilitate the establishment of demonstration plots around farming communities to showcase the advantages of incorporating different improved technologies (such as quality seed) and create demand for increased technology adoption. Other than facilitation of access to seed and other technologies, DASPA and SUGECO also link farmers to bean grain buyers. The organizations receive information from extension agents, seed companies, TARI, aggregators, and lead farmers. Some disseminate information through displays of grain/seed samples from markets or research stations. To facilitate seed production, the organizations receive specific market signals from traders, which they convey to producers, indicating what is needed for the subsequent seasons. This is done through meetings with seed and grain producers and other key actors in the value chain. Chema and Mavuno provide support in training, establishment of demo plots, field days, and fairs using different means such as radio or TV programs to reach farmers.

Table 3.38 List of institutional bean seed buyers

Organization name	Engagement in seed activities	Bean seed-related activities
Ikuwo (through AMDT and SNV)	Yes	Supporting QDS production
DASPA	Yes	Training on quality seed production and distribution
SUGECO	Yes	Linking farmers to off-takers and facilitating them in production by supplying seeds, especially TARI beans 6 and JESCA QDS production of TARI bean 6, Selian 13, and Selian 14
ADP Mbozi	Yes	QDS production
IITA	Yes	Promotion of improved seed, and training QDS producers
Empowering Farmers Foundation	Yes	Farmers' facilitation to access agricultural inputs Empowering farmers to transform from subsistence to commercial farming
Tanzania Pulse Network	Yes	Supporting farmers to access inputs, facilitating contract farming for beans and pigeon peas
Chema, Mavuno	Yes	Training, demonstration plots, meetings, field days, agricultural shows, radio and TV programs

3.10.2 Constraints

Respondents were asked to identify challenges faced in running bean seed business activities. The most common constraints cited were inadequate knowledge and limited business skills to engage in a seed business. This is because the training received in QDS production did not include business management aspects, which could help respondents to adequately plan for production to align with market demand. Marketing constraints ranged from lack of stable markets and inadequate supply to poor grading. The majority of QDS producers produce in small quantities because of a lack of capital for expansion and lack of specialization in seed. In addition, the limited access to EGS, higher purchasing prices, and higher fees for TOSCI services for QDS producers were cited repeatedly. Some humanitarian agencies provided support to QDS producers through projects. Although such support and facilitation were reported to be free, the projects were short-lived and several QDS producers failed to sustain their seed business beyond the project life. Weather challenges (both prolonged drought and excess rains) were also among the major challenges faced by bean seed value chain actors.

3.10.3 Methods for increasing access to and affordability of improved varieties

The government and humanitarian agencies opined that to increase access to and affordability of improved bean varieties, there is a need to introduce subsidies on agricultural inputs such as seed, fertilizer, and chemicals; offer credit at a low interest rate; engage in QDS production and distribution; and link farmers with input suppliers and supply enough foundation seed for both certified seed and QDS production. There is also a need to strengthen the last-mile seed supply system through agro-dealerships, strengthen the capacity of seed producers in marketing and entrepreneurship skills, and continue training and engaging more farmers in seed production. Increased seed access and affordability can be attained, along with increased seed production, particularly through an enhanced QDS production system. The annual demand for bean seed is presented in **Table 3.39**. The annual breeder seed needed by ADP Mbozi was 1 ton, while basic seed was required by IITA (17 tons), ADP Mbozi (6 tons), and Ikuwo through AMDT and SNV (0.28 tons) annually. Several organizations reported the need for certified seed: Empowering Farmers Foundation (13 tons), SUGECO (45 tons), ADP Mbozi (18 tons), and Ikuwo through AMDT and SNV (0.24 tons). A total of 284 tons were estimated as the annual QDS requirement by DASPA (20 tons), Empowering Farmers Foundation (2 tons), IITA (170 tons), ADP Mbozi (36 tons), and Ikuwo through AMDT and SNV (56 tons).

Table 3.39: Annual seed demand for selected institutions

Organization	Quantity in tons	Type of seed
ADP Mbozi	1	Breeder
	6	Basic
	18	Certified
	36	QDS
IITA	17	Basic
	170	QDS
Ikuwo	0.28	Basic
	0.24	Certified
SNV and AMDT	56	QDS
Empowering Farmers Foundation	13	Certified
	2	QDS
SUGECO	45	Certified
DASPA	20	QDS

3.10.4 Interest in disseminating improved varieties

All the organizations interviewed expressed their willingness to play a role in bridging the gap between research (development of new varieties) and farmers (end users of improved seed) in Tanzania, with a focus on three crops: beans, sorghum, and groundnuts. Most of the humanitarian and aid agencies working with bean producers and/or traders indicated their willingness to participate in the dissemination of improved varieties.[6] These same agencies have played similar roles in the past through various project interventions aimed at increasing farmers' access to improved seed. Different approaches were suggested to be used, including selling small packs of newly released varieties to farmers.

6 FAO expressed unwillingness to participate in disseminating new varieties as that is not its key mandate.

4. Sorghum

4.1 Socioeconomic characteristics of traders

Data were collected from 255 sorghum traders across 11 regions: Songwe, Mara, Simiyu, Dodoma, Mwanza, Manyara, Tabora, Dar es Salaam, Shinyanga, Singida, and Lindi. Overall, 66 were large off-takers/traders and 189 were marketplace traders, while 130 and 135 were female and male traders, respectively (**Table 4.1**).

Table 4.1 Sorghum traders sample distribution

Region	Sex of trader		Type of sorghum trader		Total
	Females	Males	Small/marketplace traders	Large off-takers	
Songwe	36	19	50	5	55
Mara	30	6	33	3	36
Simiyu	22	6	26	2	28
Dodoma	2	21	12	11	23
Mwanza	8	11	14	5	19
Manyara	9	9	15	3	18
Tabora	3	15	6	12	18
Dar es Salaam	0	17	2	15	17
Shinyanga	5	12	12	5	17
Singida	5	10	10	5	15
Lindi	0	9	9	0	9
Total	**120**	**135**	**189**	**66**	**255**

Male traders (52.9%) outnumbered female traders (47.1%) overall (**Table 4.2**). The survey's sample mainly consists of informal marketplace traders (74.1%), and the remaining proportion is large off-takers (25.9%). More than half of the informal marketplace traders are females (59%), even though a substantial proportion of males (41%) exist. The large off-takers are predominantly male (86%). A total of 56.8% of the traders are 45 years old and below across both sexes and trader types. There is also a substantial proportion of older traders, as 38.8% are aged 46 to 65. Only 4.3% are 66 years old and above. A majority of the traders (69.8%) have attained only primary school education. Men are more educated and have been in the business longer. This observation also explains why the older age group has more males that take risks since the large off-takers are predominantly male (86%), whereas informal traders are more likely to be women (59%).

Female traders are generally less educated since 12.5% have not received formal education compared to only 1.5% of males. A majority (66.3%) have been in the sorghum business for less than ten years. Among them is a fair split between those who have been in the business for 1 to 4 years (31.8%) and 5 to 9 years (34.5%). However, slightly more than a third (33.7%) have been in the business for 10 years or more. There is also a fair split among those who have been in the business for 10 to 14 years (17.6%) and 15+ years (16.1%). More men have been in the business for 10+ years.

Table 4.2 Socioeconomic characteristics of sorghum traders

	Sex of trader		Type of sorghum trader		Overall
	Females	Males	Marketplace traders	Large off-takers	
Sex (row %)	47.1	52.9			
Type of sorghum trader (row %)					
Marketplace trader	59	41			74.1
Large off-taker	14	86			25.9
Age (column %)					
15 to 29 years old	15.8	12.6	15.3	10.6	14.1
30 to 45 years old	40.8	44.4	43.9	39.4	42.7
46 to 65 years old	36.7	40.7	35.4	48.5	38.8
66 years old and above	6.7	2.2	5.3	1.5	4.3
Education level attained (column %)					
No formal	12.5	1.5	4.7	1.2	6.7
Primary	64.2	74.8	61.6	65.1	69.8
O-level	20.8	19.3	24.3	24.1	20.0
High school	0.8	0.0	4.7	1.8	0.4
Tertiary	1.7	4.4	4.7	7.8	3.1
Number of years in sorghum business (column %)					
1 to 4 years	35.8	28.1	38.4	24.1	31.8
5 to 9 years	34.2	34.8	34.5	25.3	34.5
10 to 14 years	15.8	19.3	15.7	22.9	17.6
15 years and over	14.2	17.8	11.4	27.7	16.1

4.2.1 Traded varieties/market class (including importance of varieties)

White and red sorghum were traded equally among the sampled traders (**Table 4.3**). However, more female traders (54%) sold red/brown sorghum varieties, which are mainly used for food. In comparison, more male traders (53.3%) sold white sorghum, which fetches higher prices and is sold to beer processing companies such as Serengeti Breweries Ltd. and Tanzania Breweries Ltd. (TBL). Further, analysis shows that 51.4% of the small/marketplace traders sold white varieties while 53.4% of the large traders sold red/brown varieties.

Table 4.3 Type/market class of sorghum sold, March 2022–March 2023

Sorghum type	Sex of trader				Type of trader				Overall	
	Females		Males		Marketplace traders		Large off-takers			
	n	%	n	%	n	%	n	%	n	%
White	80	46.0	113	53.3	142	51.4	51	46.4	193	50.0
Red/brown	94	54.0	99	46.7	134	48.6	59	53.6	193	50.0
Total	**174**	**100**	**212**	**100**	**276**	**100**	**110**	**100**	**386**	**100**

Preference for sorghum is generally driven by color (52.3%), taste (50.3%), and processing quality (40.9%) (**Table 4.4**). Except for color and taste, red/brown varieties perform better than white varieties for most of the attributes, such as drought and disease resistance. White sorghum has a stronger appreciation for its color (71.5%) than the red/brown varieties have (33.2%). However, both varieties are equally appreciated for their taste (50.3%). Notably, red/brown sorghum is more preferred in processing (44%) and bird resistance (13.5%) than white sorghum (37.8% and 4.7%, respectively). Albeit with a slightly higher preference, red sorghum is also more preferred in grain size/weight, reasonable pricing, high yield, drought tolerance, early maturity, and disease resistance.

Table 4.4 Sorghum type/market class preference by buyers

	White	Red/brown	Overall
Color	**71.5**	**33.2**	**52.3**
Taste	**50.3**	**50.3**	**50.3**
Good for processing	**37.8**	**44.0**	**40.9**
Grain size and weight	23.3	23.8	23.6
Good price	10.9	14.0	12.4
High yielding	9.3	11.4	10.4
Drought tolerance	8.3	10.9	9.6
Bird resistance	4.7	13.5	9.1
Short duration/quick maturing	6.7	7.8	7.3
Disease tolerance	0.5	3.1	1.8
Others*	11.9	18.1	15.0

4.2.2 Sources of varieties and destination

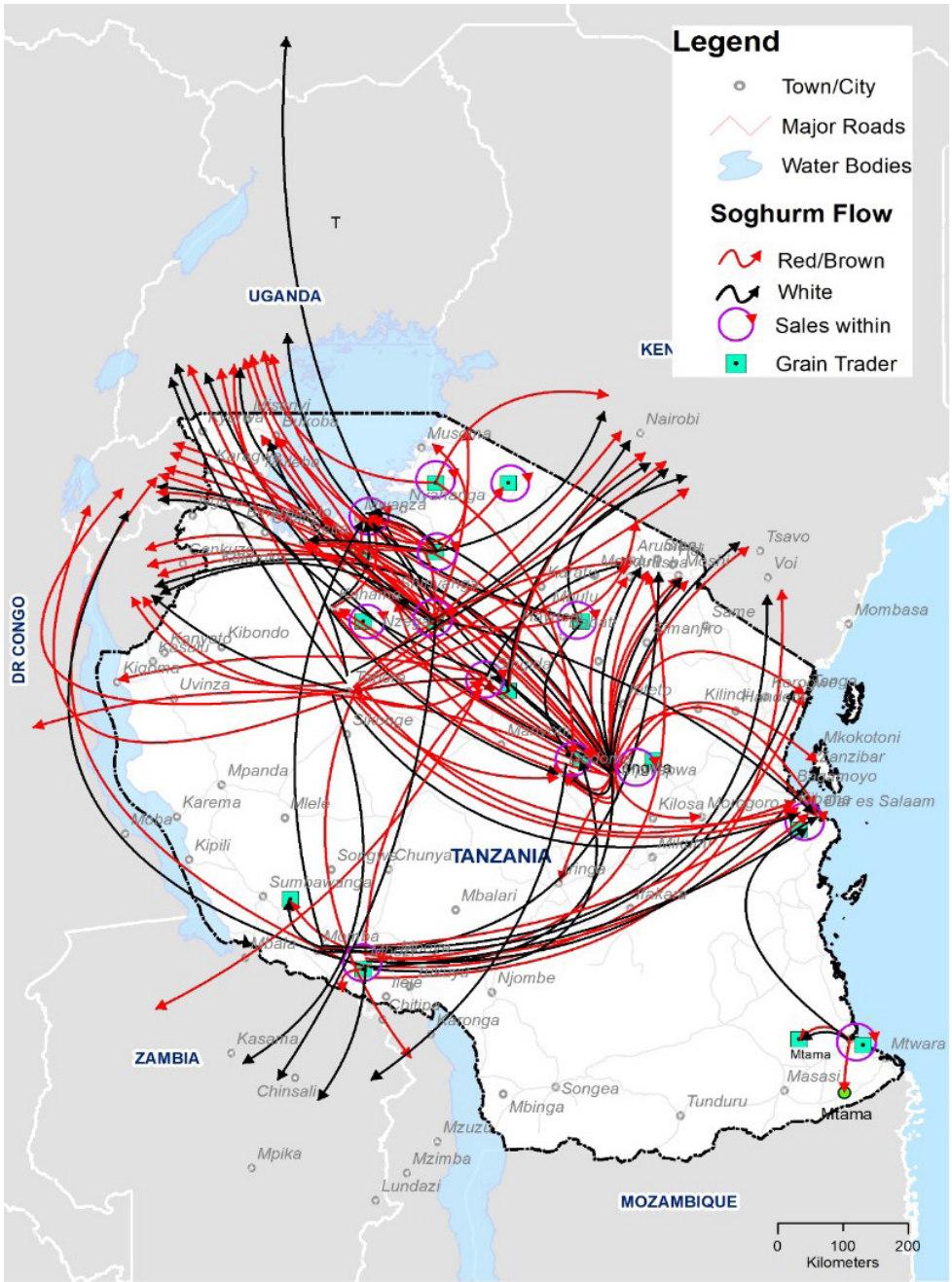
Traders often source sorghum varieties directly from farmers (52%). This observation applied to both trader types: small traders (52.6%) and large off-takers (50.6%). A substantive proportion of traders also sourced their varieties from aggregators (27.7%) and wholesalers (18.8%). Small/marketplace traders sourced from aggregators (22.0%) and wholesalers (24.6%) in almost equal proportions. However, large off-takers largely sourced from aggregators (42.1%), with a small proportion sourcing from wholesalers (4%). Overall, importation of varieties by traders was rare (**Table 4.5**).

Table 4.5 Sources of varieties (%)

Source	Marketplace traders/retailer	Large off-takers	Overall
Direct from farmers	52.6	50.6	52.0
Collectors and aggregators	22.0	42.1	27.7
Wholesalers and other traders	24.6	4.3	18.8
Own production	0.88	2.14	1.24
Importers	0	0.91	0.26

The primary production regions for sorghum are the Central and Lake zones and Southern Highlands for white and red varieties. Scarce flows are observed in the Mtwara region, while the main markets are within the Central zone and Dar es Salaam. Sorghum grain exports go to Kenya, Uganda, Southern Sudan, DR Congo, Burundi, Rwanda, Zambia, and Malawi (**Figure 23**).

Figure 23: Sorghum seed and grain flows in Tanzania, March 2022–March 2023.



4.2.3. Nature of engagement with suppliers (e.g., contract farming)

All sorghum traders do not have any formal agreement with farmers. About one-third of the traders (31.6%) have an informal/verbal agreement with farmers supplying sorghum. However, 68.4% do not have any agreement with farmers, whether formal or informal (**Table 4.6**). More male traders (38.2%) were likely to have a verbal agreement with farmers than female traders (23.6%), while a majority of the large off-takers/traders (51.8%) have a verbal agreement with farmers compared to small traders (23.6%).

Table 4.6 Nature of contractual agreement with main supplier of variety (%)

Type of agreement	Sex of trader		Type of trader		Overall
	Females	Males	Marketplace traders	Large off-takers	
None	76.4	61.8	76.4	48.2	68.4
Verbal	23.6	38.2	23.6	51.8	31.6

Traders with verbal contracts with farmers for the supply of varieties pointed out that contracts help them to be assured of quality (74.6%) and to secure the required quantity (77.9%). However, substantive disparities in quantity and quality exist across trader types. Female traders have contracts based on adherence to quality standards (87.8%), whereas male traders mainly contract to secure the required quantity (91.4%). On the other hand, small/marketplace traders preferred quality contracts (67.7%), followed by obtaining the correct quantity of produce (58.5%). In comparison, large off-takers preferred contracts that assured them of the right quantity (100%), followed by grain quality (82%) (**Table 4.7**).

Table 4.7 Why do you have a contract with your main supplier? (%)

	Sex of trader		Type of trader		Overall
	Females	Males	Informal marketplace traders	Large off-takers	
To be assured of quality	87.8	67.9	67.7	82.5	74.6
To secure the required quantity	51.2	91.4	58.5	100	77.9
Other	2.4	1.2	3.1	0.0	1.6

4.3 Sales of sorghum

4.3.1 Volumes for different buyers and prices

The small/marketplace traders sampled for this survey sold a total volume of 2,491.6 tons of sorghum in the past year: 1,480.1 tons of white sorghum and 1,011.5 tons of red/brown sorghum. Male marketplace traders sold significantly more sorghum (1,885.2 tons) than female traders (606.4 tons), although both sold more white sorghum than red/brown sorghum (**Table 4.6**). Male small marketplace traders sold 1,166.5 tons of white sorghum and 718.7 tons of red/brown sorghum. Female small traders sold 313.6 tons (4.3 tons per year) of white sorghum and 292.8 tons (3.4 tons per year) of red/brown sorghum, which indicates that men are the primary beneficiaries of the economic benefits generated from sorghum (**Table 4.8**).

Table 4.8 Volumes (tons) sold by marketplace traders in the past year, March 2022–March 2023

Type of sorghum	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
White	74	4.2	313.6	68	17.2	1,166.5	142	10.4	1,480.1
Red/brown	85	3.4	292.8	49	14.7	718.7	134	7.5	1,011.5
Total	**159**	**3.8**	**606.5**	**117**	**16.1**	**1,885.2**	**276**	**9.0**	**2,491.6**

Large traders sold more than 98% of the total sorghum sold in Tanzania. On average, each large trader sold 424 tons per year (46,606.7 tons in total) in the past year. Of this volume, red/brown sorghum was 16,632.6 tons and white sorghum was 29,974 tons. Male off-takers sold significantly more sorghum (44,929 tons) than female off-takers (1,677.5 tons). Both males and females sold more red/brown sorghum (more than 60% of the sorghum sold by large traders) (**Table 4.9**). Male off-takers sold 15,443.1 tons of red/brown sorghum and 29,486 tons of white sorghum. Female small traders sold 1,189.5 tons of red/brown sorghum and 488 tons of white sorghum.

Table 4.9 Volumes (tons) sold by large off-takers in the past year, March 2022–March 2023

Type of sorghum	Female			Male			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Red/ brown	9	132	1,189	50	308.9	15,443.1	59	281.9	16,632.6
White	6	81	488	45	655.2	29,486	51	587.7	29,974
Total	**15**	**112**	**1,678**	**95**	**720.3**	**44,929.2**	**110**	**423.7**	**46,606.7**

The total volume of sorghum sold in the past year was 49,098.3 tons, earning a total revenue of USD 28,970,382 annually. The white variety was sold in higher volumes (31,454.2 tons) than the red/brown varieties (17,644.1 tons). White sorghum subsequently earned more revenue (USD 20,130,688) from 31,454.2 tons sold (**Table 4.10**).

Table 4.10 Total volume (tons) of sorghum traded and revenue per market class, March 2022-March 2023)

Type of sorghum	n	Total volume sold (tons)	Total revenue (USD)
Red/brown	193	17,644.1	8,839,694
White	193	31,454.2	20,130,688
Total	**386**	**49,098.3**	**28,970,382**

Grain selling price

Table 4.11 presents the average sorghum grain sale prices in USD per ton. The average selling price is USD 571 per ton (USD 640 for white and USD 501 for red sorghum). White sorghum fetched a much higher selling price than red/brown sorghum because white is preferred for processing while red/brown is preferred for consumption. Female traders had higher selling prices (USD 634) than their male counterparts (USD 519). Female traders, on average, sold white sorghum at USD 739 compared to males at USD 570. Female traders sold red/brown sorghum at USD 544 compared to males at USD 461.

Marketplace traders also sold at significantly higher prices, which was expected, given that large off-takers (USD 415) handle large volumes and benefit from economies of scale. The same trend is observed among female traders experiencing higher prices than males, except for white sorghum among large off-takers, for which males obtained higher prices (**Table 4.11**).

