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Understanding the Rice Value Chain in Uganda: Opportunities and Challenges to Increased Productivity

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EXECUTIVE SUMMARY

Introduction

Government of Uganda considers rice as one of the strategic agricultural enterprises with the potential to remarkably contribute to increasing rural incomes and livelihoods, and improving food and nutrition security. However, current rice yields are remarkably low, a situation partly attributed to the fact that farmers hardly use agro-inputs such as improved seed, fertilisers and herbicides, which would otherwise boost yields. Low rice yields lower farm incomes from rice production, which partly contribute to the poor and declining performance of the agriculture sector. It is reported in the 2010/11-2014/15 National Development Plan that one of the major constraints to the performance of the agriculture sector is weak value chain linkages from production, processing and marketing; and limited extension support. The current study focuses on rice and assesses the constraints and opportunities for intensification along the value chain, as one of the strategies to accelerate growth of the agriculture sector.

Objectives of the study

The need to intensify rice production and strengthen the rice value chain is the motivation behind this study, with the following specific objectives:

1) To characterise key actors in the rice value chain;
2) To assess farmers' access to and use of rice yield-augmenting inputs; and
3) To identify core constraints and opportunities for improving efficiency in the rice value chain.

Methodology

The rice value chain survey was conducted in May 2015, covering three major rice growing districts in Eastern Uganda namely; Tororo, Bugiri, and Butaleja. The value chain approach was adopted to identify different actors along the chain and analyse their characteristics, constraints and opportunities encountered along the chain, and assess access to and use of rice yield-augmenting inputs. The actors interviewed at each node of the rice value chain included; 35 farmer groups, 46 agro-input dealers, 4 rice seed multipliers, 82 rice processors (millers), and 97 rice traders. Survey data were analysed through generation of descriptive statistics.

Key findings

Farmers in Eastern Uganda mostly grow three rice varieties namely; Kaiso, Super and WITA9. There is a huge mismatch between the rice varieties that are commonly grown by farmers and those that are multiplied by seed multipliers. Apart from WITA9, the rest of rice varieties that are multiplied in relatively big quantities (i.e. NERICA, Namuche, CH and GRS10057) are not commonly grown by farmers. Most (74%) farmers grow local rice varieties, and a high proportion of them (81%) use recycled seed. Other yield-augmenting inputs, particularly fertilisers are also not widely used as evidence shows that about 82 percent of rice growing households do not apply fertilisers to their rice fields. Generally, there is limited access to and use of yield-augmenting inputs, especially improved rice seed and fertiliser. Evidence further suggests that leveraging on farming experience and access to agricultural extension and training are potential catalysts to rice crop intensification.

Employment structure in the rice value chain shows that all nodes are dominated by men - all rice seed multipliers are men, 87 percent of agro-input dealers are men, 98 percent of rice millers are men; and 96 percent of rice traders are men. Analysis of contribution to labour invested in rice related activities also shows that men generally contributed more than women. Generally speaking, currently, women are not participating in the rice value chain in an economically meaningful manner.

Actors along the rice value chain face a myriad challenges; some are unique to specific actors while others cut across all actors. The study identifies the following as core constraints in the rice value chain: limited use of yield-augmenting inputs; lack of reliable input and output markets; high transport costs, lack of physical and personal means of transport, and poor road network, especially during rainy seasons; inadequate capital and limited access to formal sources of credit; presence of low quality/fake agro-inputs on the market; pests and diseases, which significantly reduce yield and undermine quality; weather uncertainties (particularly heavy rains and prolonged drought); lack of appropriate post-harvest handling facilities (e.g. tarpaulin); and frequent power outages and high electricity tariffs.