Table 4.11. Average grain sale prices (mean USD/ton)*, March 2022–March 2023

Type of sorghum	Small/market traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
White	768	648	**710**	381	452	**444**	739	570	**640**
Red/brown	559	536	**551**	410	388	**390**	544	461	**501**
Total	**656**	**601**	**633**	**393**	**418**	**415**	**634**	**519**	**571**

*USD 1 = TZS 2319.

The average sorghum grain sale price to consumers was USD 713 for white sorghum and USD 546 for red/brown sorghum. Overall, female traders sold both varieties at higher prices than male traders. For instance, female traders sold white sorghum at USD 796, while male traders sold the same at USD 637 to consumers. Female traders also sold red/brown sorghum at USD 572, while male traders sold it at USD 513.

Marketplace traders sold both varieties to consumers at higher prices than large off-takers. Small/marketplace traders sold white sorghum at USD 750 and red/brown sorghum at USD 572. Female small traders sold both varieties at higher prices (white, USD 812; red, USD 582) than male traders (white, USD 680; red, USD 556). Large off-takers sold white sorghum at USD 503 and red/brown sorghum at USD 448. Female off-takers sold both varieties at higher prices (white, USD 520; red, USD 478) than male traders (white, USD 500; red, USD 439) (**Table 4.12**).

Table 4.12 Sale price to consumers (mean USD/ton), March 2022–March 2023

Type of sorghum	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
White	812	680	**750**	520	500	**503**	796	637	**713**
Red/brown	582	556	**572**	478	439	**448**	572	513	**546**
Total	**689**	**629**	**664**	**492**	**465**	**471**	**675**	**580**	**629**

Interestingly, the average price for other traders was lower than consumer prices, reflecting that those other traders obtained wholesale prices (**Table 4.13**). The findings show that white sorghum (USD 466) had a higher selling price than red/brown sorghum (USD 399). Female traders sold both varieties to other traders at higher prices than male traders. Overall, female traders sold white sorghum at USD 524, whereas male traders sold it at USD 450 to consumers. Similarly, female traders (both small/marketplace and large traders) still sold to other traders at relatively higher prices than male traders, probably because the latter moved higher quantities and benefited from economies of scale.

Table 4.13 Sale prices for traders (mean USD/ton), March 2022–March 2023

Type of sorghum	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
White	553	536	**541**	480	409	**418**	524	450	**466**
Red/brown	488	423	**458**	433	363	**374**	467	374	**399**
Total	**516**	**497**	**505**	**453**	**384**	**394**	**491**	**412**	**431**

The average sorghum grain sale prices to institutions were probably the lowest because the latter purchased large quantities. However, caution should be exercised as the sample size for institutions was trivial and not adequate for accurate statistical analysis. Small/marketplace traders sold only red sorghum to institutions such as schools, restaurants, and hotels at USD 690. Red sorghum is mainly used for food and household consumption. However, male marketplace traders charged higher prices (USD 862) than female small traders (USD 517) to institutions (**Table 4.14**). For the large off-takers, only male traders sell to institutions (at USD 479 per ton). This observation means that male traders can access profitable and sustainable markets requiring higher volumes.

Table 4.14 Sale prices to institutions (mean USD/ton), March 2022–March 2023

Type of sorghum	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
White	-	-	-	-	479	**479**	-	479	**479**
Red/brown	517	862	**690**	-	-	**-**	517	862	**690**
Total	**517**	**862**	**690**	**-**	**479**	**479**	**517**	**555**	**549**

Revenue

For the small/marketplace traders sampled for this survey, white sorghum (USD 1,050,871) earned them a significantly higher revenue than red/brown sorghum (USD 557,337) in the past year (**Table 4.15**). This is expected given that white sorghum fetched higher prices and is commonly sold in large volumes. Male traders earned higher revenue than female traders for both sorghum varieties. Male small traders earned USD 755,892 from white sorghum, while female counterparts earned a lower revenue of USD 240,845 (less than half of that of males). For the red/brown variety, male small traders earned USD 385,223 vis-à-vis female small traders' earnings of USD 240,845, reflecting that women marketplace traders mainly sell red/brown sorghum with limited engagement in white sorghum business. For the large off-takers, the red/brown variety (USD 15,651,714) had higher earnings than the white variety (USD 13,308,500) in the past year. Male off-takers (USD 28,603,406) earned more revenue than female off-takers (USD 659,258).

Table 4.15 Revenue for small marketplace traders and large traders by market class (USD per year), March 2022-March 2023

Type of sorghum	Small/Marketplace traders								
	Females			Males			Total		
	n	Mean (USD)	Total (USD)	n	Mean (USD)	Total (USD)	n	Mean (USD)	Total (USD)
White	74	3,226	240,845	68	11,146	755,892	142	7,384	996,737
Red/brown	85	1,901	163,675	49	7,879	385,223	134	4,133	548,898
Total	**159**	**2,493**	**404,520**	**117**	**9,676**	**1,141,115**	**276**	**5,697**	**1,545,635**
Large traders/Off-takers									
Red/brown	9	54,202	487,695	50	302,213	15,109,923	59	265,278	15,597,618
White	6	30,975	185,928	45	296,060	13,327,717	51	260,939	13,513,645
Total	**15**	**43,937**	**673,623**	**95**	**301,085**	**28,437,640**	**110**	**264,480**	**29,111,263**

4.3.2 Main buyers of grain (gender, type of institutional buyer)

The traders pointed out that individual customers (62.6%) are the primary buyers of sorghum grain, followed by traders (26.3%) (**Table 4.16**). Farmers (5.43%), processors (5.03%), and institutional buyers (0.72%) also purchase sorghum grain from traders. The leading institutions that purchased sorghum were learning institutions (e.g., schools and colleges) and NGOs (e.g., humanitarian organizations such as the WFP).

Female traders predominantly sold to individual customers (78.9%), confirming their limited engagement with institutions and other traders. On the other hand, nearly half of the male traders sold to individual customers (49.2%) and other traders (38.9%). The survey established that small/marketplace traders predominantly sold to individual customers (80.4%), and large off-takers widely sold to other traders (69.9%).

Table 4.16 Main buyers of sorghum by gender and type of trader, March 2022-March 2023

Buyers	Sex of trader		Type of trader		Overall
	Females	Males	Marketplace traders	Large off-takers	
Individual consumers	78.9	49.2	80.4	17.7	62.6
Other traders	10.9	38.9	8.8	69.9	26.3
Processors	4.20	5.71	4.75	5.73	5.03
Farmers	6.05	4.92	5.94	4.16	5.43
Institutional buyers	0.01	1.31	0.01	2.50	0.72

4.3.3 Traders' engagement in the export market

This study established the incidence of selling sorghum outside the country. Small/marketplace traders do not export sorghum, which is ubiquitous, as confirmed by 97.8%. Almost half of the large off-takers (47.3%) export, even though 52.7% of them do not (**Table 4.17**). Considering that the large off-takers' sample is predominantly males, this explains why the sampled male traders (23.6%) are more likelier to export than the female traders (only 4.6%).

Among the traders who exported, the total volume exported in the past year was 29,649.5 tons. The share of these exports was 20,916.9 tons of white sorghum and 8,732.6 tons of red/brown sorghum. Sorghum exports were dominated by male traders, who exported 29,343.4 tons vis-à-vis female traders' 306.1 tons.

Table 4.17 Volumes (tons) of sorghum exported by market class, March 2022-March 2023

	Females			Males			Overall		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Do you export (%)?			4.6		23.6				15
White	5	6.9	34.5	20	1044.1	20,882.4	25	836.7	20,916.9
Red/brown	3	90.5	271.6	30	282.0	8,461.0	33	264.6	8,732.6
Total	**8**	**38.3**	**306.1**	**50**	**586.9**	**29,343.4**	**58**	**511.2**	**29,649.5**

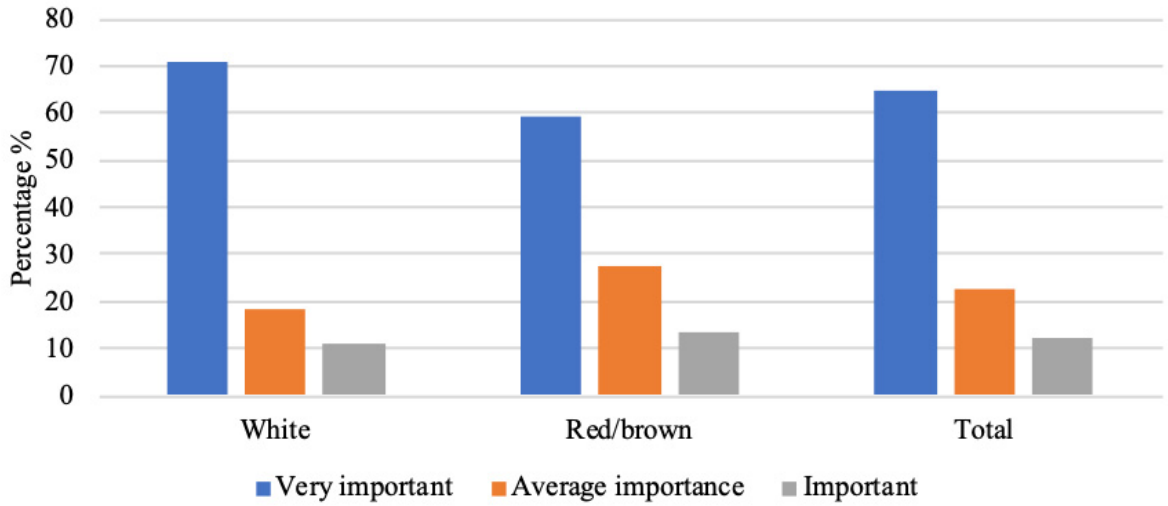
This study established the countries that traders export to among the traders who sell sorghum outside Tanzania. Rwanda (62.1%) is the primary importer of Tanzanian sorghum, followed by Uganda (41.4%), Kenya (36.2%), and Burundi (27.6%) (**Table 4.18**). Smaller proportions of traders also export to DR Congo (3.4%), Zambia (3.4%), Malawi (1.7%), and South Sudan (1.7%). Among the traders who sold sorghum outside Tanzania, both market classes were exported (white 50% and red 54%), with more red sorghum being exported.

Table 4.18 Proportion of traders who export sorghum to different countries (%), March 2022-March 2023

Country	Small traders	Large off-takers	Overall
Rwanda	0	69.2	62.1
Uganda	0	46.2	41.4
Kenya	66.7	32.7	36.2
Burundi	0	30.8	27.6
DR Congo	0	3.8	3.4
Zambia	33.3	0	3.4
Malawi	0	1.9	1.7
South Sudan	0	1.9	1.7

More than 65% of the traders considered sorghum very important (**Figure 24**). However, white sorghum was found to be more important than red/brown sorghum since the latter had the higher score of 71% compared to 59.1% for the red/brown variety. As explained earlier, white sorghum fetches higher prices in the market, indicating higher income for traders.

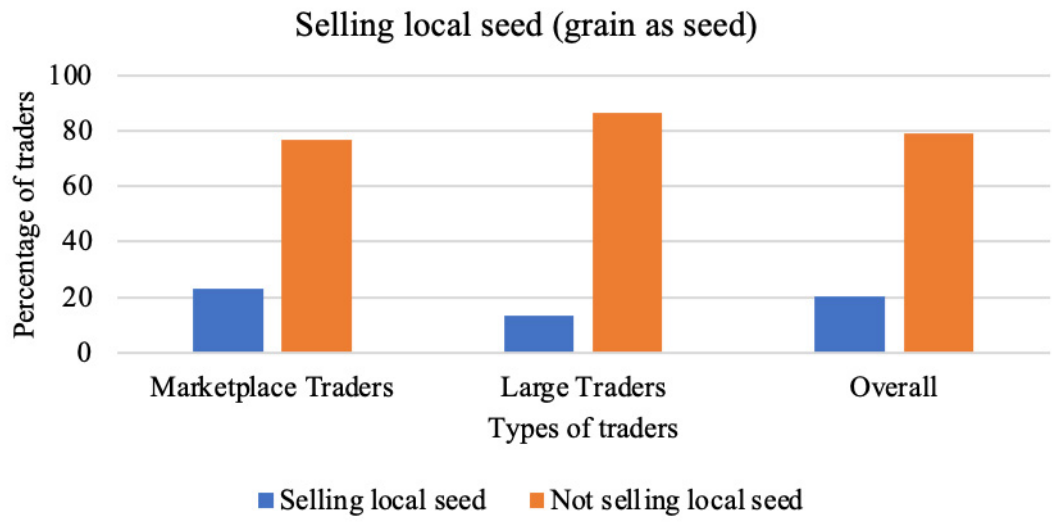
Figure 24: Relative importance of sorghum varieties to traders



4.4 Sorghum trader seed management practices

Overall, 20% of the traders sold local sorghum seeds for planting. Most of the farmers predominantly use farm-saved seeds. Female traders (22.9%) were more likely to sell local sorghum seed (grain as seed) than male traders (13.3%) (**Figure 25**).

Figure 25: Traders selling local seed (grain as seed)



Among the traders who have ever sold local seed, **Table 4.19** illustrates their seed management practices. The most common practice among traders is how to keep the variety pure (as a clean single variety) (65.9% overall), with small/marketplace traders (69.5%) practicing this more often than large off-takers (51.9%). However, all other practices were carried out more by large off-takers, such as sorting out waste (pebbles, dirt, dust) (42.4%), seeking specific varieties to buy (that can be planted) (40.9%), and sorting out bad grains/seed (i.e., broken, immature, or discolored) (36.4%). The less common seed management practices by traders were grading stocks (which grain/which seed) (25%), having special storage conditions (to help with seed viability) (24.2%), getting grain from specific areas/regions believed to have grain that will grow in the local area (adapted) (20.5%), and buying from specific growers who are known for high-quality seed, keeping freshly harvested stocks apart, and selling seed and grain separately at different

prices (Table 4.19). Few traders did germination tests (less than 2.3%), and they were those who worked with national research institutes, mainly TARI. A few traders (less than 1.5%) also asked growers (ahead of time) to multiply select varieties based on the preferences of different segmented clients (females, males, youth, etc.).

Table 4.19 Sorghum seed management practices by traders (%)

	Type of trader		Overall (n=132)	P-value
	Marketplace traders (n=105)	Large off-takers (n=27*)		
Keep each variety pure, as a single variety	69.5	51.9	65.9	0.084
Sort out waste (pebbles, dirt, dust)	39.0	55.6	42.4	0.122
Seek out specific varieties to buy (that can be planted)	40.0	44.4	40.9	0.675
Sort out bad grains/seed (i.e., broken, immature, or discolored)	33.3	48.1	36.4	0.154
Grade stocks (which grain/which seed)	22.9	33.3	25.0	0.262
Have special storage conditions (to help with seed viability).	22.9	29.6	24.2	0.464
Get grain from specific areas/regions believed to have grain that will grow in the local area (adapted).	16.2	37.0	20.5	0.017
Buy from specific growers who are known for high-quality seed	17.1	25.9	18.9	0.299
Keep freshly harvested stocks apart	12.4	22.2	14.4	0.194
Sell seed and grain separately at different prices	4.8	29.6	9.8	0.000
Do germination tests	1.0	7.4	2.3	0.045
Ask growers (ahead of time) to multiply select varieties based on the preferences of different segmented clients (females, males, youth, etc.)	1.9	0.0	1.5	0.470
Others	6.7	11.1	7.6	0.436

4.5 Sales of sorghum seeds and farmer purchase structure and patterns

4.5.1 Sorghum seed prices

Local red/brown sorghum seed was sold in larger volumes (232.3 tons) than white sorghum (72.8 tons) (**Table 4.20**). Male traders sold 242.5 tons of sorghum seed, significantly higher than the 62.6 tons for female traders. Male traders sold 186.3 tons of red/brown sorghum and 56.2 tons of white sorghum, while female traders sold 46.1 tons of red/brown sorghum and 16.5 tons of white sorghum.

Table 4.20 Quantity of local seed sold (tons in past one year) per market class

	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Red/brown	44	1.0	46.1	31	6.0	186.3	75	3.1	232.3
White	27	0.6	16.5	41	1.4	56.2	68	1.1	72.8
Total	**71**	**0.9**	**62.6**	**72**	**3.4**	**242.5**	**143**	**2.1**	**305.1**

On the other hand, male marketplace traders sold 42.8 tons and female small traders sold 33.3 tons per year (**Table 4.21**). In total, marketplace traders sold 76.1 tons of sorghum seed. Male large off-takers sold 199.7 tons and female large off-takers sold 29.3 tons. In total, large off-takers sold 22.9 tons of sorghum seed. Large off-takers moved higher volumes of sorghum seed than small/marketplace traders.

Table 4.21: Total volume of informal/local seed (tons in past one year), March 2022-March 2023

	Small/marketplace traders			Large off-takers		
	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)
Male	47	0.9	42.8	25	8.0	199.7
Female	61	0.6	33.3	10	2.9	29.3
Combined	108	0.7	76.1	35	6.5	229.0

Like grains, white sorghum seed (USD 811) attracted a higher price than red/brown seed (USD 679) per ton (**Table 4.22**). Female traders were selling white sorghum seed (USD 881) at a higher price than male traders (USD 764), whereas male traders were selling red/brown sorghum seed (USD 688) at a higher price than female traders (USD 673). Marketplace traders sold both varieties at a higher price than large off-takers since the latter often handled large volumes of seed that they distributed to farmers and sold to institutional seed buyers such as NGOs. White sorghum seed was sold at USD 843 and USD 660 by marketplace and large traders, respectively. In comparison, red/brown sorghum seeds attracted relatively lower prices and were sold at USD 714 and USD 600 by small traders and large off-takers, respectively.

Table 4.22 Average seed prices (mean USD/ton)

Type of sorghum	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
White	890	807	**843**	805	612	**660**	881	764	**811**
Red/brown	678	802	**714**	647	581	**600**	673	688	**679**
Total	**762**	**806**	**781**	**694**	**592**	**621**	**752**	**731**	**742**

4.5.2 Revenue from sorghum seed sales

In the past year, on average, traders earned USD 1,558 per trader, with large traders earning more than USD 4,037 per trader. All the sampled traders combined earned USD 198,429, with males earning the highest economic benefits (USD 152,720 for males and USD 45,709 for females). Male traders generate more revenue because they sell higher volumes than female traders. Small traders earned USD 59,871annually (USD 34,496 for males and USD 25,375 for females) (**Table 4.23**). Large off-takers earned revenue of USD 118,224 for males and USD 20,334 for females, which gives a total revenue of USD 138,558.

Table 4.23 Total revenue from seed sales (mean USD in past one year)

	Small/marketplace traders			Large traders (off-takers)			Overall		
	n	Mean USD per year	Total USD	n	Mean USD per year	Total USD	n	Mean USD per year	Total USD
Males	47	725	34,496	25	4,736	118,224	72	2,485	152,720
Females	61	457	25,375	10	2,013	20,334	71	677	45,709
Combined	108	547	59,871	35	4,037	138,558	143	1,558	198,429

4.5.2 Farmer seed purchase signals

Customers provide signals when they are purchasing seeds. Specifically, more than 72% of the traders indicated that customers openly informed them that they were buying seeds, 67% searched for a specific variety by name, and 60% searched for pure varieties (not mixed). In comparison, 50% looked for clean stocks with no debris. There were no significant differences between the sexes of the seed buyers (**Table 4.24**).

Table 4.24 Signals provided by buyers are aiming to buy local sorghum seed (%)

	Sex of sorghum seed buyer		
	Males	Females	Youth
Say they are buying seed	71.3	71.3	74.3
Searching for a specific variety by name	65.3	71.3	64.4
Searching for pure varieties, not mixed	58.4	62.4	60.4
Searching for stocks that are clean (no debris)	47.5	56.4	46.5
Asking for a particular quantity	16.8	9.9	19.8
Asking for well-matured grain from past seasons	15.8	23.8	15.8
Asking how the stocks were stored/conserved	5.0	8.9	7.9
Asking about the origin (place) where the stocks are from	4.0	5.9	3.0
Other*	5.0	5.9	2.0

*Percentages are based on 101 traders that sold sorghum grain as seed in the past year.

4.6 Challenges and opportunities in sorghum production and marketing

Traders experienced several challenges during the COVID-19 pandemic, with the main ones being inadequate demand (20%), lack of a stable market (18%), inadequate supply (13.3%), and low prices (6.3%) (**Table 4.25**). Disaggregating key challenges across sexes shows that inadequate demand and lack of a stable market affected female traders significantly more than male traders. Low prices affected male traders more extensively than it did female traders. Small/marketplace traders were more affected by the lack of a stable market and inadequate supply than those affected large off-takers.

Other challenges experienced during COVID-19 were mobility restrictions imposed by the government, credit constraints, closed borders that limited sales to other countries, poor grading, inadequate/poor storage, and increased domestic responsibilities.