The major obstacle to rice crop intensification requiring urgent action is lack of access to improved rice seed. The results show that it is harder to access improved rice seed compared to fertiliser and other inputs. Estimates show that the total volume of rice seed produced by existing seed multipliers during the main growing season (41,328kgs) is less by over 90 percent of what farmers would actually require if most of them were to embrace use of improved seed. The seed supply deficiency is worsened by the fact that currently, the biggest rice seed multipliers rarely sell seed to farmers within their communities; they mainly sell seed to seed companies and other organisations that provide the foundation seed. The study estimates that in order to meet local farmers' demand for improved rice seed, at least 40 new seed production enterprises should be established; and this is estimated to cost over one billion Uganda shillings.

Recommendations

This report suggests the following interventions that can be implemented to improve efficiency along the rice value chain. They include:

a) Designing and implementing input subsidy programmes;
b) Establishing community level rice seed multiplication sites (enterprises) that are specifically meant to serve the seed needs of farmers;
c) Strengthening the inspection arm of MAAIF including inspectors' capacity to deal with issues of counterfeit agro-inputs;
d) Recruiting adequate number of extension workers and strengthening their capacity to reach out to all farmers with relevant information and skills; and
e) Designing and implementing awareness creation campaigns about availability, access and use of rice yield-augmenting inputs.

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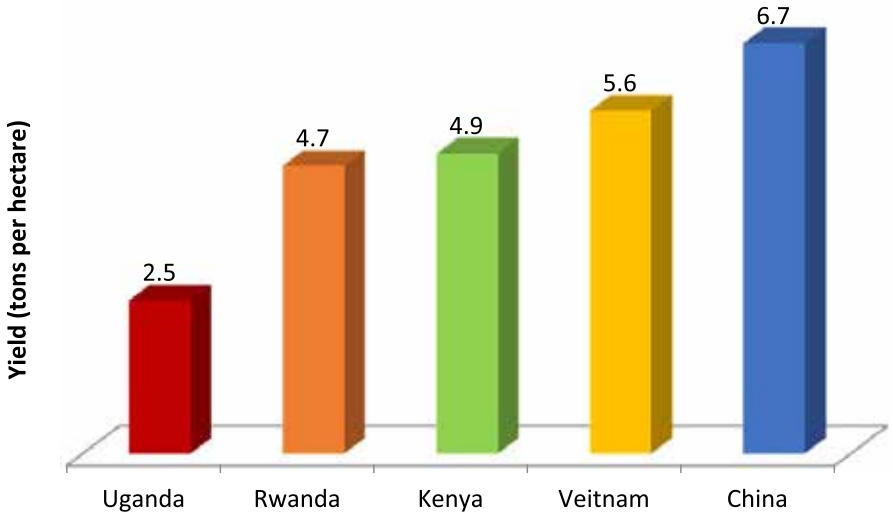
ABBREVIATIONS/ACRONYMS

A2N	Africa 2000 Network
ABCs	Agri-Business Clusters
aBi Trust	Agribusiness Initiative Trust
CATALIST	Catalyse Accelerated Agricultural Intensification for Social and Environmental Stability
DSIP	Development Strategy and Investment Plan
EPRC	Economic Policy Research Centre
EPSEDEC	Eastern Private Sector Development Centre
FGD	Focus Group Discussion
GoU	Government of Uganda
Ha	Hectare
IFDC	International Fertiliser Development Centre
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
JICA	Japan International Cooperation Agency
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MT	Metric Ton
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organisation
NASECO	Nalweyo Seed Company
NDP	National Development Plan
NGO	Non-governmental Organisation
NPA	National Planning Authority
PASIC	Policy Action for Sustainable Intensification of Ugandan Cropping systems
SEPSPEL	South Eastern Private Sector Promotion Enterprise Ltd
UCA	Uganda Census of Agriculture
UCA	Uganda Cooperative Alliance
UGX	Uganda shillings
UNADA	Uganda National Agro-input Dealers Association
US$	United States Dollar
USAID	United States Agency for International Development