Table 4.25 First major challenge faced in the sorghum business during the COVID pandemic (%)

Challenge	Sex of trader		Type of sorghum trader		
	Females (n=120)	Males (n=135)	Marketplace traders (n=189)	Large off-takers (n=66)	Total (n=255)
Inadequate demand	**27.5**	**13.3**	**20.6**	**18.2**	**20.0**
Lack of a stable market	**20.0**	**16.3**	**19.6**	**13.6**	**18.0**
Inadequate supply	**14.2**	**12.6**	**15.9**	**6.1**	**13.3**
Low Prices	**3.3**	**8.9**	**6.3**	**6.1**	**6.3**
Mobility restrictions imposed by the government	3.3	3.7	4.2	1.5	3.5
Credit constraints	5.0	2.2	3.7	3.0	3.5
Closed borders that limited sales to other countries	0.0	3.7	0.5	6.1	2.0
Poor grading	0.8	3.0	2.1	1.5	2.0
Inadequate/poor storage	2.5	0.0	1.1	1.5	1.2
Increased domestic responsibilities	0.8	1.5	1.6	0.0	1.2
Inadequate market information	0.0	1.5	1.1	0.0	0.8
Closed borders that limited imports	0.0	1.5	0.0	3.0	0.8
Costly/or Inadequate transportation	1.7	0.0	0.5	1.5	0.8
Buyers are not trustworthy	0.8	0.7	0.5	1.5	0.8
High taxes/levies	0.0	0.7	0.5	0.0	0.4
Businesses closed during COVID	0.8	0.0	0.4	0.0	0.4
Others	4.2	3.0	3.7	3.0	3.5
No challenges	15.0	27.4	17.5	33.3	21.6

The challenges experienced post-COVID-19 were inadequate supply (25.5%) and lack of a stable market (19.2%). The lack of a stable market substantively affected female traders (21.7%) more than male traders (17.0%) post-COVID-19. Inadequate supply significantly affected large off-takers (40.9%) compared with small traders (20.1%) post-COVID-19. Small traders were more affected by the lack of a stable market (22.8%), but this did not affect large off-takers (9.1%) as much (**Table 4.26**). Traders also noted their coping strategies for dealing with these challenges (**Table 4.27**).

Table 4.26 Major challenges faced in the sorghum business post-COVID-19 (%)

Challenge	Females (n=120)	Males (n=135)	Informal marketplace traders (n=189)	Large off-takers (n=66)	Total (n=255)
Inadequate supply	**24.2**	**26.7**	**20.1**	**40.9**	**25.5**
Lack of a stable market	**21.7**	**17.0**	**22.8**	**9.1**	**19.2**
Inadequate demand	9.2	9.6	11.1	4.5	9.4
Low prices	5.0	6.7	6.3	4.5	5.9
Poor grading	4.2	5.9	5.3	4.5	5.1
Inadequate market information	5.0	3.0	4.2	3.0	3.9
Credit constraints	3.3	3.7	2.1	7.6	3.5
Inadequate/poor storage	3.3	3.7	3.7	3.0	3.5
Weather-/climate-related	1.7	3.0	2.6	1.5	2.4
Mixed grain	1.7	2.2	1.6	3.0	2.0
High taxes/levies	0.8	1.5	1.6	0.0	1.2
Buyers are not trustworthy	0.8	0.0	0.4	0.0	0.4
Others	5.8	2.2	4.8	1.5	3.9
No challenges	13.3	14.8	13.2	16.7	14.1

Table 4.27 Major coping strategies (%)

Coping strategy	Females n=120	Males n=135	Small/ marketplace traders n=189	Large off-takers n=66	Total (n=255)
Borrowing from relatives and friends	25.0	19.3	21.2	24.2	22.0
Membership in informal saving groups	16.7	12.6	15.3	12.1	14.5
Informal trust-based credit from suppliers	11.7	11.1	10.6	13.6	11.4
Loans from commercial banks	3.3	5.9	1.1	15.2	4.7
Reduced staff	0.8	2.2	1.6	1.5	1.6
Other	60.8	69.6	63.5	71.2	65.5

4.7 Technical support required by sorghum traders to promote new varieties

There is a prevalent knowledge gap in the handling and management of varieties among traders (61%). This technical support should be prioritized among female traders, for whom the knowledge gap is more widespread (75.8%) than for males (50%). The knowledge gap is also more extensive among small traders (65.6%) than among large off-takers (42.9%). All other knowledge gaps exist, but at a much lower extent (**Table 4.28**).

Table 4.28 Technical support required by traders to promote new varieties (%)

	Sex of trader		Type of bean trader		
	Females (n=33)	Males (n=42)	Small/ marketplace traders (n=61)	Large off-takers (n=14)	Total (n=75)
Information about varieties (handling, management)	75.8	50.0	65.6	42.9	61.3
Training on extension skills	12.1	11.9	11.5	14.3	12.0
Information about how and where to source varieties	9.1	14.3	8.2	28.6	12.0
Training on business management and administration skills	3.0	14.3	9.8	7.1	9.3
Training on sales and promotion skills	0.0	4.8	3.3	0.0	2.7
Information on potential markets	0.0	2.4	0.0	7.1	1.3
Seed promotion leaflets to give to farmers	0.0	2.4	1.6	0.0	1.3

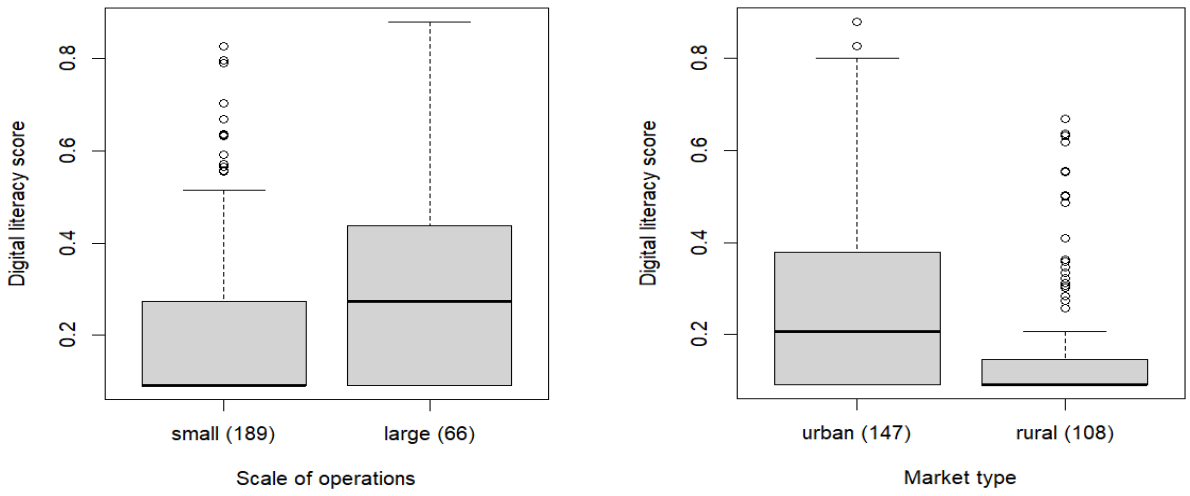
4.7 Digital readiness of sorghum traders

Sorghum traders hardly use advanced digital tools, and less than half have smartphone access. They seek relevant information from other traders, customers, and farmers. Personal meetings and phone calls are, by far, the most critical communication channels.

4.7.1 Sorghum traders' level of digital skills

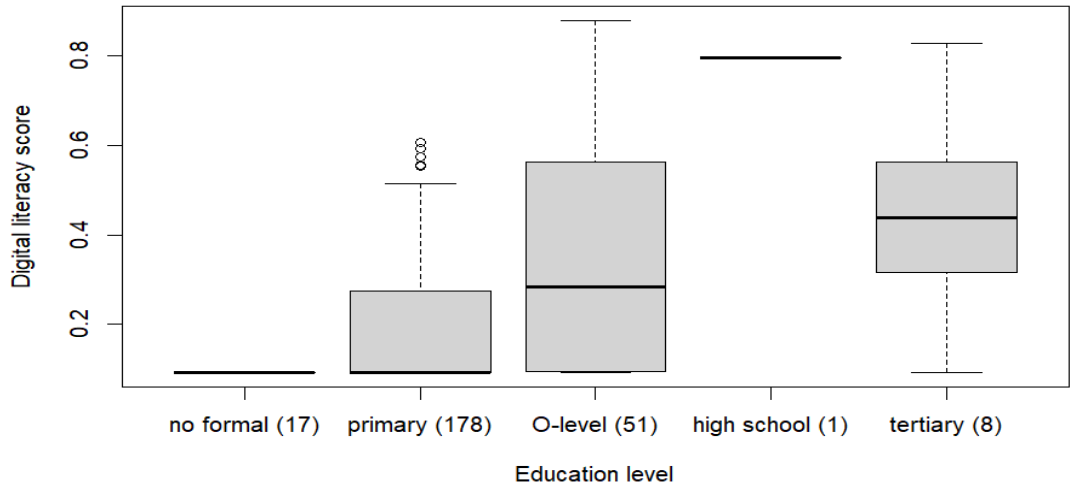
On average, sorghum traders have low digital skills and experience. Digital literacy refers to practical skills using digital tools and services, such as mobile phones, smartphones, or the internet. Digital literacy was expressed by a score from 0 to 1. Overall, the digital literacy of sorghum traders is relatively low, with a mean = 0.22 (SD = 0.18). However, some significant differences existed within the group of traders. Large off-takers had higher digital literacy than marketplace traders, while traders in urban markets had higher digital literacy than traders in rural markets (**Figure 26**). Notably, there were no significant gender differences in digital literacy (t-test, P >0.10).

Figure 26: Sorghum traders' digital literacy



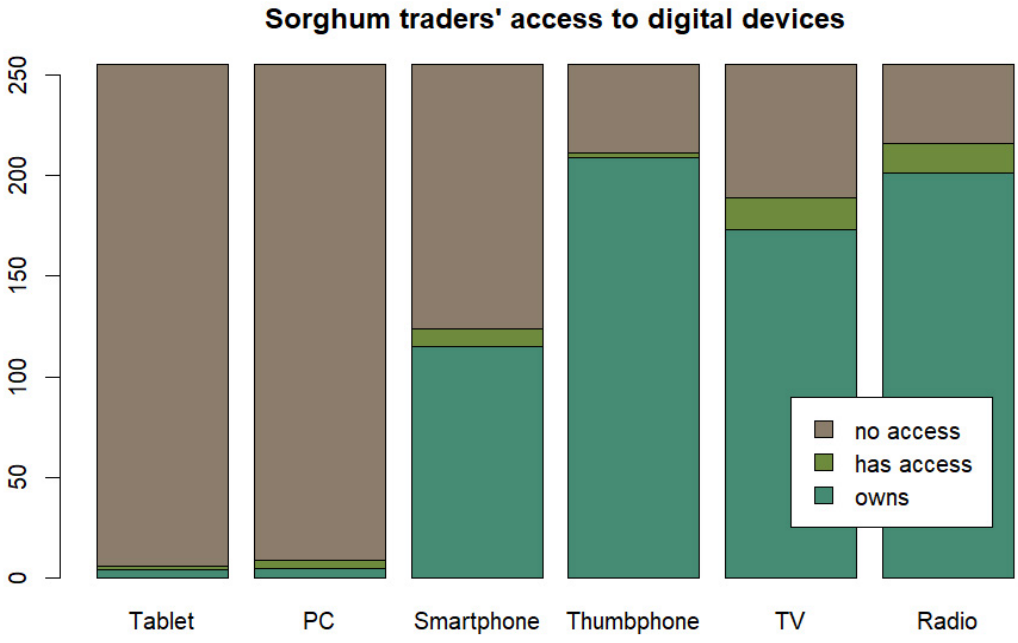
Overall, traders with a higher level of formal education tend to have higher digital literacy (**Figure 27**). On average, digital literacy is relatively low everywhere, although substantial variation exists, especially in the Coastal and Northern zones.

Figure 27: Traders digital literacy by education level



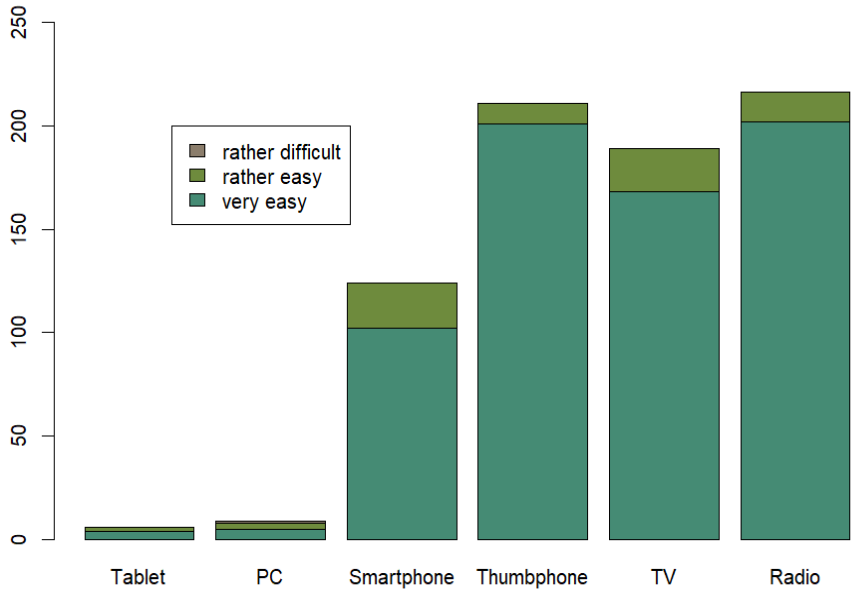
Most sorghum traders own a mobile phone and use a radio. Less than half own a smartphone, but there is a strong difference between small and large traders. Ownership of phones and radio is widespread, whereas computers are uncommon. For traders who do not own a device, it is somewhat common to access smartphones, TVs, or radios owned by friends or family members (**Figure 28**). Mobile phones are almost ubiquitous: 95% of all traders own either a conventional mobile phone (82%) or a smartphone (45%). Many own both (33%). Nevertheless, there is a gender difference in smartphone ownership, which is significantly less common among women (37%) than among men (78%). A strong difference also exists between small and large traders regarding smartphone ownership (35% vs. 72%).

Figure 28: Sorghum traders' access to digital devices



Traders perceived little difficulty in using digital devices (**Figure 29**).

Figure 29: Perceived ease of using digital devices



Besides TV and radio, sorghum traders commonly use phone calls and SMS. Less than half of the traders ever use WhatsApp (**Figure 30**). Traders widely use basic phone functionalities: phone calls and SMS. Mobile money, such as M-Pesa, is widespread too, with 86% of all traders using it at least sometimes. Radio and TV are still relatively common.

Fewer traders use more advanced digital services that require the internet (e.g., social media, Google, or Facebook). Messenger chats, such as WhatsApp, are used by only about 40% of the traders, which roughly corresponds to the rate of smartphone ownership. These general patterns are essentially the same for both men and women, although men are likelier to use internet-related services, such as Messenger (e.g., WhatsApp). More explicit differences exist between small and large traders, though, in line with the observed strong difference in smartphone ownership (bigger traders are about twice as likely to own a smartphone). Differences also exist in the use of internet-related services between the business sizes. Interestingly, larger traders also use mobile money services (which do not require a smartphone) more regularly.

Figure 30: Traders' use of digital services

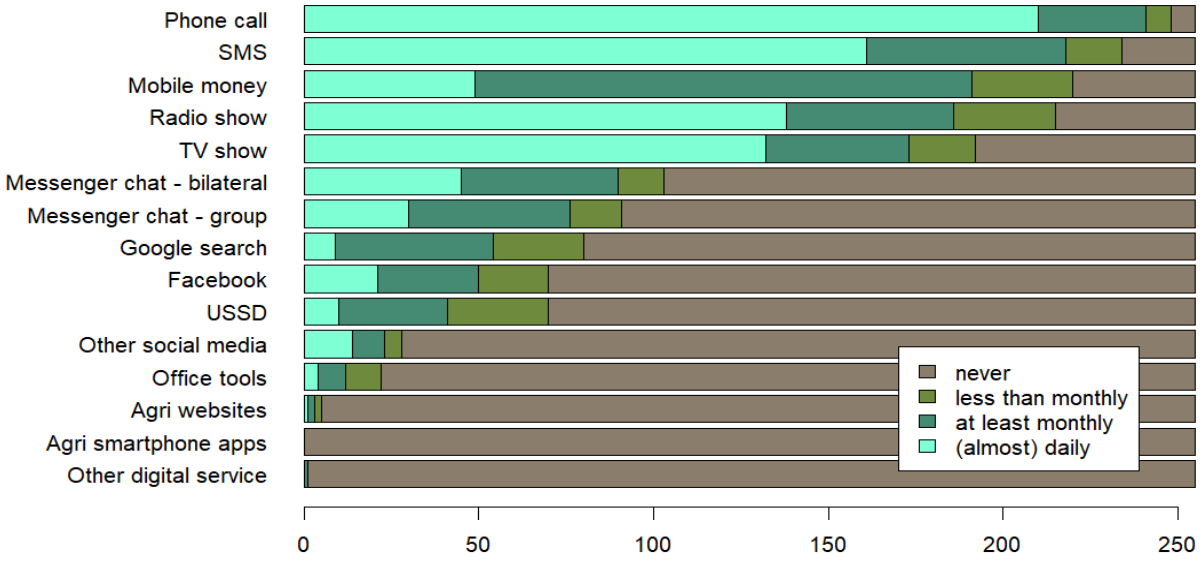
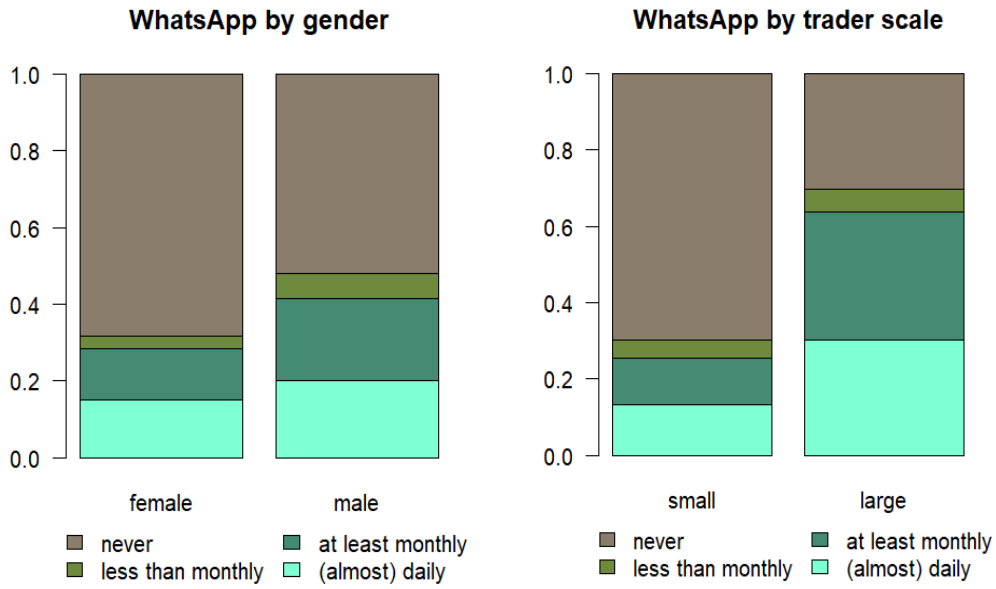
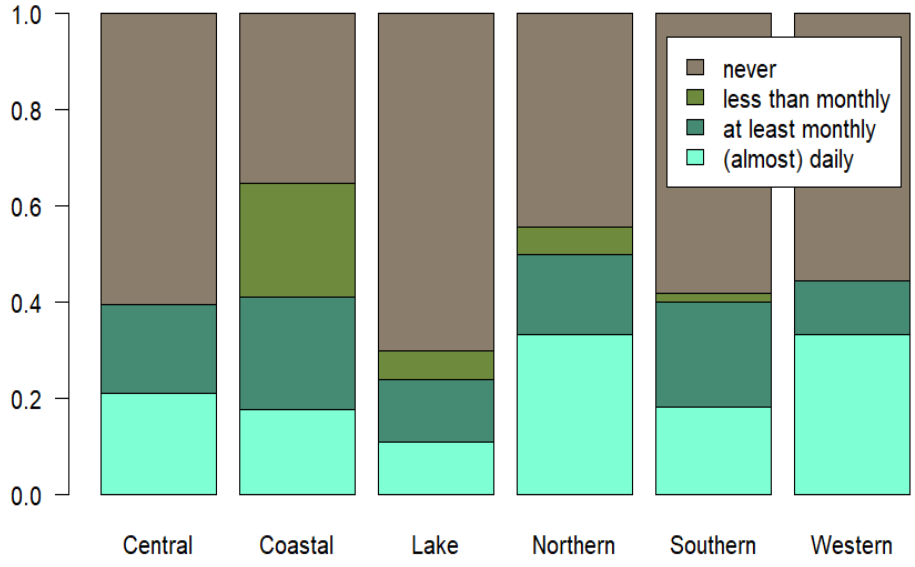


Figure 31: Use of WhatsApp by gender and type of trader



As an example of the differences in the use of internet-related services, 42% of the male traders used a Messenger app (such as WhatsApp) at least monthly, while this was true for only 28% of the female traders (t-test, P <0.05). The difference between small and large traders is even stronger (**Figure 31**). In line with digital literacy, digital messengers such as WhatsApp are most used by sorghum traders in the Northern and Western zones (**Figure 32**).

Figure 32: Use of WhatsApp by region



Digital services that traders use in their business

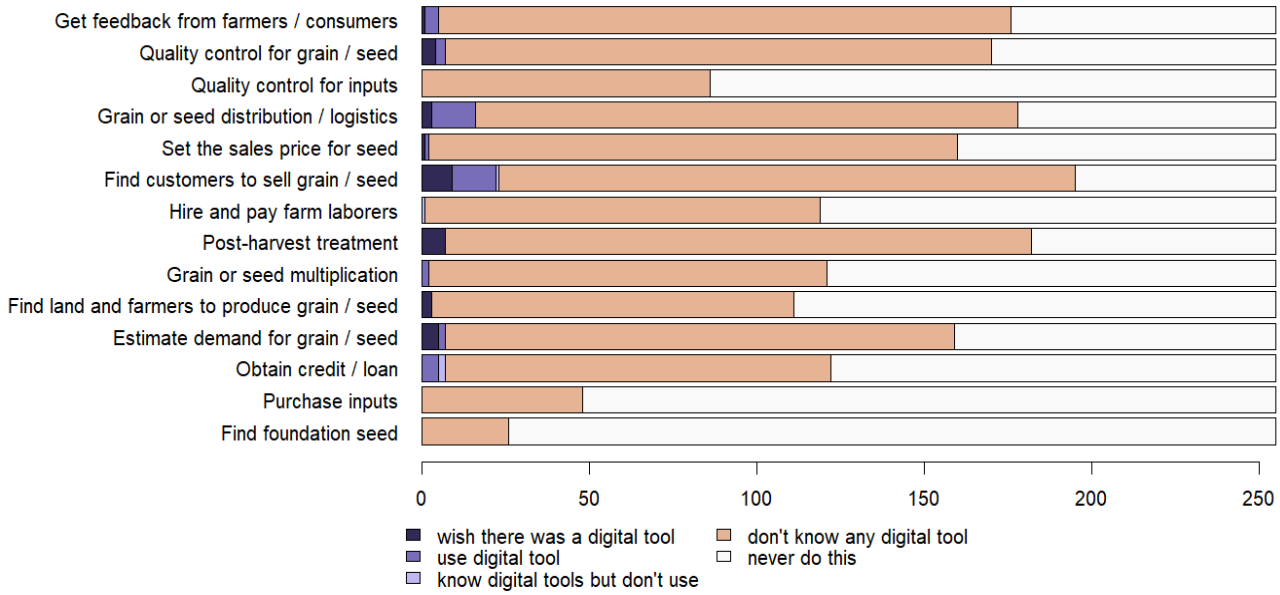
Apart from phone calls, there is minimal use of digital tools and services in sorghum traders' business (**Figure 33**). Traders want to use these tools to find new customers to grow their business, decrease costs, and improve sorghum quality.

Traders currently do not strongly use digital services for their business activities. Some are aware of digital services but mention that a lack of smartphones hinders them. Those who do use digital tools mention phone calls and WhatsApp.

Logistics and finding customers are the most digitalized activities (mostly phone calls and

WhatsApp). However, finding customers is also where hope for further digitalization is highest. Traders have clear expectations for what purposes digital services should serve. Traders expressed hope for using digital tools to decrease costs/increase cost efficiency, grow their business by reaching new customers and retailers, and improve the quality of traded products.

Figure 33: Traders' use of digital tools in their business



4.7.3 Traders' communication channels and their information-seeking behavior

Most traders spoke with their customers (consumers/retailers for grain and farmers for seed), other retailers and aggregators, and the farmers who supply grain for sale (**Figure 34**). However, there is little communication with upstream stakeholders of the breeding process, such as foundation seed providers (13%) and breeders (15%). Large traders communicate more than small traders (**Figure 35**). This difference is significant for upstream stakeholders of the breeding pipeline (TOSCI, breeders, QDS-producing farmers) and for institutional buyers. Personal communication (through meetings or phone calls) dominates information exchange with all stakeholders. SMS is used, but much less commonly, and Messenger (WhatsApp) is used only by some large traders.

Figure 34: Sorghum traders' preferred communication channels

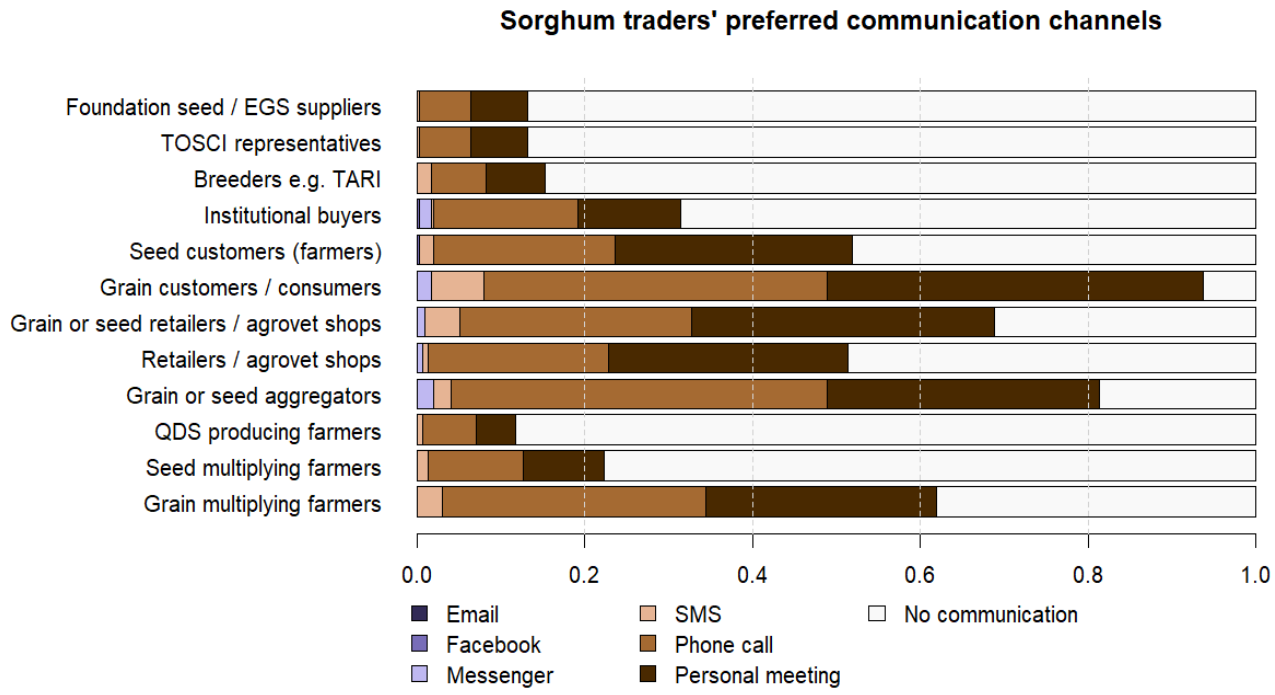
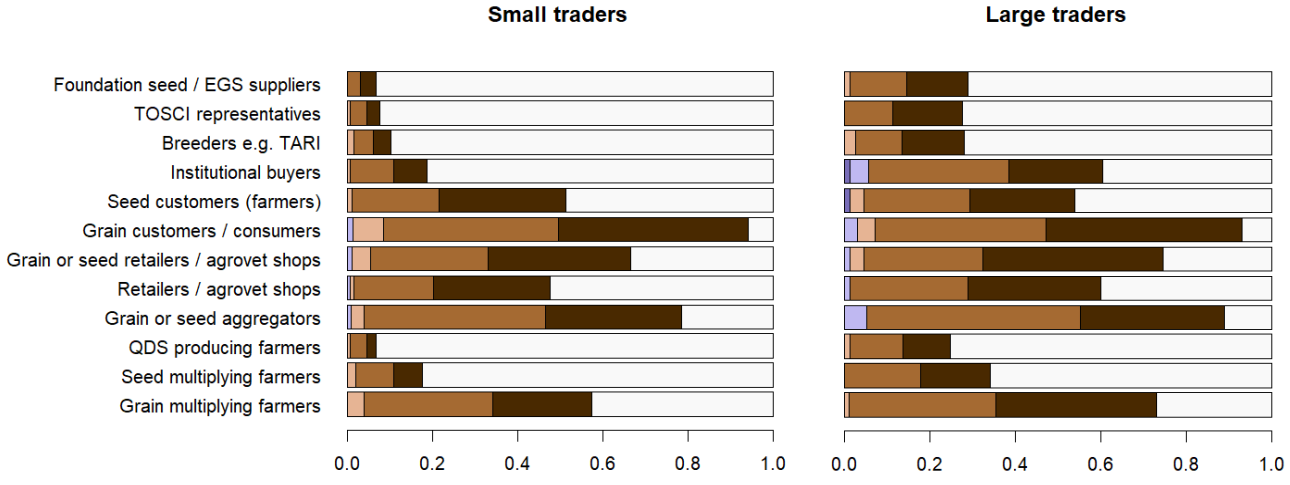
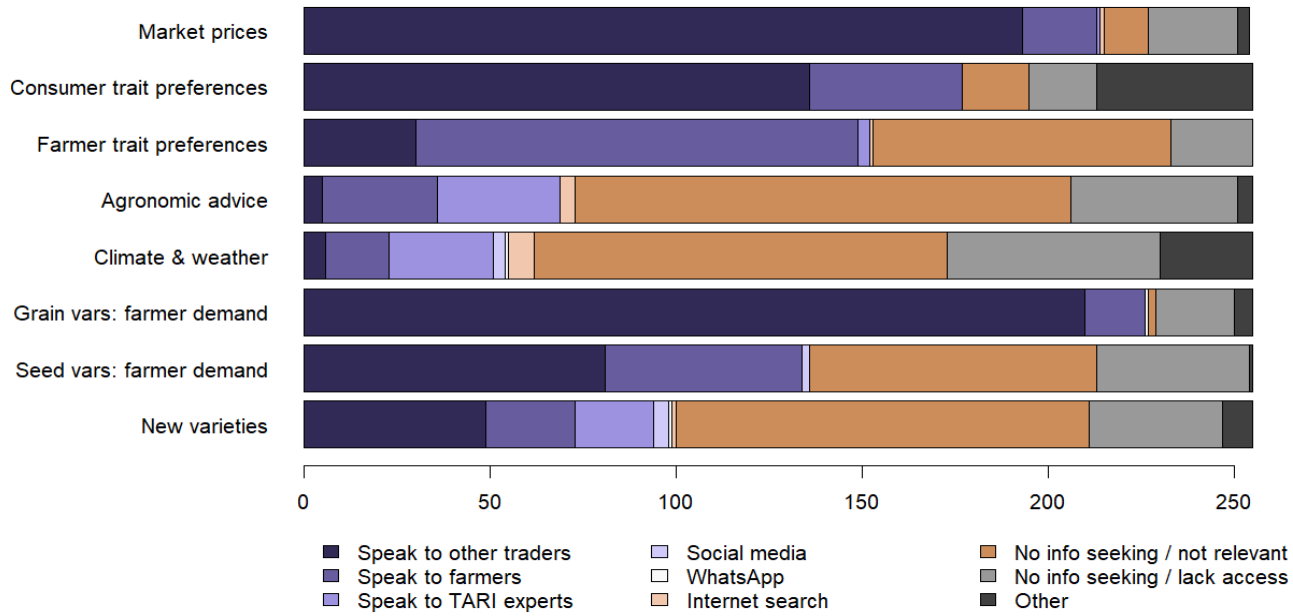


Figure 35: Sorghum traders' communication channels by trader type



On the other hand, the survey sought to understand traders' behavior and preferences regarding information seeking. It emerged that traders primarily rely on other traders for important information. For the seed business, farmers are also an essential source of information (**Figure 36**). Agrovets and retailers provide additional information on customer demand. Less than half ever seek information on new varieties.

Figure 36: Traders' information-seeking behavior in the sorghum value chain



The peer network in which traders exchange with other traders (word of mouth) is the most important source of information for the most critical topics: market prices, consumer trait preferences, and farmer variety demand. Farmers are considered an important source of information only for their trait preferences. Possibly, this is because, for many traders, the grain business is more important than the seed business. Therefore, consumer preferences are more important than farmer preferences. Traders did not widely seek information on agronomic advice, climate and weather, and new varieties.

Radio and TV are additional sources of information for learning about new varieties and climate. For consumer preferences, direct interaction with customers is an important source of information. Social media, WhatsApp, and internet searches are not very meaningful sources of information for traders.

4.8 Role of government and humanitarian agencies in the sorghum seed system

4.8.1 Government involvement in the sorghum value chain

The government agencies acknowledged that traders are active channels for distributing new varieties. The Tanzanian Government, through TAMISEMI, the Ministry of Agriculture, TARI, and the local government, partnered with traders to distribute new sorghum seed varieties (**Table 4.29**). They reach farmers by establishing demonstration plots, trader promotions, introducing new varieties to farmers, participatory varietal selection, farmer groups, technology hubs, farmer field schools, and collaboration with TARI and ASA, which provide subsidy programs. The vignette below exemplifies private sector involvement in working with different stakeholders.

Serengeti Breweries Limited (SBL) purchased grain from aggregators and farmers, with the latter having to sell their produce through off-takers. The company linked farmers to suitable aggregators to collaborate with them throughout the season to make sure the aggregators provided them with the necessary inputs on behalf of the company. SBL's annual demand is 4,000 tons. However, they purchase up to 15,000 tons for sister companies in Kenya and Uganda. Purchasing prices range from TZS 1,100 to 1,200 (USD 0.50 to 0.70) per kilogram, with the company preferring white sorghum, which has 75% starch for extraction.

The agencies acknowledged that collaborating with traders can help to efficiently reach youthful farmers through targeted training, agribusiness expos, farmer field schools, establishment of demonstration plots, creating youth farmer groups, and popularizing new varieties. This observation holds since most traders are aged 25 to 45. The government agencies also confirmed that the traders spread information to farmers through personal meetings as they sell grain and seeds, verbal information to customers, hanging posters in their shops, labeling seeds, demonstration plots, farmer groups and individual farmers spreading information during planting season, and forums.

Multistakeholder platforms in which grain traders, researchers, agro-dealers, grain traders, and farmers are members help to spread information about new varieties.

Farmers can obtain information about new varieties from private companies, farmers, other traders, agro-dealers, physical meetings, WhatsApp chats and platforms, local governments, ASA, TARI, meetings with the seed sector, and an online forum known as M-Kilimo. A few local governments and the Ministry of Agriculture at the district level produce QDS that they distribute to farmers or use at demonstration sites.

Table 4.29 Annual capacity for sorghum seed production.

Organization name	District	QDS (tons)
Local Government Authority	Babati Town	10
Local Government Authority	Temeke	10
Ministry of Agriculture	Singida	10
Ministry of Agriculture	Kyerwa	0
Ministry of Agriculture	Nyamagana	25

4.9 Institutional seed buyers

4.9.1 Engagement in seed-related activities

A qualitative analysis showed that all the organizations have direct contact with grain and seed farmers except for WFP, which does not engage in seed production activities but supports farmers by linking them with the source of varieties: institutional seed buyers to support seed production using the QDS system (**Table 4.30**). In addition, they support farmers and seed producers by establishing demonstration sites, providing training on production and distribution of grain and seed, facilitating TOSCI inspection of seeds, collaborating with government bodies, establishing village community seed banks, postharvest management, and market skills/ commercial farming.

Table 4.30 Seed-related activities of institutional seed buyers

Organization name	Seed-related activities
Diocese of Central Tanganyika (DCT)	• Support QDS production • Promote improved varieties • Train farmers on farm seed selection
Save the Children	• Support initial seed to farmers through demos • Link farmers with seed supply
INADES Formation	• Provide training for QDS Producers • Link seed producers and research for EGS • Facilitate TOSCI inspection • Support the establishment of a village community seed bank
Empowering Farmers Foundation	• Help farmers obtain agricultural inputs • Transform farmers from subsistence farming to commercial farming
East African Grain Council	• Link farmers with input supply • Provide capacity building on production and postharvest management
BRiTEN	• QDS production • Provide training on good agricultural practices (GAP) • Provide training on market skills to farmers' groups
DASPA	• Provide training on quality seed production and distribution
SUGECO	• QDS production • Help link farmers to small and large off-takers • Help farmers in production by supplying seeds, especially TARI bean 6 and Jesca
Caritas	• QDS production
Miik	• QDS production
FAO	• Production of certified seed in collaboration with Jeshi la Kujenga Taifa (JKT) and TOSCI; production of QDS with farmers and TOSCI (variety Jesca)

Table 4.31 shows the volumes of seeds in tons that institutional seed buyers purchase annually. The Diocese of Central Tanganyika (DCT) purchases 0.2 tons of basic seed and INADES Formation purchases 0.4 tons. World Vision purchases 4 tons of breeder seed and Farm Africa purchases 80 tons. Empowering Farmers Foundation purchases 22.5 tons of certified seed and RECODA purchases 14 tons per annum. INADES Formation purchases 10 tons of QDS, DASPA buys 15 tons, and Farm Africa purchases 40 tons.

Table 4.31 Annual sorghum seed demand

Organization name	Annual seed demand (tons)	
	Quantity	Type of seed
Diocese of Central Tanganyika (DCT)	0.2	Basic
INADES Formation	0.4	Basic
	10	QDS
Empowering Farmers Foundation	22.5	Certified
DASPA	15	QDS
World Vision	4	Breeder
Farm Africa	80	Breeder
	40	QDS
RECODA	14	Certified

These institutional buyers obtained their breeder or basic seeds from TARI as it has the sole mandate to produce and supply foundation/ starter seed (breeder seed) in Tanzania.

4.9.2 Constraints

The institutional seed buyers sampled for this survey gave feedback on their production and marketing constraints (**Table 4.32**). The primary production-related challenges were inadequate knowledge of production and costly or unavailable foundation seed. The major marketing constraints were an inadequate supply of seeds and low prices of informal or local seed.

Table 4.32 Production and marketing constraints

Production constraint	Rank	Marketing constraint	Rank
Inadequate knowledge of production	1	Inadequate supply of seeds	1
Foundation seed is unavailable and costly	2	Low prices of informal or local seed	2
Lack of stable seed market	3	Inadequate supply of information	3
Lack of business skills on how to make sales	4	Inadequate storage facilities	4
Cash flow or credit constraints	5	Credit constraints	5

4.9.3 Methods for increasing access to and interest in disseminating new varieties

This study sought to determine how training support for small traders can be crafted to ensure that women, men, male and female youth, and those with disabilities can obtain seeds during crises. The results from the institutional seed buyers reinforce three solutions: a sufficient supply of seed, support for seed production, and conducting need assessments. Other solutions mentioned are water management, moisture conservation, and awareness creation. Except for FAO, all institutional seed buyers would consider disseminating new varieties to farmers with informal (and local seed) traders.

5. Groundnuts

5.1 Socioeconomic characteristics of traders

Data were collected from 300 traders across 12 regions: Mwanza, Mbeya, Dodoma, Mtwara, Tabora, Katavi, Singida, Shinyanga, Dar es Salaam, Kigoma, Songwe, and Simiyu. Overall, 87 were large off-takers/traders and 213 were marketplace traders, while 118 and 182 were female and male traders, respectively (**Table 5.1**).

Table 5.1 Groundnut sample distribution

Region	Sex of trader		Type of sorghum trader		Overall
	Females	Males	Marketplace traders	Large traders	
Mwanza	19	20	26	13	39
Mbeya	20	18	33	5	38
Dodoma	5	27	19	13	32
Mtwara	6	26	25	7	32
Tabora	6	23	24	5	29
Katavi	15	14	23	6	29
Singida	4	21	16	9	25
Shinyanga	16	5	18	3	21
Dar es Salaam	1	18	8	11	19
Kigoma	17	2	16	3	19
Songwe	8	8	4	12	16
Simiyu	1	0	1	0	1
Total	**118**	**182**	**213**	**87**	**300**

A total of 71% of the traders were marketplace traders, while 29% were large off-takers. Marketplace traders were gender balanced, with 51.6% males and 48.4% females. Large off-takers/traders were predominantly males (82.8%), while the rest were females. Almost half the traders were 30 to 45 years old (49%), 33.7% were aged 46 to 65, and 16% were 15 to 29 years old and above. It was uncommon to find traders who were 66 years and above (1.7%).

Traders were not well educated since most had only attained primary school education (67%) and 23.7% reached O-level (**Table 5.2**). More male traders had O-level education (24.2%), high school (2.2%), and tertiary level (6%) than female traders (22.9%, 0.8%, and 0.8%, respectively). Female traders were generally less educated.

More than 73% of the traders had been in the groundnut business for less than ten years, while 27% had more than ten years' experience. Regarding gender, women were predominantly marketplace traders and were much younger/less experienced than males, who were primarily large traders.