1. INTRODUCTION

The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in the 2010/11-2014/15 Development Strategy and Investment Plan (DSIP) identified rice as one of the strategic commodities with the potential to remarkably contribute to increasing rural incomes and livelihoods, and improving food and nutrition security (MAAIF, 2010 & MAAIF, 2012). According to the Uganda Census of Agriculture (UCA) 2008/09, Eastern region is the leading rice producer in Uganda; it accounts for 48 percent of the total area under rice production and over 67 percent of the country's rice harvest. The estimated rice yield for Eastern Uganda (3.6 MT/Ha) is above the national average of 2.5 MT/Ha (see Appendix I). When compared with other countries, rice yields in Uganda are remarkably low (Figure 1). The relatively low rice yields in Uganda are partly attributed to the fact that farmers hardly use agro-inputs such as improved seed, fertilisers and herbicides, which would otherwise increase yields (MAAIF, 2010).

Figure 1: Average rice yields (tons per hectare) in selected countries



Source: FAO, 2014

Low rice yield is a real problem in that it lowers farm incomes from rice production, which negatively impact on the livelihoods of rice farming communities. Additionally, low rice yields contribute to the poor and declining performance of Uganda's agriculture sector. The problem of declining performance of the sector in the last ten years has generally affected development of the economy. It is observed by NPA (2010) in the 2010/11-2014/15 National Development Plan (NDP), that one of the major constraints to the performance of the agriculture sector is weak value chain linkages from production, processing and marketing; and limited extension support. Thus, the way forward towards addressing this problem would be through an assessment of constraints and opportunities for intensification along the value chain as one of the strategies to accelerate development of specific crop commodities. Efforts by Government (MAAIF) to support development of value chains of strategic agricultural commodities are ongoing. For example, MAAIF divided the country into agricultural production zones and is pursuing agricultural development using the commodity approach. Also, the second NDP 2015/16 – 2019/20 emphasises the need to increase investment in selected strategic agricultural value chains. However, despite these efforts, the challenge of weak agricultural value chains still remains.

This report focuses on rice and notes that a number of studies have been carried out on the rice value chain in Uganda, however, there are key issues which still have not been addressed as discussed in the next paragraphs.

The Chinese Rice Study (1982) distinctly showed that Uganda offers ideal conditions for rice production. Rice is among the emerging crops in Uganda that play an important role as both a food and cash crop (Sabiiti, 1995; Ochollah *et al.,* 1997). Rice ranks fourth among the cereal crops in the area cultivated, occupying a total of about 80,000 hectares of land, with an estimated annual output of 191,000 metric tons (Hyuha, 2007; UBOS 2010; MAAIF, 2009).

Even though rice is increasingly becoming a staple in the country, especially in the urban areas; available statistics show that Uganda is a net importer of rice and will continue to be so unless domestic production improves significantly (World Bank, 1993; Hyuha, 2006). It was estimated in Uganda's National Rice Development Strategy of 2009 – 2018 that Uganda consumes 224,000MT and produces 164,000MT of rice annually, implying the balance of 60,000MT is met through imports (MAAIF, 2009).

The introduction of new rain-fed (upland) rice varieties in Uganda, to supplement the swampy paddies (that dominate world production today), offers prospects for doubling rice production in the country (MAAIF, 2009). This underscores the importance of better seed varieties in increasing crop production. It also provides an opportunity to analyse the extent to which farmers are using improved seed in rice production as well as gaps in the supply of improved rice seed; and provides insights on the kind of action or investment required to address such gaps at sub-regional level.

Dalipagic and Elepu (2014) analysed the value chain of five crops including rice in four districts in Northern Uganda (i.e. Amuru, Nwoya, Otuke and Lira). The study described the physical flow of paddy and milled rice along the value chain. At production level, the study identified Super, Upland (NERICA) and Sindano as the commonly grown rice varieties. However, the study paid no attention to the input supply level of the rice value chain, especially on use of productivity enhancing inputs such as fertilisers and improved seed, which are necessary for crop intensification at the production level of the value chain. In their study, Dalipagic and Elepu (ibid) mentioned other rice value chain actors such as local traders, who linked farmers to millers by collecting paddy rice from farmers and transporting it to the millers. The millers sold milled rice to urban retailers and regional exporters to South Sudan and Kenya. The rural and urban retailers also sold to consumers. The study pointed out that apart from milled rice, there was no other value addition to rice. Thus in the current study we also gather information on the critical factors that constraint value addition.