Table 5.2 Socioeconomic characteristics of groundnut traders

	Sex of trader		Type of sorghum trader		Overall (n=300)
	Females (n=118)	Males (n=182)	Informal marketplace traders (n=213)	Large off-takers (n=87)	
Sex (Row %)	39.3	60.7			
Type of sorghum trader (Row %)					
Informal marketplace trader	48.4	51.6			74.1
Large off-taker	17.2	82.8			25.9
Age (Column %)					
15 to 29	16.9	15.9	19.2	9.2	16.3
30 to 45	49.2	47.3	47.4	49.4	48.0
46 to 65	31.4	35.2	31.5	39.1	33.7
66 and above	2.5	1.6	1.9	2.3	1.7
Education level attained (Column %)					
No formal	6.8	1.6	5.2	0.0	3.7
Primary	68.6	65.9	67.6	65.6	67.0
O-level	22.9	24.2	22.1	27.6	23.7
High school	0.8	2.2	1.4	2.3	1.7
Tertiary	0.8	6.0	3.8	4.6	4.0
Number of years in sorghum business (Column %)					
1 to 4 years	47.5	32.4	44.6	23.0	38.3
5 to 9 years	28.0	39.6	34.3	36.8	35.0
10 to 14 years	16.1	11.0	9.9	20.7	13.0
15 or more years	8.5	17.0	11.3	19.5	13.7

Traders pointed out that more than 91.7% of their customers purchase grains for food, 52% for re-selling to other customers such as retailers and consumers, and 47% for seeds or planting (**Table 5.3**). In addition, small/marketplace traders significantly sold to final consumers (96.7%) more than did large off-takers (79.3%). The proportion of customers reported to buy and re-sell was higher for large off-takers (66.7%) than for marketplace traders (46.5%). This observation could be because large off-takers could handle larger volumes of groundnuts, thus having additional opportunities to serve customers of different levels. More marketplace traders (54%) sold local seed (grains as seed) to farmers than large traders (28.7%).

Table 5.3 Customers' use of groundnut grain bought from traders (%), March 2022–March 2023

By sex	Females (n=118)	Males (n=182)	Total (n=300)	P-value
Food	91.5	91.8	91.7	0.943
Re-selling	49.2	54.4	52.3	0.374
Planting	55.1	41.8	47.0	0.024
Other uses	2.5	1.1	1.7	0.340
By type of trader	**Informal marketplace traders (n=213)**	**Large off-takers (n=87)**	**Total (n=300)**	
Food	96.7	79.3	91.7	0.000
Re-selling	46.5	66.7	52.3	0.001
Planting	54.5	28.7	47.0	0.000
Other uses	1.9	1.1	1.7	0.655

Most of the groundnut traders were retailers (77%), followed by wholesalers (30%), collectors/aggregators (18%), processors (5%), and producer-traders and exporters (less than 1.5%). However, women dominated the retailing business at 90%, whereas men dominated large groundnut trading or off-taking. As expected, about 95% of the marketplace traders were retailers, although some wholesalers or large traders existed in those marketplaces. On the other hand, large traders were mainly wholesalers (80.5%), while some were also retailing (44%) and aggregating groundnuts (45%) (**Table 5.4**).

Table 5.4 Type of groundnut business (%)

	Sex of trader			Type of trader			Total (n=300)
	Females (n=118)	Males (n=182)	P-value	Marketplace traders (n=213)	Large off-takers (n=87)	P-value	
Retail trade	89.8	69.2	0.000	94.8	34.5	0.000	77.3
Collector/aggregator/broker	14.4	20.9	0.157	7.5	44.8	0.000	18.3
Wholesaler	16.9	39.0	0.000	9.9	80.5	0.000	30.3
Processor	4.2	4.9	0.776	6.1	1.1	0.065	4.7
Producer-trader	0.0	0.5	0.420	0.0	1.1	0.117	0.3
Exporter	0.0	1.6	0.161	0.0	3.4	0.006	1.0

The findings showed that most traders (78.6%) had one employee or none, while only 18.7% had two to five employees (**Table 5.5**). It is uncommon for traders to have more than five employees (2.7%). Most female traders (90.7%) had from zero to one employee compared with male traders (70.9%). On the other hand, most marketplace traders (who are predominantly women) had zero to one employee compared with large off-takers (55.2%) who handled relatively larger volumes. A substantial proportion of large off-takers have two to five employees (36.8%), while 8% have more than five employees.

Table 5.5 Number of employees in the groundnut business (%), March 2022–March 2023

Number of employees	Sex of trader		Type of groundnut trader		Total (n=300)
	Females (n=118)	Males (n=182)	Informal marketplace traders (n=213)	Large off-takers (n=87)	
1 or none	90.7	70.9	88.3	55.2	78.6
2 – 5 employees	7.6	25.8	11.3	36.8	18.7
> 5 employees	1.7	3.3	0.5	8.0	2.7

5.2 Sources of varieties

5.2.1 Trader varieties/market class (including the importance of varieties)

Medium tan dominates the groundnut traded, accounting for 37%, followed by large red (24%) and small tan (16%), while 23% sold either medium red, large tan, or small red (**Table 5.6**). This observation means that medium red (9.6%), large tan (9.1%), and small red (4.4%) are less popular varieties in Tanzania. However, slight disparities exist across gender and trader types, with female traders being more likely to sell the main or popular varieties, such as medium tan (39.4%) and large red (25.3%), more than male traders. More male traders preferred to sell smaller varieties than females. Despite the medium tan variety being the most sold across both traders, small traders (40.7%) sold more than large off-takers (28.4%). It is important to note that large off-takers who exported groundnuts sold the large tan variety predominantly.

Table 5.6 Type/market class of groundnut sold

Type of variety	Sex of trader				Type of trader				Overall	
	Females		Males		Informal traders		Large off-takers			
	n	%	n	%	n	%	n	%	n	%
Medium tan	78	39.4	114	35.5	148	40.7	44	28.4	192	37.0
Large red	50	25.3	72	22.4	85	23.4	37	23.9	122	23.5
Small tan	31	15.7	54	16.8	57	15.7	28	18.1	85	16.4
Medium red	16	8.1	34	10.6	36	9.9	14	8.0	50	9.6
Large tan	17	8.6	30	9.3	24	6.6	23	14.8	47	9.1
Small red	6	3.0	17	5.3	14	3.8	9	5.8	23	4.4

5.2.2 Sources of varieties and destination

There are three primary sources for groundnut varieties: collectors and aggregators (35.6%), farmers (33.7%), and wholesalers/traders (26.7%) (**Table 5.7**). Traders rarely source varieties from their production (1.5%) and importers (0.3%). Marketplace traders predominantly source from collectors, aggregators, and wholesalers, while large traders mainly obtain their varieties directly from farmers, collectors, and aggregators (Table 5.7).

Table 5.7 Sources of groundnut varieties (%), March 2022–March 2023

	Informal traders/retailer	Large off-takers	Overall
Collectors and aggregators	34.5	38.2	35.6
Direct from farmers	29.3	44.1	33.7
Wholesalers and other traders	32.1	14.1	26.7
Other sources	2.5	1.3	2.1
Own production	1.5	1.5	1.5
Importers	0.2	0.7	0.3

5.2.3. Nature of engagement with suppliers (e.g., contract farming)

A majority of the groundnut traders (69.4%) did not have any form of contract with their leading suppliers. However, a third (30.3%) had a verbal agreement. Formal written agreements were unpopular among groundnut traders (<1%). More female traders (87%) than male traders (59%) did not have written agreements. About 25% and 42% of the marketplace and large traders had verbal contracts, respectively (**Table 5.8**).

Table 5.8 Do you have a contract with your main varietal supplier (%)?

	Sex of trader		Type of trader		Total
	Females	Males	Marketplace traders	Large off-takers	
None	86.9	58.6	74.5	57.4	69.4
Verbal	13.1	40.8	25.3	41.9	30.3
Written	0.0	0.6	0.3	0.6	0.4

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 types are Kenya, Uganda, Burundi, Rwanda, and Malawi (**Figure 37**).

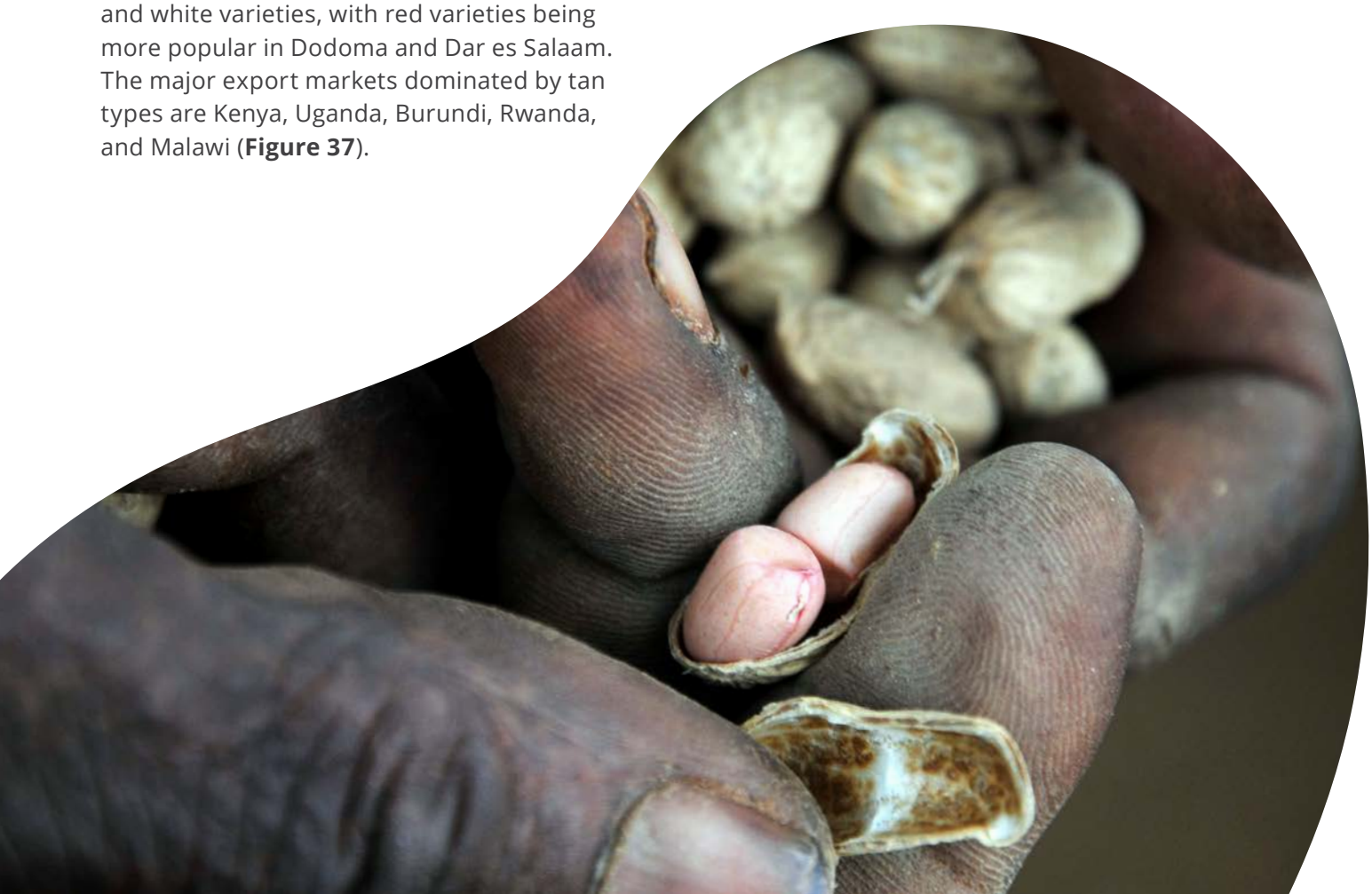
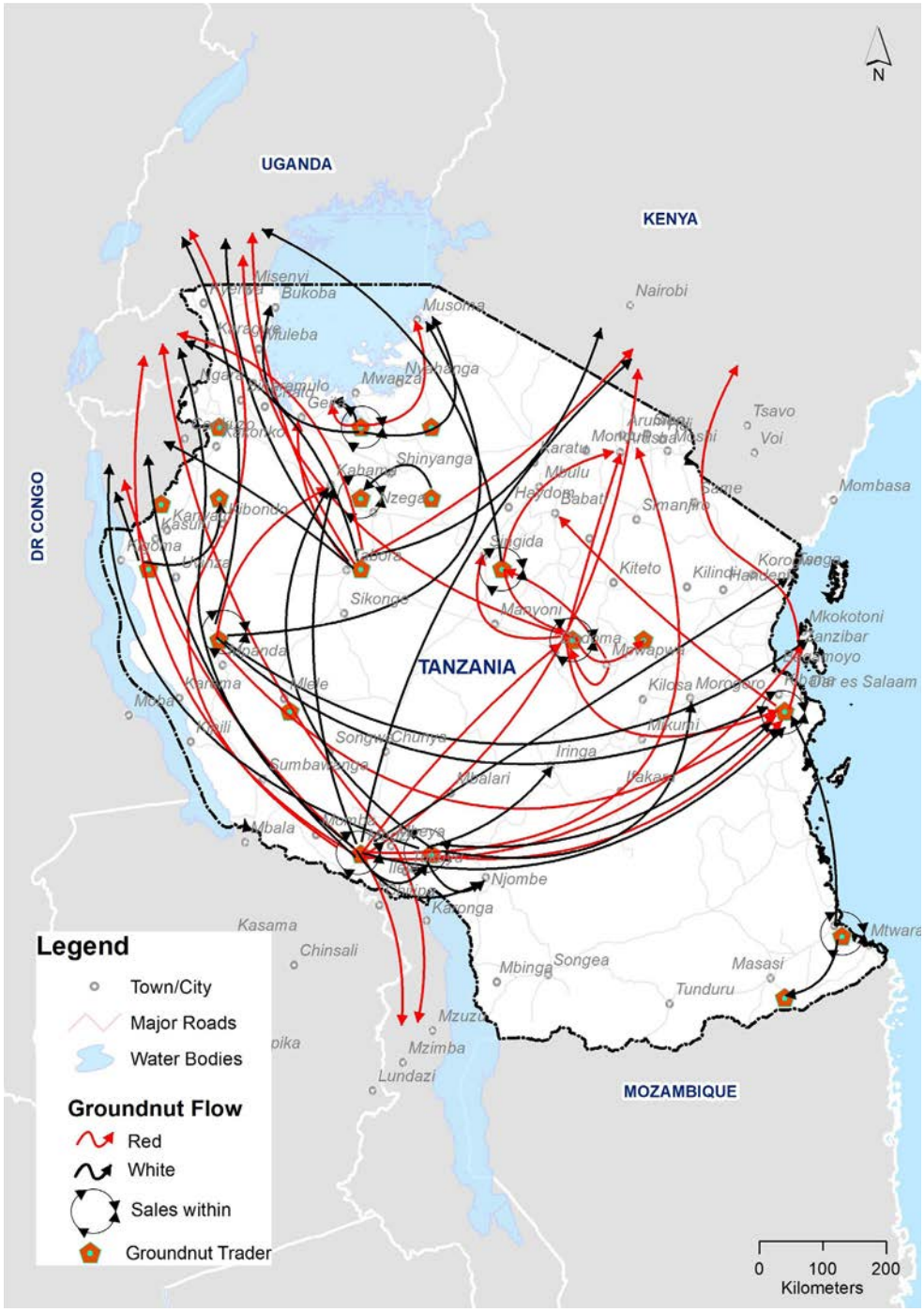


Figure 37: Groundnut grain and seed flow in Tanzania.



5.3 Sale of groundnuts

5.3.1 Volumes for different buyers and prices

The results in **Table 5.9** show that marketplace traders sold small red at 219 tons per trader per year. The rest of the varieties were sold in much smaller volumes: large tan, 47 tons; medium red, 36.5 tons; medium tan, 29.1 tons; large red, 20 tons; and small tan, 11.6 tons. Female marketplace traders predominantly sold the small red variety (502.8 tons), while the rest of the varieties were sold in much smaller proportions: large tan, 68.3 tons, and large red, 22.9 tons. It is less common for female traders to sell small tan, medium tan, and medium red varieties than their male counterparts, who prefer to sell medium red, medium tan, and large red ones. The most sold groundnuts were medium tan, small red, and large red, with female traders preferring to sell small red.

Table 5.9 Volumes (tons) sold by small/marketplace traders in the past year, March 2022–March 2023

	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Small red	5	502.8	2,513.8	9	62.2	559.4	14	219.5	3,073.2
Large tan	11	68.3	751.2	13	28.9	375.7	24	47.0	1,126.9
Medium red	14	1.95	27.3	22	58.5	1,287.9	36	36.5	1,315.2
Medium tan	72	2.5	179.9	76	54.3	4,128.7	148	29.1	4,308.6
Large red	41	22.9	937.4	44	17.3	760.9	85	20.0	1,698.3
Small tan	26	3.3	87.0	31	18.6	575.8	57	11.6	662.8
Total	**169**	**26.6**	**4,496.5**	**195**	**39.4**	**7,688.4**	**364**	**33.5**	**12,184.9**

In contrast, large off-takers mainly sold the small tan variety (362.6 tons per trader) and the large tan variety (356.5 tons per trader). The other popular varieties were large red (168.5 tons per trader), medium tan (138.6 tons per trader), small red (113 tons per trader), and medium red (94.4 tons per trader) (**Table 5.10**). Large traders were predominantly males and were moving higher volumes than their female counterparts.

Table 5.10 Volumes (tons) sold by large off-takers in the past year, March 2022–March 2023

Tons (mean) sold per trader	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Small tan	5	23.4	116.9	23	436.3	10,034.8	28	362.6	10,151.7
Large tan	6	391.6	2,349.8	17	344.1	5,849.7	23	356.5	8,199.5
Large red	9	276.7	2,490.4	28	133.7	3,743.5	37	168.5	6,233.9
Medium tan	6	387.6	2,325.6	38	99.3	3,773.2	44	138.6	6,098.8
Medium red	2	171.0	342.0	12	81.6	979.4	14	94.4	1,321.4
Small red	1	6.0	6.0	8	126.4	1,011.2	9	113.0	1,017.2
Total	**29**	**263.1**	**7,630.7**	**126**	**201.5**	**25,391.8**	**155**	**213.0**	**33,022.5**

The overall results in **Table 5.11** show that small, medium, and large tan varieties were more popular among the traders. This observation means that consumers prefer tan varieties, given the higher volumes sold than red types. For example, 10,814 tons of small tan, 10,407.4 tons of medium tan, and 9,326.4 tons of large tan were sold in the past year.

Table 5.11 Volumes (tons) sold per trader by market class in the past one year. March 2022–March 2023

Tons (mean) sold per trader	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Small tan	31	6.6	203.8	54	196.5	10,611	85	127.2	10,814.5
Medium tan	78	32.1	2,505.5	114	69.3	7,902	192	54.2	10,407.4
Large tan	17	182.4	3,101.0	30	207.5	6,225	47	198.4	9,326.4
Large red	50	68.6	3,427.8	72	62.6	4,504	122	65.0	7,932.2
Small red	6	420	2,519.8	17	92.4	1,571	23	177.8	4,090.3
Medium red	16	23.1	369.3	34	66.7	2,267	50	52.7	2,636.6
Total	**198**	**61.2**	**12,127.2**	**321**	**103.1**	**33,080**	**519**	**87.1**	**45,207.4**

Since traders sold higher quantities of tan varieties, it is no surprise that those varieties earned them the highest revenues in the past year (**Table 5.12**). The medium red variety had the lowest sales of 2,636.6 tons, with a revenue of USD 3,059,511. The total groundnut volume sold in the past year was 45,207 tons, with a revenue of USD 54,728,078.

Table 5.12 Total volume (tons) traded and revenue per market class, March 2022–March 2023

	n	Total volume sold (tons)	Total revenue (USD)
Small tan	85	10,814.5	13,896,633
Medium tan	192	10,407.4	12,473,269
Large red	122	7,932.2	9,943,806
Large tan	47	9,326.4	9,905,569
Small red	23	4,090.3	5,231,494
Medium red	50	2,636.6	3,059,511
Total	**519**	**45,207**	**54,728,078**

Grain sale prices (general)

The average selling prices across the varieties were small tan, USD 1,462 per ton; large red, USD 1,396; medium tan, USD 1,390; medium red, USD 1,262; small red, USD 1,258; and large tan, USD 1,156. Female traders sold at higher prices than male traders across all varieties except for large tan, which male traders sold at a higher price. In addition, marketplace traders sold all varieties at much higher prices than large off-takers. This situation is expected since large off-takers handle bulk volumes and give discounts to their buyers.

Female informal traders also sold large red, medium tan, medium red, and small red varieties at much higher prices than male informal traders (**Table 5.13**). On the other hand, male marketplace traders sold small tans and large tans at higher prices than their female counterparts. The same trend observed in female off-taker sales existed among large off-takers, with females selling at a higher price than males. Small tan and large red attracted the highest prices at USD 1,462 and USD 1,396 per ton, respectively.

Table 5.13 Average grain sale prices (mean USD/ton)* March 2022–March 2023

	Small/market traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Small tan	1,525	1,704	**1,623**	1,397	1,078	**1,135**	1,505	1,437	**1,462**
Large red	1,485	1,463	**1,474**	1,180	1,229	**1,218**	1,430	1,372	**1,396**
Medium tan	1,444	1,414	**1,429**	1,097	1,288	**1,262**	1,417	1,372	**1,390**
Medium red	1,390	1,249	**1,303**	1,272	1,134	**1,154**	1,375	1,208	**1,262**
Small red	1,466	1,195	**1,292**	1,272	1,197	**1,206**	1,434	1,196	**1,258**
Large tan	1,160	1,489	**1,338**	848	1,008	**967**	1,049	1,217	**1,156**
Total	**1,444**	**1,447**	**1,445**	**1,141**	**1,179**	**1,172**	**1,400**	**1,341**	**1,363**

*USD 1 = TZS 2,319.

Grain sale prices (consumers)

The average groundnut sale prices to consumers in USD per ton show that selling prices across the varieties vary by type of groundnut. Small tan is sold at USD 1,393 per ton, large red at USD 1,340, small red at USD 1,288, medium tan at USD 1,276, large tan at USD 1,202, and medium red at USD 1,167 (**Table 5.14**). Female traders sold large red, medium tan, and medium red at higher prices than male traders, whereas male traders sold small tan, small red, and large tan at higher prices than female traders. As expected, marketplace traders sold to consumers at higher prices than large off-takers (Table 5.14). Female marketplace traders sold medium tan and medium red varieties at higher prices than male traders. Small tan attracted the highest consumer prices at USD 1,393 per ton, followed by large red at USD 1,340 per ton.

Table 5.14 Sale prices for consumers (mean USD/ton), March 2022–March 2023

Groundnut type	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Small tan	1,345	1,554	**1,450**	1,294	1,130	**1,167**	1,340	1,436	**1,393**
Large red	1,409	1,424	**1,416**	841	1,109	**1,055**	1,355	1,327	**1,340**
Small red	1,285	1,406	**1,324**	-	1,216	**1,216**	1,285	1,289	**1,288**
Medium tan	1,321	1,297	**1,309**	1,003	1,146	**1,127**	1,304	1,256	**1,276**
Large tan	1,272	1,330	**1,305**	689	1,099	**963**	1,126	1,253	**1,202**
Medium red	1,247	1,148	**1,189**	1,121	1,083	**1,090**	1,232	1,130	**1,167**
Total	**1,335**	**1,350**	**1,343**	**973**	**1,130**	**1,101**	**1,303**	**1,284**	**1,292**

Grain sale prices (other traders)

Traders sold to other traders at lower prices than for consumers because other traders bought for resale. The selling prices for other traders were as follows: small tan, USD 1,249; medium tan, USD 1,151; large red, USD 1,143; small red, USD 1,093; medium red, USD 1,075; large tan, USD 987 (**Table 5.15**). Female traders sold small tan, small red, and medium red at higher prices than male traders. However, male traders sold medium and large tans at higher prices than female traders.

Marketplace traders sold to other traders at higher prices than large off-takers did. They sold

small tan at USD 1,516 per ton, medium tan at USD 1,181, large red at USD 1,235, small red at USD 1,100, medium red at USD 1,137, and large tan at USD 1,200. Male marketplace traders sold most of the varieties at higher prices than their female counterparts. Large off-takers sold to other traders with small tan at USD 1,001, medium tan at USD 1,117, large red at USD 1,068, small red at USD 1,084, medium red at USD 978, and large tan at USD 904. Consistent with other types of buyers, female off-takers sold all the groundnut varieties at higher prices than male traders. All the traders rarely sold to institutions such as schools, prisons, universities, etc.

Table 5.15 Sale prices to traders (mean USD/ton), March 2022–March 2023

Groundnut type	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Small tan	1,207	1,578	**1,516**	1,130	971	**1,001**	1,164	1,267	**1,249**
Medium tan	1,190	1,176	**1,181**	1,003	1,137	**1,117**	1,137	1,156	**1,151**
Large red	1,211	1,248	**1,235**	1,030	1,081	**1,068**	1,149	1,149	**1,143**
Small red	1,013	1,121	**1,100**	1,035	1,091	**1,084**	1,021	1,106	**1,093**
Medium red	1,195	1,106	**1,137**	1,013	972	**978**	1,155	1,045	**1,075**
Large tan	835	1,492	**1,200**	743	961	**904**	780	1,081	**987**
Total	**1,157**	**1,276**	**1,240**	**981**	**1,051**	**1,038**	**1,086**	**1,152**	**1,135**

Revenue (marketplace traders)

Medium tan generated the highest revenue for marketplace traders, representing about 35% of their total revenue. It is important to note that each marketplace trader, on average, earned USD 48,408 per annum from the groundnut business (**Table 5.16**). On average, men earned higher revenue than women by about USD 7,000. Small red was second after medium tan. A total revenue of USD 17,607,181 was collected from groundnut sales in the past year. Female traders had the most earnings from small red (USD 3,685,230) and large red (USD 1,392,039) varieties.

Table 5.16 Revenue for small/marketplace traders by market class (USD per year), March 2022–March 2023

Market class	Females (n=169)		Males (n=195)		Total (n=364)	
	Mean (USD)	Total (USD)	Mean (USD)	Total (USD)	Mean (USD)	Total (USD)
Medium tan	3,610	259,776	76,780	5,837,982	41,584	6,156,989
Small red	737,105	3,685,230	74,329	668,483	283,594	3,970,574
Large red	34,007	1,392,039	25,310	1,113,197	29,480	2,503,294
Medium red	2,711	37,947	73,067	1,608,587	47,560	1,713,706
Large tan	79,228	871,392	43,032	559,417	62,886	1,507,792
Small tan	5,033	132,675	31,694	981,163	18,827	1,075.724
Total	**38,410**	**6,492,946**	**45,192**	**8,818,595**	**48,408**	**17,607,181**

Revenue (large off-takers)

In contrast, large off-takers predominantly sold tans and earned the highest revenue from small tan (USD 11,522,180), followed by large tan (USD 7,928,917) and medium tan (USD 7,696,686) varieties. The lowest revenue was earned from medium and small red. In terms of gender, male off-takers (USD 29,936,933) earned more revenue from groundnut trade than female off-takers (USD 8,706,629) (**Table 5.17**). Male off-takers mainly earned from medium tan (USD 10,817,514) and female off-takers earned from large red (USD 2,938,672) and medium tan (USD 2,551,183) varieties.

Table 5.17 Revenue for large off-takers by market class (USD per year), March 2022–March 2023

Market class	Females (n=29)		Males (n=126)		Total (n=155)	
	Mean (USD)	Total (USD)	Mean (USD)	Total (USD)	Mean (USD)	Total (USD)
Small tan	32,690	163,309	470,331	10,817,514	370,691	11,522,180
Large tan	332,077	1,992,630	346,853	5,896,498	344,736	7,928,917
Medium tan	425,197	2,551,183	127,898	4,859,881	174,913	7,696,686
Large red	326,506	2,938,672	164,317	4,600,762	205,233	7,592,890
Medium red	217,512	435,024	92,534	1,110,640	108,938	1,524,896
Small red	7,632	7,632	151,301	1,210,406	136,278	1,226,743
Total	**300,198**	**8,706,629**	**237,569**	**29,936,933**	**249,636**	**38,702,370**

5.3.2 Main buyers of grain (gender, type of institutional buyer)

The findings indicated that individual customers (49.3%) and other traders (36.7%) were the primary buyers of groundnuts sold in Tanzania (Table 5.18). Farmers (8.1%) and processors (5.8%) rarely purchased groundnuts for food/seed and processing, respectively. It was rare for traders to sell to institutional buyers such as schools, universities, hotels, and humanitarian agencies. Female traders mainly sold to individual customers (64.8%), whereas male traders predominantly sold to other traders (46.3%) and individual customers (39.7%). Marketplace traders equally sold to individual customers (63.9%), while large off-takers sold to other traders (78.2%).

Table 5.18 Quantity (tons) of groundnuts bought by different buyers, March 2022–March 2023

	Sex of trader		Type of trader		Total
	Females	Males	Marketplace traders	Large off-takers	
Individual consumers	64.8	39.7	63.9	15.0	49.3
Other traders	21.2	46.3	19.0	78.2	36.7
Processors	4.0	7.0	7.3	2.5	5.8
Farmers	10.0	7.0	9.8	4.3	8.1
Institutional buyers	0.0	0.1	0.1	0.1	0.1

Groundnut variety preference drivers

Taste (69.4%) is the main driver for groundnut varietal preference and choice, making it an essential priority for breeding. High oil content becomes second after taste, as 48% of the traders indicated. The size and color of the grain were also quite crucial, as indicated by 36% and 29% of the traders (**Table 5.19**). The other preferred drivers mentioned were good milling properties, visual appeal, and the ability to be stored for a long time.

Table 5.19 Groundnut type/market class preference by buyers (% response by trait)

Trait	Small red	Medium red	Large red	Small tan	Medium tan	Large tan	Overall
Taste	60.9	72.0	71.3	70.6	70.8	57.4	69.4
High oil content	52.2	40.0	24.6	77.6	56.8	23.4	47.8
Size	21.7	36.0	63.1	21.2	24.5	55.3	36.8
Color	17.4	38.0	27.0	20.0	33.3	31.9	29.3
Good confectionary	39.1	32.0	18.0	15.3	19.8	25.5	21.2
Easy shelling	17.4	2.0	3.3	25.9	17.7	8.5	13.3
High yield	0.0	14.0	13.9	4.7	14.6	19.1	12.5
Good price	13.0	2.0	16.4	8.2	11.5	17.0	11.8
Disease resistance	0.0	2.0	0.8	0.0	1.6	6.4	1.5
Drought tolerance	4.3	2.0	1.6	2.4	0.0	2.1	1.3
Others*	8.7	4.0	1.6	5.9	10.9	12.8	7.3

5.3.3 Traders' engagement in the export market

This study sought to measure the incidence of selling groundnuts outside the country. Most traders sampled (87.9%) did not sell groundnuts outside the country. Groundnut was mainly exported by large traders (29%) (**Table 5.20**).

Table 5.20 Incidents of traders selling groundnuts outside the country (%), March 2022–March 2023

	Sex of trader		Type of trader		Total
	Females	Males	Marketplace traders	Large off-takers	
Yes	8.6	14.3	4.9	29.0	12.1
No	91.4	85.7	95.1	71.0	87.9

A total of 21,152.5 tons of groundnut were exported in the past year. As confirmed above, the small tan variety (6,867.2 tons) had the leading export volume, followed by medium tan (4,437.7 tons), large tan (3,683.9 tons), large red (2,954.0 tons), and small red (2,863.2 tons), with medium red (1,374.7 tons) having the lowest export volume (**Table 5.21**). This observation equally confirms that small tan, medium, and large tan are preferred by consumers in East and Southern Africa, where Tanzanian traders predominantly export.

Table 5.21 Volumes (tons) of groundnut exported by small marketplace traders, March 2022–March 2023

	Females			Males			Total		
	n	Mean (tons)	Total	n	Mean (tons)	Total	n	Mean (tons)	Total
Small tan	0	-	-	10	124.8	6,737.8	10	80.8	6,867.2
Medium tan	5	13.5	1,052	10	29.8	3,397.8	15	23.1	4,437.7
Large tan	4	91.2	1,551	6	67.4	2,023	10	78.4	3,683.9
Large red	6	30.9	1,542.5	11	20.7	1,486	17	24.2	2,954.0
Small red	1	336	2,016.0	3	61.6	1,047	4	124.4	2,863.2
Medium red	1	9.2	148.0	6	36.1	1,228.2	7	27.5	1,374.7
Total	**17**	**28.8**	**5,707**	**46**	**48.1**	**15,448**	**63**	**40.8**	**21,152.5**

5.4 Seed management practices of groundnut traders

The three main practices for preparing grain as seed for selling are keeping each variety pure/as a single variety (60.9%), sorting out waste (pebbles, dirt, dust) (52.1%), and sorting out bad seed (broken, immature, discolored) (45%) (**Table 5.22**). Both trader types preferred to keep each variety pure. However, large off-takers were not keen on sorting out waste (pebbles, dirt, dust) (37.5%) and sorting out bad seeds (broken, immature, discolored) (37.5%) compared with informal traders (55.5% and 47.4%, respectively).

Other seed management practices mentioned by traders were seeking out specific varieties to buy (that can be planted) (30.2%) and grading stocks (which grain/which seed) (28.4%).

Table 5.22 Groundnut seed management practices by traders (%), March 2022–March 2023

Management practice	Type of trader			P-value
	Small/marketplace traders (n=137)	Large off-takers (n=32)	Overall (n=169)	
Keep each variety pure, as a single variety	60.6	62.5	60.9	0.841
Sort out waste (pebbles, dirt, dust)	55.5	37.5	52.1	0.067
Sort out bad grains/seed (i.e., broken, immature, or discolored	47.4	37.5	45.6	0.309
Seek out specific varieties to buy (that can be planted)	29.2	34.4	30.2	0.566
Grade stocks (which grain/which seed)	27.0	34.4	28.4	0.405
Get grain from specific areas/regions believed to have grain that will grow in the local area (adapted).	21.2	12.5	19.5	0.265
Sell seed and grain separately at different prices	16.8	18.8	17.2	0.791
Have special storage conditions (to help with seed viability).	13.9	28.1	16.6	0.051
Buy from specific growers who are known for high-quality seed	12.4	6.3	11.2	0.321
Keep freshly harvested stocks apart	8.0	9.4	8.3	0.804
Do germination tests	2.9	0.0	2.4	0.328
Ask growers (ahead of time) to multiply select varieties based on the preferences of different segmented clients (females, males, youth, etc.).	0.7	0.0	0.6	0.628
Others	7.3	15.6	8.9	0.136

***Percentages are based on the number of traders that indicated they have ever sold grain as seed.

5.5 Sales of groundnut seeds and farmer purchase structure/patterns

5.5.1 Groundnut prices

About 24% of the traders sold seeds to customers, most being marketplace traders (**Table 5.23**). It is also noteworthy that the more significant proportion of traders (76.2%) did not engage in selling groundnut seeds.

Table 5.23 Trader involvement in seed sales, March 2022–March 2023.

	Marketplace traders (n=110)		Large off-takers (n=62)		Overall (n=172)	
	n	%	n	%	n	%
Yes	34	30.9	7	11.3	41	23.8
No	76	69.1	55	88.7	131	76.2

A measurement of the volume of informal groundnut seeds sold in tons in the past year was established (**Table 5.24**). A total of 1,707.3 tons was sold overall, and the dominant proportion (75%) of this was the medium tan variety, which sold 1,287 tons. The remaining smaller proportion of groundnut seed sales is distributed across large red (149 tons), large tan (136.1 tons), medium red (75.1 tons), and small tan (58.6 tons), and the lowest seed sale is for small red (1.5 tons). The segregation of the results by sex shows that male traders have a similar trend/ranking in the overall results, and medium tan is also the outstanding variety sold. However, there seems to be a fairer distribution of seed sales for female traders across all the varieties.

Table 5.24 Quantity of informal seed sold (tons) per market class in the past one year, March 2022–March 2023

	Females			Males			Pooled		
	n	Mean	Total	n	Mean	Total	n	Mean	Total
Medium tan	41	1.7	70.4	57	21.3	1,216.6	98	13.1	1,287.0
Large red	31	1.7	52.8	28	3.4	96.2	59	2.5	149.0
Large tan	7	6.6	46.1	10	9.0	90.0	17	8.0	136.1
Medium red	9	4.3	38.6	13	2.8	36.6	22	3.4	75.1
Small tan	14	2.6	36.0	9	2.5	22.6	23	2.5	58.6
Small red	2	0.6	1.2	1	3.0	3.0	3	0.5	1.5
Total	**104**	**2.4**	**245.1**	**118**	**12.4**	**1,462.2**	**222**	**7.7**	**1,707.3**

Male traders sold 1,466 tons and female traders sold 725 tons, representing up to 2,191.6 tons of informal groundnut seed. The total volumes of informal seed sold in the past year were assessed by the sex of the traders, as shown in **Table 5.25**. Male informal traders sold 1,161.5 tons and female informal traders sold 550.1 tons. In total, informal traders sold 1,711.7 tons of sorghum seed. Male large off-takers sold 304.5 tons and female large off-takers sold 175.4 tons. In total, large off-takers sold 479.9 tons of groundnut seed.

Table 5.25 Total volume of informal seed (tons) in the past one year, March 2022–March 2023

	Small/marketplace traders			Large off-takers			Overall		
	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)	n	Mean (tons)	Total (tons)
Males	84	13.8	1,161.5	34	9.0	304.5	118	12.4	1,466.0
Females	92	6.0	550.1	12	14.6	175.4	104	7.0	725.6
Combined	176	9.7	1,711.7	46	10.4	479.9	222	10.0	2,191.6

The overall average prices for groundnut seed varieties in USD per ton are small tan at 1,786, medium tan at 1,699, small red at 1,696, large red at 1,655, medium red at 1,494, and large tan at 1,257. The overall average selling price is USD 1,641 per ton. Analysis by sex shows that this average selling price is higher for female traders (USD 1,676) than for male traders (USD 1,611). This observation is premised on female traders selling most varieties at a higher price. These results were also assessed by the two trader types (**Table 5.26**). The analysis shows that informal traders (USD 1,689) sell all seed varieties at a higher price than large off-takers (USD 1,462), who handle bulk volumes. For the informal traders, female traders (USD 1,725) sell at a higher average price than male traders (USD 1,648). For the large off-takers, male traders (USD 1,521) sell at a higher price than female traders (USD 1,295).

Table 5.26 Average seed prices (mean USD/ton)

	Small/marketplace traders			Large off-takers			Overall		
	Females	Males	Pooled	Females	Males	Pooled	Females	Males	Pooled
Small tan	1,869	1,725	**1,821**	1,940	1,315	**1,628**	1,879	1,622	**1,786**
Medium tan	1,760	1,674	**1,713**	1,186	1,710	**1,631**	1,718	1,685	**1,699**
Small red	1,682	1,725	**1,696**	-	-	**-**	1,682	1,725	**1,696**
Large red	1,745	1,692	**1,722**	1,114	1,420	**1,328**	1,684	1,624	**1,655**
Medium red	1,509	1,487	**1,497**	1,509	1,466	**1,483**	1,509	1,483	**1,494**
Large tan	1,324	1,466	**1,395**	873	1,134	**1,060**	1,195	1,300	**1,257**
Total	**1,725**	**1,648**	**1,689**	**1,295**	**1,521**	**1,462**	**1,676**	**1,611**	**1,641**

In the past year, the sampled traders for this survey obtained an overall revenue of USD 3,553,363 in local groundnut seed sales (**Table 5.27**). Male traders (USD 2,377,297) made more revenue from groundnut seed overall than female traders (USD 1,176,066). The same trend was detected across the two trader types. For the informal traders, males (USD 1,914,152) obtained more revenue than females (USD 948,923). For the large off-takers, males (USD 463,145) also obtained more revenue than females (USD 227,143). Overall, marketplace traders (USD 2,863,075) obtained more revenue from seed sales than large off-takers (USD 690,288).

Table 5.27 Total revenue from seed sales (mean USD in past one year), March 2022–March 2023

	Small/marketplace traders			Large off-takers			Overall		
	n	Mean USD per year	Total (USD)	n	Mean USD per year	Total (USD)	n	Mean USD per year	Total (USD)
Males	84	22,742	1,914,152	34	13,689	463,145	118	19,976	2,377,297
Females	92	10,350	948,923	12	18,907	227,143	104	11,732	1,176,066
Combined	176	16,383	2,863,075	46	15,205	690,288	222	16,410	3,553,363

5.5.2 Farmer purchase signals

Among the traders that sold groundnut as seed in the past year, they confirmed that the main signals for purchasing groundnut seed were when a customer searched for pure varieties/not mixed, said that they were buying seed, searched for a specific variety by name, and searched for stocks that were clean/had no debris, in that order (**Table 5.28**). Searching for pure varieties (not mixed) was observed by more male traders (81.3%) than female traders (76.6%). However, searching for pure varieties was the second signal for youth at 69.5%. The highest proportion of youth observed the buyer directly saying that they were buying seed (71.1%).

Table 5.28 Signals given by customers when buying seed (%)

	Sex of groundnut seed buyer		
	Males (n=128)	Females (n=128)	Youth (n=128)
Say they are buying seed	66.4	69.5	71.1
Searching for pure varieties, not mixed	81.3	76.6	69.5
Searching for a specific variety by name	63.3	61.7	61.7
Searching for stocks that are clean (no debris)	46.9	55.5	52.3
Asking for well-matured grain from past seasons	14.1	16.4	13.3
Asking how the stocks were stored/conserved	9.4	10.2	9.4
Asking for a particular quantity	5.5	9.4	6.3
Asking about the origin (place) where the stocks were from	3.1	7.8	6.3
Other*	3,9	3.1	1.6

*Percentages are based on 101 traders that sold groundnut as seed in the past year.

5.6 Challenges and opportunities in groundnut production and marketing

This study sought to uncover the main challenges groundnut traders experienced during the COVID-19 pandemic. The results in **Table 5.29** show that the main challenges were inadequate demand (20.7%), lack of a stable market (20.7%), inadequate supply (14%), and low prices (10.3%). The sex segregation of the results shows that female traders suffered more than male traders on all these four challenges during the pandemic. The assessment of the results across the two trader types shows that large off-takers were more affected by inadequate demand (23%) and lack of a stable market (21.8%) than informal traders (19.7% and 20.2%, respectively). On the other hand, informal traders were slightly more affected by inadequate supply (14.4%) and low prices (11.3%) than large off-takers/traders (13.8% and 8%, respectively).

Table 5.29 Major challenges faced in groundnut business during COVID-19 (%)

Challenge	Sex of trader		Type of trader		Total (n=300)
	Females (n=118)	Males (n=182)	Marketplace traders (n=213)	Large off-takers (n=87)	
Inadequate demand	**23.7**	**18.7**	**19.7**	**23.0**	**20.7**
Lack of a stable market	**22.9**	**19.2**	**20.2**	**21.8**	**20.7**
Inadequate supply	**14.4**	**13.7**	**14.4**	**13.8**	**14.0**
Low prices	**12.7**	**8.8**	**11.3**	**8.0**	**10.3**
Mobility restrictions imposed by the government	0.8	3.8	2.3	3.4	2.7
Credit constraints	1.7	9.3	8.5	1.1	6.3
Closed borders that limited sales to other countries	0.0	3.8	0.5	6.9	2.3
Poor grading	0.8	2.2	1.9	1.1	1.7
Inadequate/poor storage	0.0	1.1	0.5	1.1	0.7
Increased domestic responsibilities	1.7	0.5	1.4	0.0	1.0
Inadequate market information	0.8	1.6	1.9	0.0	1.3
Costly/inadequate transportation	0.8	1.1	0.9	1.1	1.0
Mixed grains	0.8	0.5	0.9	0.0	0.7
Buyers are not trustworthy	4.2	0.0	2.3	0.0	1.7
High taxes/levies	0.0	0.5	0.5	0.0	0.3
Businesses closed during COVID	1.7	1.6		0.0	0.4
Delayed payments	0.8	0.0	0.5	0.0	0.3
Cultural factors	0.8	0.0	0.5	0.0	0.3
Others	4.2	3.0	1.9	3.4	2.3
No challenges	8.5	11.0	8.9	12.6	10.0

The study also sought to discover the main challenges groundnut traders experienced post-COVID-19 pandemic (**Table 5.30**). The two main challenges persisting after the pandemic were the lack of a stable market (19.3%) and inadequate supply (18% overall) The analysis by sex shows that female traders suffered more than male traders on these two persistent challenges. The evaluation of the results by the two trader types shows that large off-takers (24.1%) were affected by the lack of a stable market more than informal traders (17.4%) post-COVID-19. In contrast, informal traders (19.7%) were affected by inadequate supply more than large off-takers (13.8%).

Table 5.30 Major challenges faced in groundnuts business post-COVID (%)

Challenge	Sex of trader		Type of trader		
	Females (n=118)	Males (n=182)	Marketplace traders (n=213)	Large off-takers (n=87)	Total (n=300)
Lack of a stable market	**22.9**	**17.0**	**17.4**	**24.1**	**19.3**
Inadequate supply	**19.5**	**17.0**	**19.7**	**13.8**	**18.0**
Inadequate demand	14.4	6.6	9.9	9.2	9.7
Low prices	6.8	6.6	4.7	11.5	6.7
Poor grading	4.2	9.9	9.9	2.3	7.7
Inadequate market information	0.0	2.7	1.9	1.1	1.7
Credit constraints	7.6	8.8	10.8	2.3	8.3
Inadequate/poor storage	0.0	3.8	1.9	3.4	2.3
Weather-/climate-related challenges	0.8	0.5	0.5	1.1	0.7
Mixed grain	2.5	2.2	3.3	0.0	2.3
High taxes/levies	3.4	4.4	3.8	4.6	4.0
Buyers are not trustworthy	0.8	0.5	0.5	1.1	0.7
Thefts	0.0	0.5	0.5	0.0	0.3
Others	7.6	5.5	6.6	5.7	6.3
No challenges	7.6	10.4			

5.7 Technical support required by groundnut traders to promote new varieties

There is a prevalent knowledge gap in handling and management of groundnut varieties among traders (58.2%). This technical support on how to promote new varieties should be prioritized among female traders, for whom the knowledge gap is more widespread (61%) than for male traders (56%). The knowledge gap is also more extensive among small traders (59.2%) than among large off-takers (55%). All other knowledge gaps exist but at a much lower extent (**Table 5.31**).

Table 5.31 Technical support required by groundnut traders to promote new varieties (%)

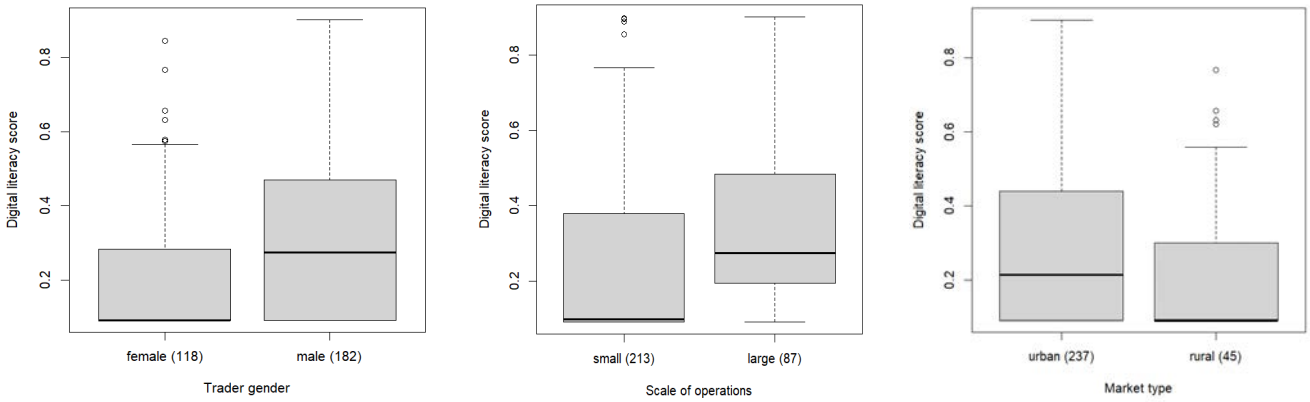
Type of technical support	Sex of trader		Type of bean trader		Total (n=91)
	Females (n=41)	Males (n=50)	Marketplace traders (n=71)	Large off-takers (n=20)	
Information about varieties (handling, management	**61.0**	**56.0**	**59.2**	**55.0**	**58.2**
Training on extension skills	**24.4**	**10.0**	**14.1**	**25.0**	**16.5**
Information about how and where to source the varieties	**7.3**	**12.0**	**9.9**	**10.0**	**9.9**
Training on business management and administration skills	4.9	12.0	9.9	5.0	8.8
Training on sales and promotion skills	2.4	8.0	7.0	0.0	5.5
Information on potential markets	0.0	2.0	0.0	5.0	1.1

5.7 Digital readiness of groundnut traders

5.7.1 Level of traders' digital skills

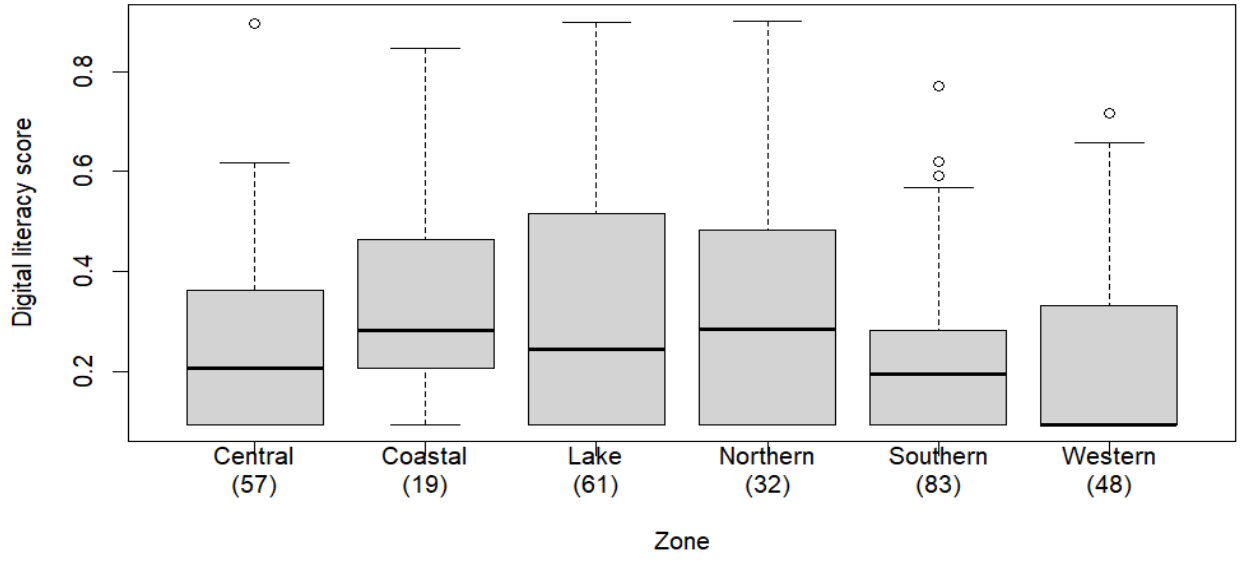
On average, groundnut traders have low digital skills and experience. Digital literacy refers to practical skills using digital tools and services, such as mobile phones, smartphones, and the internet. Overall, the digital literacy of groundnut traders is relatively low, with a mean = 0.29 (SD = 0.21). However, significant differences within the group of traders exist. For example, men have higher digital literacy than women. Large traders have higher digital literacy than small and informal traders. Traders in urban markets have higher digital literacy than traders in rural markets. Traders with a higher level of formal education tend to have higher digital literacy (**Figure 38**).

Figure 38: Digital literacy by gender, scale of operations, and market type



On average, digital literacy is relatively low everywhere, but it is highest in the Coastal, Lake, and Northern zones and lowest in the Southern zone (**Figure 39**).

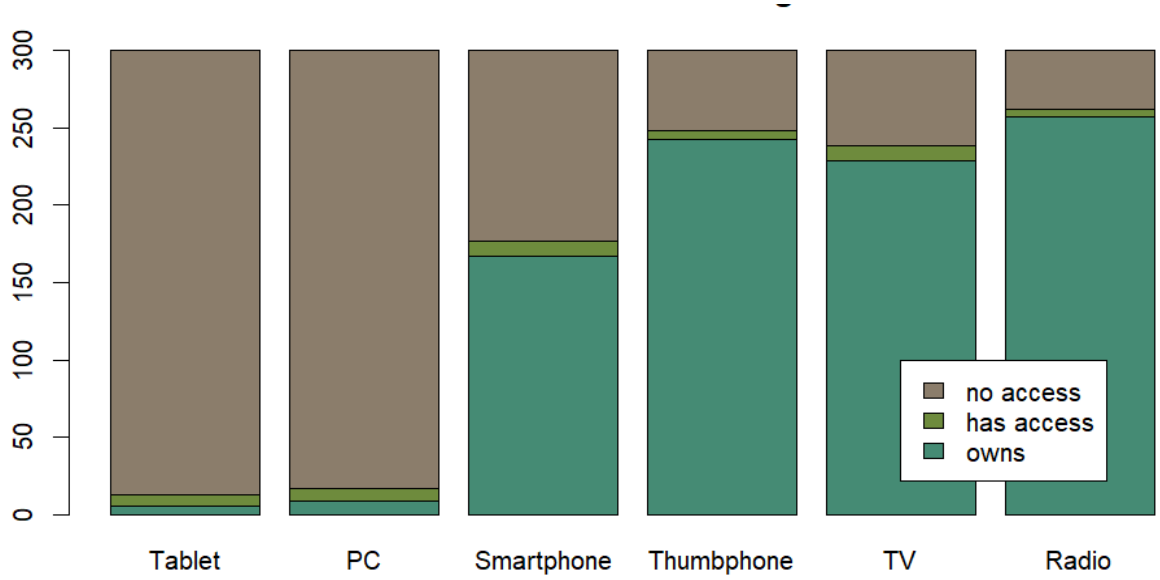
Figure 39: Digital literacy score by region



5.7.2 Digital tools and services traders use

Most groundnut traders own a radio and all own a mobile phone. However, less than two-thirds own a smartphone. Phone, TV, and radio ownership is widespread, whereas computers are uncommon. For traders who do not own a device, accessing devices owned by friends or family members is uncommon. Mobile phones are almost ubiquitous, with 96% of all groundnut traders owning either a conventional mobile phone (82%) or a smartphone (56%), while 41% own both. However, there is a gender difference in smartphone ownership, which is significantly less common among women (47%) than among men (61%). There is also a strong difference between marketplace and large traders (49% vs. 71% in smartphone ownership, respectively) (**Figure 40**). For all types of devices, traders perceive little difficulty in using them.

Figure 40: Access to digital devices



5.7.3 Digital services that traders use

Traders widely use basic phone functionalities: phone calls and SMS. Mobile money use, such as M-Pesa, is widespread, with 89% of all traders using it (**Figure 41**). Radio and TV are still relatively common. Fewer traders use more advanced digital services that require the internet (e.g., social media, Google, and Facebook). Messenger chats, such as WhatsApp, are used by just over half of all traders. This observation is surprising given that more than half own a smartphone and could imply that some traders do not regularly maintain internet bundles for their smartphones. They use a conventional phone for calls and SMS and an additional smartphone only for offline activities (taking pictures, listening to music, calculator, etc.).

These general patterns are the same for both men and women and small and large traders. In line with the observed differences in smartphone ownership (bigger traders and male traders are more likely to own a smartphone), slight differences exist in the use of internet-related services between genders and business sizes (**Figure 42**).

In line with digital literacy, digital messengers such as WhatsApp are more commonly used by groundnut traders in the Northern zone and least frequently in the Western zone (**Figure 43**).

Figure 41: Traders' use of digital services

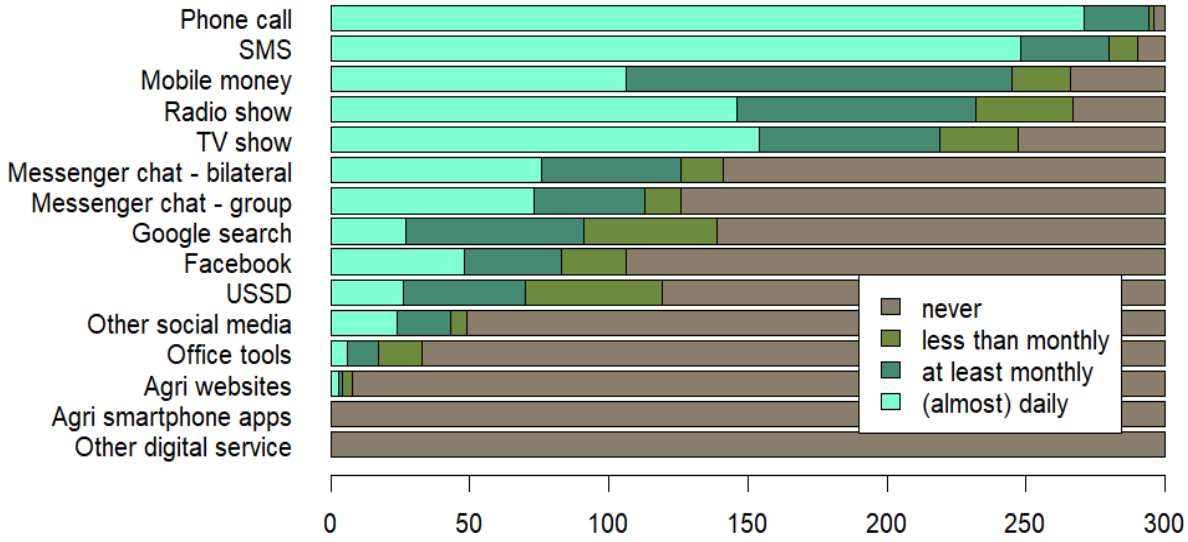


Figure 42: WhatsApp use by gender and type of traders

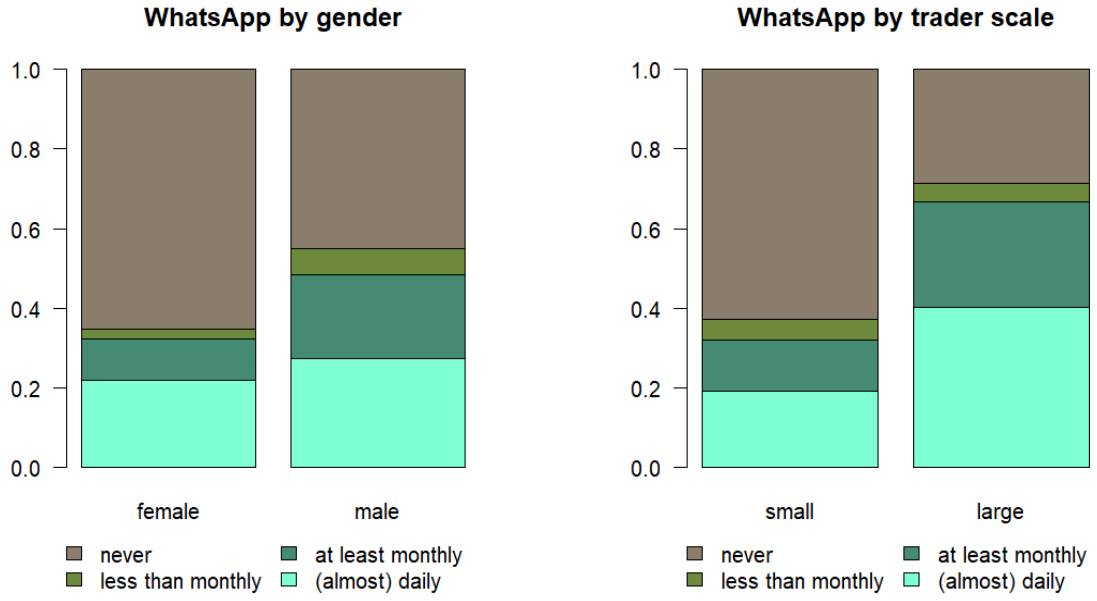
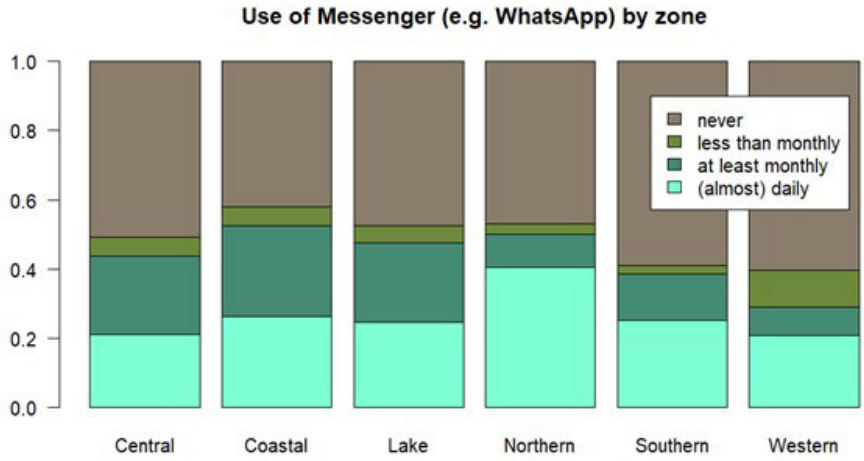


Figure 43: WhatsApp use by zone among groundnut traders

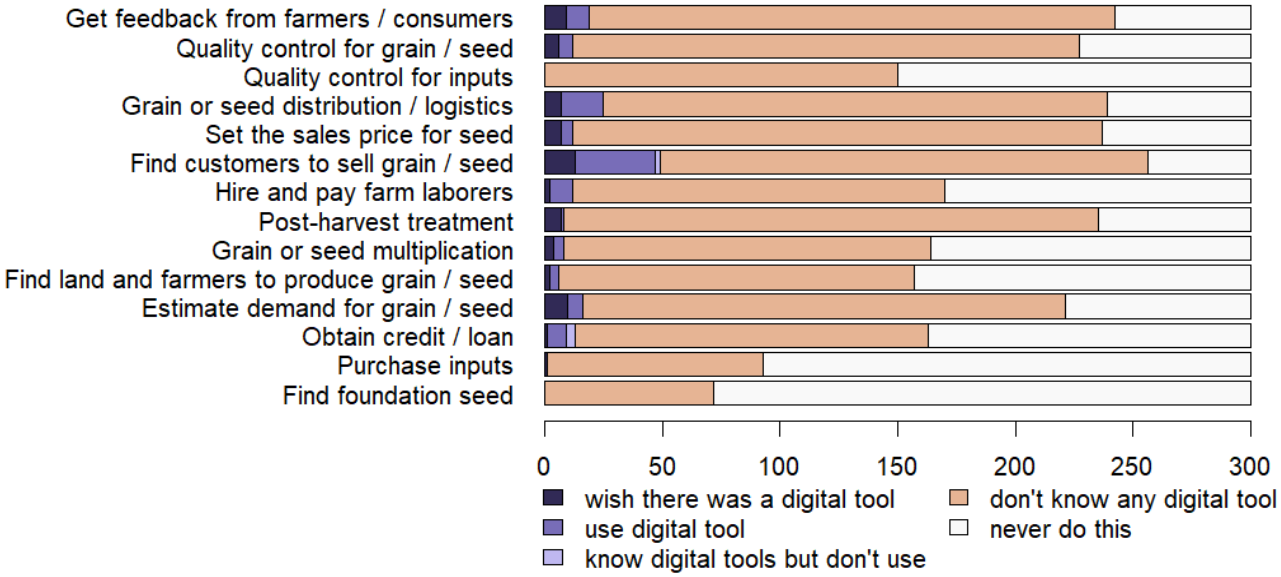


5.7.4 Digital services traders use in their business

Apart from phone calls, there is minimal use of digital tools and services in groundnut traders' business (**Figure 44**). Traders want to use digital tools to find new customers to grow their business and decrease costs. Traders do not strongly use digital services for their business activities presently. Some are aware of digital services but mention that the lack of smartphones hinders them. Those who do use digital tools mention phone calls, WhatsApp, M-Pesa, and social media. Among all activities, finding customers is the most digitalized (mostly phone calls and WhatsApp).

Nevertheless, this activity is where hope for further digitalization is most substantial. Traders have clear expectations for what digital services should do: decrease costs/increase cost efficiency and help grow the business/boost sales by reaching new customers and retailers. Overall, patterns of digital service use are similar between small and large traders, with one exception: large traders are more keen than small traders on using digital tools for estimating demand.

Figure 44: Groundnut traders' use of digital tools

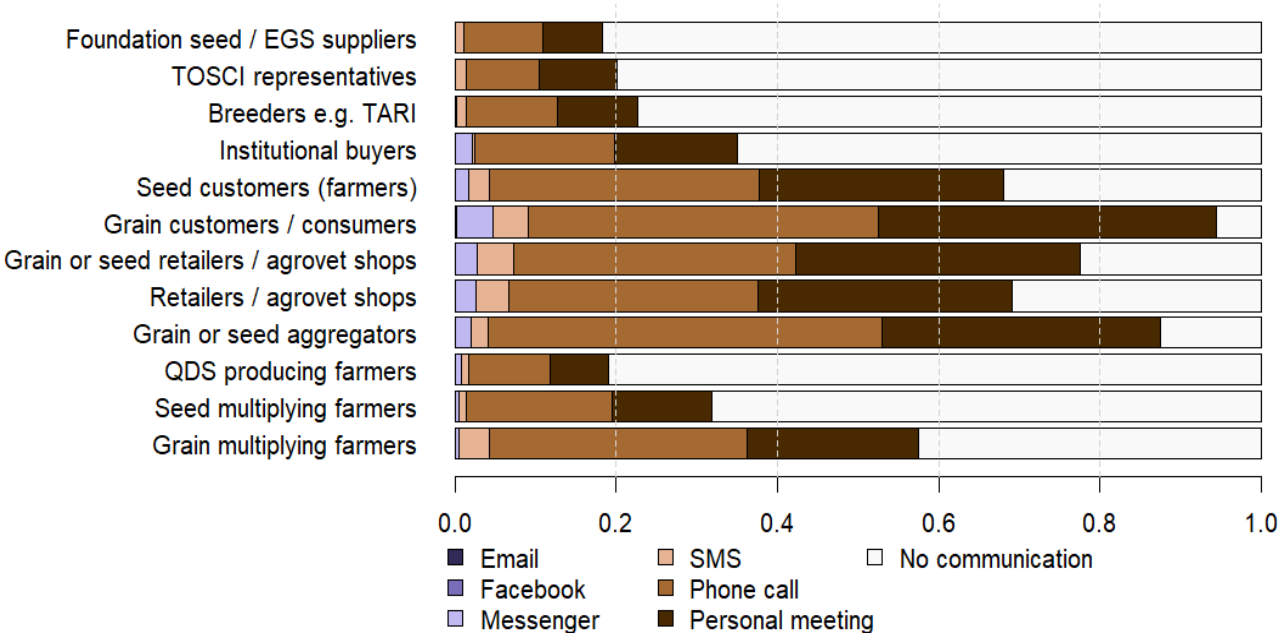


5.7.3 Traders' communication channels and their information-seeking behavior

Verbal communication (meetings or phone calls) is the most common communication method (**Figure 45**). However, traders do not communicate equally with all seed sector stakeholders. Overall, groundnut traders do not communicate much with upstream stakeholders of the breeding pipeline, such as breeders or foundation seed suppliers. Most traders speak with their customers (consumers for grain and farmers for seed), other retailers and aggregators, and the farmers who supply grain for sale. There is little, though not negligible, communication with upstream stakeholders of the breeding process, such as foundation seed providers (18%) and breeders (22%).

Personal communication (through meetings or phone calls) dvominates information exchange with all stakeholders. SMS and Messenger (WhatsApp) are also somewhat common for specific stakeholders (customers, agrovet shops).

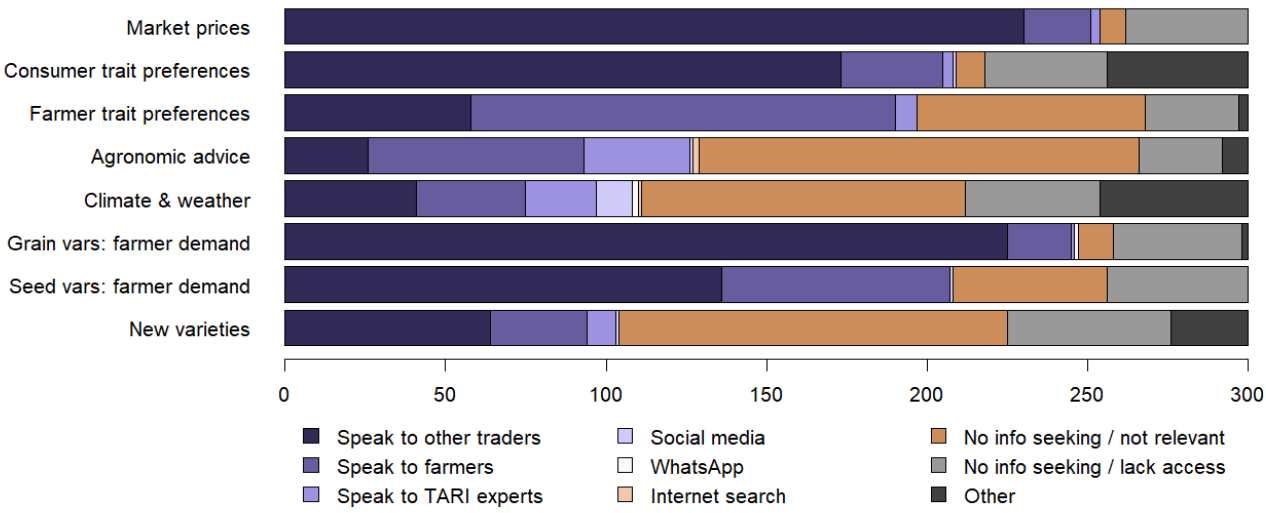
Figure 45: Groundnut traders' preferred communication channels.



For the topics that matter most, exchange with other traders (word of mouth) is the most important source of information. These topics are market prices, consumer trait preferences, and farmer varietal demand (**Figure 46**). Farmers were considered an important source of information only for insights about farmers' trait preferences. Possibly, this is because, for many traders, the grain business is more important than the seed business. Therefore, consumer preferences are more important than farmer preferences. Traders did not widely seek information on agronomic advice, climate, weather, and new varieties.

For learning about new varieties, exchange with agrovets and other retailers as well as radio and TV are additional sources of information. Direct interactions with customers, agrovets, and retailers are relevant for learning about consumer preferences. Social media, WhatsApp, and internet searches are not relevant sources of information for traders.

Figure 46: Groundnut traders' information-seeking behavior.



5.8 Government involvement in the groundnut value chain

More than 50% of the government institutions (mainly the Ministry of Agriculture) operating in all the districts in Tanzania confirmed that the traders they work with are actively engaged in distributing new groundnut varieties. The government agencies that had traders who distribute new varieties to farmers are LGA Temeke, TAMISEMI Bunda, TARI Dodoma, TARI Misungwi, MOA Dodoma, MOA Kibondo, MOA Bariadi, MOA Nyamagana, and MOA Kasulu. Additional methods employed to reach farmers are participatory varietal selection, seed subsidy program, collaborating with TARI and ASA for effective distribution, youth and farmer groups, farmer field schools, demonstration plots, and small seed packs. It was reported that trader distribution channels are dominated by women, thus making it easier to reach female farmers.

This study sought to find out whether traders receive and spread information on where customers/farmers can obtain new varieties. More than 60% of the institutions interviewed confirmed that the traders they collaborate with inform customers about where they can obtain new varieties of groundnut seed. The methods that were predominantly used by public and not-for-profit institutions were in-person meetings, preparation and hanging of posters, labeling seed, information about varieties for buyers, demonstration plots, use of farmers during planting season to communicate seed varieties that other farmers can plant, and forums with different stakeholders (i.e., MOA, agro-dealers, traders, and farmers).

The primary sources of information about new varieties are private seed companies, farmers, other traders, agro-dealers, physical meetings, local governments, ASA, TARI, and an online forum known as M-Kilimo. **Table 5.32** shows what these sources produced in the past one year.

Table 5.32 Annual capacity for groundnut seed production

Name of government agency	District	Breeder seed (tons)	Certified seed (tons)	QDS (tons)
Local Government Authority	Temeke	-	-	10
Ministry of Agriculture	Dodoma	-	10	50
Ministry of Agriculture	Singida	-	-	10
Ministry of Agriculture	Kibondo	-	-	3
Ministry of Agriculture	Kasulu	-	-	1.5
Ministry of Agriculture	Kahama	-	0.5	0
TARI	Dodoma	-	10	15
TARI	Misungwi	400	-	-

5.9 Institutional seed buyers

5.9.1 Engagement in seed-related activities

This section evaluates the seed-related activities that institutional seed buyers engage in. Most institutional seed buyers interact with farmers and QDS producers. It is common for institutional seed buyers to support certified seed production using QDS producers. They support the QDS in various ways, such as production, training on production and distribution, linking producers to EGS research, and facilitating TOSCI inspection. The farmers receive support through facilitation of agricultural outputs, transforming them from subsistence to commercial farming, and promotion of varieties. The organizations that are involved in seed-related activities are Miik, NADES Formation, Empowering Farmers Foundation, DASPA, RECODA, and IITA. **Table 5.33** shows the annual seed demand (in tons) of various organizations interviewed.

Table 5.33 Annual groundnut seeds demand (tons) by institutional buyers

Organization name	Qty (tons)	Seed class
Empowering Farmers Foundation	6.5	QDS
DASPA	20	QDS
	0.8	Breeder
	14	Certified
RECODA	8.5	QDS
	2	Breeder
IITA	15	QDS

The institutional seed buyers sampled as key informants for this study were also asked for their sources of information on seed. Three organizations responded to this question. TARI seems to be a key source of information since it was mentioned by two of the three organizations. Other sources of information were seed companies, extension officers, and key farmers. The results show that traders communicate through small parks, leaflets, sharing messages during meetings, group leaders, and saying what kind of grains they will buy next season for farmers to produce them.

5.9.2 Constraints

The institutional seed buyers sampled for this survey gave feedback on their production and marketing constraints (**Table 5.34**). The main production constraint was foundation seed being costly or unavailable. Groundnut is difficult to produce, harvest, transport, and store. It is underground and therefore hard to tell the likelihood of a good crop yield or not. It is also bulky and can be stored only in the shell to avoid loss of viability. The main marketing constraints experienced by traders were low prices and inadequate seed supply.

Table 5.34 Production and marketing constraints for institutional groundnut seed buyers

Production constraints	Rank	Marketing constraints	Rank
Foundation seed is costly or unavailable	1	Low prices of products	1
Limited supply of seed (demand is there)	2	Inadequate seed supply	2
Inadequate knowledge on production and storage aspects	3	Lack of a stable market	3
Cash flow or credit constraints	4	Inadequate/poor storage	4
Limited business skills on how to make sales	5	Limited market information	5
Delayed inspection and high cost of inspection	6	Poor grading of seeds	6

5.9.3 Increasing access to and affordability of improved varieties

This study sought to determine how training support for traders and farmers can be done to ensure that women, men, youth, and those with disabilities have access to quality seeds. Institutional seed buyers often consider inclusivity and reinforce various solutions such as creating awareness about the source of seeds, conducting need assessments so that training can address existing community challenges, providing financial services, and supplying improved seeds in potential production areas. All institutional seed buyers indicated that they would consider disseminating and promoting new varieties to farmers and traders.

6. Conclusions and recommendations

6.1 Conclusions

The findings from this survey confirm that smallholder farmers in Africa widely use informal seed channels to access seeds for their range of crops. It is estimated that 80% to 90% of smallholder seed comes from informal systems, with the exact proportion differing by crop (Louwaars et al., 2012). This scoping study underscores the need for strengthened and dynamic breeding and seed systems that can contribute to increased varietal turnover as a core strategy for crops to adapt to the changing climate. It also demonstrates the extent to which such seed trade is genuinely a business linked to, but also distinct from, the crop (sorghum, groundnut, and bean) grain business. Second, informal seed traders function as private sector entrepreneurs who are vital for promoting the grain business and the local seed business and for moving varieties at remarkable speed and scale (Sperling et al., 2021). This suggests that the informal/local seed business should be regarded as an always-present, robust, and dynamic force that could be explicitly linked to other research and development partners aiming to broaden positive impacts among smallholder farmers. Further conclusions follow:

- This study confirms the critical role of the informal seed sector in making available seeds of open-pollinated crops such as beans, groundnuts, and sorghum to smallholder farmers across Africa. It also confirms past findings that the informal seed sector should be widely recognized as a critical node that smallholder farmers in Africa use to obtain seed for their range of crops.
- White sorghum still dominates the market (representing 64% of the total sorghum traded) because of its color appreciation and processing quality. However, the market share of red/brown is growing and currently represents 36%. Red/brown is mainly exported in the region; thus, there is an opportunity to enhance breeding efforts to come up with more improved red/brown varieties. Traders prefer white sorghum varieties as they attract higher prices than red ones. Women commonly sold red types for food, while men preferred white sorghum.
- Yellow, purple, and red mottled bean varieties dominate Tanzania's bean business (marketplace and large grain trading business). On average, small traders sell 9.4 tons per annum (per trader), while large traders sell 200 tons per annum (per trader).
- Tan types of groundnuts, especially small and medium tan, are popular and dominate both domestic and regional markets. The export markets dominated by tan types are Kenya, Uganda, Burundi, Rwanda, and Malawi.
- Large bean traders/off-takers dominate the bean business, selling up to 81,101 tons per year, with male traders dominating the large-scale business, selling more than 55% of the total quantity sold by all traders combined.
- Both the interlink between and independence of seed and grain trade are demonstrated. Overall, 56%, 20%, and 47% of bean, sorghum, and groundnut grain traders, respectively, consciously sell local seed and are mostly clear on what farmers' varietal and trait preferences are and when they need seed. Traders manage seeds differently than 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 the local seed business and moving varieties widely and fast. Essentially, these traders are central as last-mile agents to deliver quality seeds to farmers and accelerate varietal turnover.
- Taste emerged as an essential trait since it is the main driver for bean, sorghum, and groundnut preference; thus, taste should be prioritized in breeding efforts.
- Contractual arrangements, albeit mostly verbal, are a tool for grain/seed quantity and quality assurances, thus further demonstrating efforts by informal traders to create both an 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 seed and grain sales with traceable pathways, including beyond national borders.
- Similarly, seed prices are much higher than grain prices for all crops and vary significantly by variety. The price gap between grain and seed is USD 98/ton for beans, USD 170/ton for sorghum, and USD 278/ton for groundnuts, thus motivating traders to engage in seed sales.
- More than half of the bean traders expressed willingness to participate in promoting and accelerating the adoption of new varieties and turnover. However, there is a prevalent knowledge gap in the handling and management of new seed varieties, business management skills training, and information on sources of varieties, in that order. Technical support should be prioritized among female traders, for whom the knowledge gap is more widespread than for males. Business management skills should be taught to establish viable seed businesses within Tanzanian seed regulations and law.
- 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 about their business.
- This study confirms that multistakeholder platforms provide space for learning and knowledge exchange in which various stakeholders come together to diagnose their challenges, identify opportunities, and share knowledge and information to address them for mutual benefit. This also was detailed by Rubyogo et al. (2019).
- 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 creating seed demand pull. These institutional buyers collaborate with the national research institutes.
- Traders, government agencies, and humanitarian agencies are willing to engage in efforts to accelerate the varietal adoption and turnover of OPVs (sorghum, bean, and groundnut).

6.2 Recommendations

- The findings confirm that there is a need for strengthened and dynamic breeding and seed systems that result in high rates of varietal turnover as a core strategy for crops to adapt to biotic and abiotic stresses and meet ever-changing consumer preferences. This can be achieved by engaging traders in varietal development and building (their staff) capacity in field testing/popularizing of new varieties and seed systems as part of demand-led breeding initiatives.
- Traders (off-takers, aggregators), institutional seed buyers, and consumers indicate that traders and institutional seed buyers are pivotal in stimulating farmers' investments in the use of improved varieties. There is a need to catalyze traders' investments in the delivery of quality seeds to farmers and accelerate varietal turnover. This provides an impetus for further testing of the hypothesis that traders and institutions (NGOs and humanitarian organizations) can play a significant role in accelerating varietal turnover.
- There is a need to determine clear modalities for engaging all types of traders in seed delivery proactively, openly, and in a structured manner. This might include, but not be limited to, the registration of traders as seed dealers (if they are qualified) to officially run seed businesses alongside their grain businesses and establishing sustainable seed supply channels by linking them to the Agricultural Seed Agency, seed companies, and QDS producers. Other support needs might involve enhancing their technical capacity to handle local seeds to maintain quality, which can be in the form of training to complement their current seed and variety management skills.

- The fact that bean, groundnut, and sorghum customers openly indicate to traders that they are buying seeds of specific varieties is clear evidence for the need to link traders to better sources of improved seeds from the formal and semi-formal seed systems (e.g., certified seed and QDS, respectively) to ensure that farmers use quality planting material. Traders can play a role in linking farmers (customers) with sources of quality and new seeds for accelerating varietal turnover.
- Large off-takers engage in aggregation, provision of tailored extension services, messaging, and moving larger local seed volumes than small marketplace traders; therefore, their involvement in an integrated seed system model would accelerate varietal adoption and turnover. Thus, it is important to strengthen their capacity (and that of their staff) to provide extension training to farmers and correct information on new varieties of the three crops.
- Cross-border seed and grain movement in East and Southern Africa should be further strengthened by a regional breeding network sharing germplasm, followed by region-wide varietal promotion and seed marketing strategy.
- Given the limited digital literacy and limited ownership of smartphones, computers, and tablets among traders, it is critical to enhance peer networks that are connected by telephone chains to diffuse information on new varieties and create demand for them. Therefore, there is a need to explore other options for digitizing traders and farmers by testing innovative digital solutions that would increase varietal turnover and increase productivity and food and nutrition security.
- Since trade-led multistakeholder platforms provide space for learning and knowledge and information exchange in which various stakeholders converge to jointly diagnose their challenges and identify opportunities to address them, it is ideal to promote trader-led MSPs to facilitate access to quality seeds and other complementary services needed for increased productivity and income for all value chain actors.
- The limited availability of starter seed/EGS (breeder, basic, and pre-basic), 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 EGS challenges through direct licensing agreements between NARS and private seed companies has had limited success because of the stringent conditions and restrictions placed on the licenses (Seed CLIR, 2013). Thus, there is a need to reverse this.
- It is essential to build the capacity of TARI in breeder seed production and TOSCI in certification by simplifying and harmonizing varietal release processes and to motivate other partners to invest in seed systems. A review of seed licensing policy to remove restrictive conditions is a viable option to increase the availability of and access to quality seeds for farmers, seed companies, and institutional buyers.

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8. ANNEX

Annex 1: List of participants for baseline survey team training held on 11 to 14 April 2023, Arusha, Tanzania

#	Name	Position	Institute	Crop
1	Reinfred Maganga	Pathologist	TARI - Uyole	Common bean
2	Michael Kilango	Breeder	TARI - Uyole	Common bean
3	Agness Ndunguru	Socio-economist	TARI - Uyole	Common bean
4	Happy Daudi	National coordinator	TARI - Naliendele	Groundnut
5	Gerald Alex	Economist	TARI - Naliendele	Groundnut
6	Emmanuel Mwenda	National coordinator	TARI - Ilonga	Sorghum
7	Ismail Ngolinda	Seed system expert	TARI - Ilonga	Finger Millet + Sorghum
8	Julius Mbiu	Bean breeder	TARI - Maruku	Common bean
9	Joseph Kimisha	Agronomist	TARI - Maruku	Common bean
10	Shida Nestory	Bean breeder	TARI - Selian	Common bean
11	Sylvia Kalemera	Senior research associate	Alliance of Bioversity International and CIAT	Common bean
12	Fadhili Kasubiri	Senior research associate	Alliance of Bioversity International and CIAT	Common bean
13	Teshale Assefa	Scientist-breeder	Alliance of Bioversity International and CIAT	Common bean
14	Eliud Birachi	Scientist-economist	Alliance of Bioversity International and CIAT	Common bean
15	Jean Claude Rubyogo	Global Bean Program leader and PABRA Director	Alliance of Bioversity International and CIAT	Common bean
16	Mercy Mutua	Senior research associate	Alliance of Bioversity International and CIAT	Common bean
17	Noel Templer	Senior research associate	Alliance of Bioversity International and CIAT	Common bean
18	Radegunda Kessy	Senior research associate	Alliance of Bioversity International and CIAT	Common bean
19	Wilfred Odhiambo	Scientist-Economist	Consultant - Alliance of Bioversity International and CIAT	Common bean

Alliance Bioversity & CIAT

CGIAR

PABRA
Pan-Africa Bean Research Alliance

CIMMYT

CGIAR

BILL & MELINDA GATES foundation

TARI
Transforming Agriculture

TOSCI
TANZANIA OFFICIAL SEED CERTIFICATION INSTITUTE