A study by USAID (2008) identified key constraints in the rice value chain. These included: inefficient input supply systems which make small holder rice farmers lack regular access to quality inputs such as seed of improved varieties and capital machinery. The study further revealed that there were gaps in extension support services and rice processing infrastructure – it was reported that rice processed by Ugandan millers was of low quality to compete with imported rice from countries such as Vietnam and Pakistan. There is therefore need to study how the processing segment of the value chain could become more efficient.

Another study by Kilimo Trust (2012) revealed that rice varieties which were mostly grown by farmers were Kaiso (K85) and Super (TDX 305). Consumers preferred Super followed by Kaiso. The same study also found that rice enterprises were profitable at all stages of the chain; and that profitability increased with the use of improved production technologies such as quality seed, fertilisers, irrigation and mechanization. The findings thus, emphasise the need to promote use of yield-enhancing inputs (intensification) in order to improve the profits that accrue to rice farmers. Although this study covered a relatively wide geographical scope, and takes account of other complementary services (such as finance, extension, research and development) in rice production, it is deemed important to identify the sources of the rice varieties at the input node of the value chain; specifically to ascertain adherence to quality and consistence in yield performance of the available varieties of rice to the farmers.

TRIAS (2012), in a rice value chain study covering both the seed and grain enterprises, noted that different actors are faced with different constraints which included: low quality/fake seed, high cost of improved seed, gaps in seed supply versus demand, lack of capital, poor transport infrastructure, and lack of storage facilities. Despite these constraints, all actors across the value chain received some profit, but farmers were obtaining the highest profit margin compared to other actors along the value chain. The study falls short in pointing out factors that influence use of yield-augmenting inputs.

From the forgoing studies, we note that the National Planning Authority rightly asserts that the performance of the agriculture sector is not impressive partly because the value chain linkages of strategic commodities are weak (NPA, 2010). Since MAAIF) has identified rice as one of the commodities with the potential to improve rural incomes and food security, this potential can only be translated into reality if linkages among the rice value chain actors are strengthened. The current study focuses on promoting intensification because increasing rice productivity has spillover benefits to other actors in the chain. For instance, when farmers produce more rice, the millers get more rice to process and the traders too are supplied with adequate quantities to enable them keep in business. Hence, the need to intensify rice production and strengthen the rice value chain is the motivation behind this study, with the following specific objectives:

1) To characterise key actors in the rice value chain;
2) To assess farmers' access to and use of rice yield-augmenting inputs; and
3) To identify core constraints and opportunities for improving efficiency in the rice value chain.

The rest of the report is organised as follow: section two contains the methods used in the study, section three presents the study findings and discussions, section four provides a summary of key messages, while conclusions and recommendations for action are documented in section five.

2. METHODOLOGY

2.1 Description of study location

This study was implemented in May 2015, covering three major rice growing districts selected under the Policy Action for Sustainable Intensification of Ugandan Cropping systems (PASIC) project in Eastern Uganda namely; Tororo, Bugiri, and Butaleja. Selection of the study sites was dependent on the 2014 PASIC baseline household socio-economic survey conducted by the International Food Policy Research Institute (IFPRI) under the same project. Accordingly in each district, all the sub-counties that were covered during IFPRI's baseline survey were followed. More sub-counties which had International Fertiliser Development Centre's (IFDC's) CATALIST project intervention but were not covered in the 2014 socio-economic survey (i.e. 3 sub-counties in Tororo and 1 in Bugiri) were also included. In total therefore, 11 sub-counties, 7 sub-counties, and 4 sub-counties were covered in Tororo, Bugiri, and Butaleja respectively (see details in Appendix II).

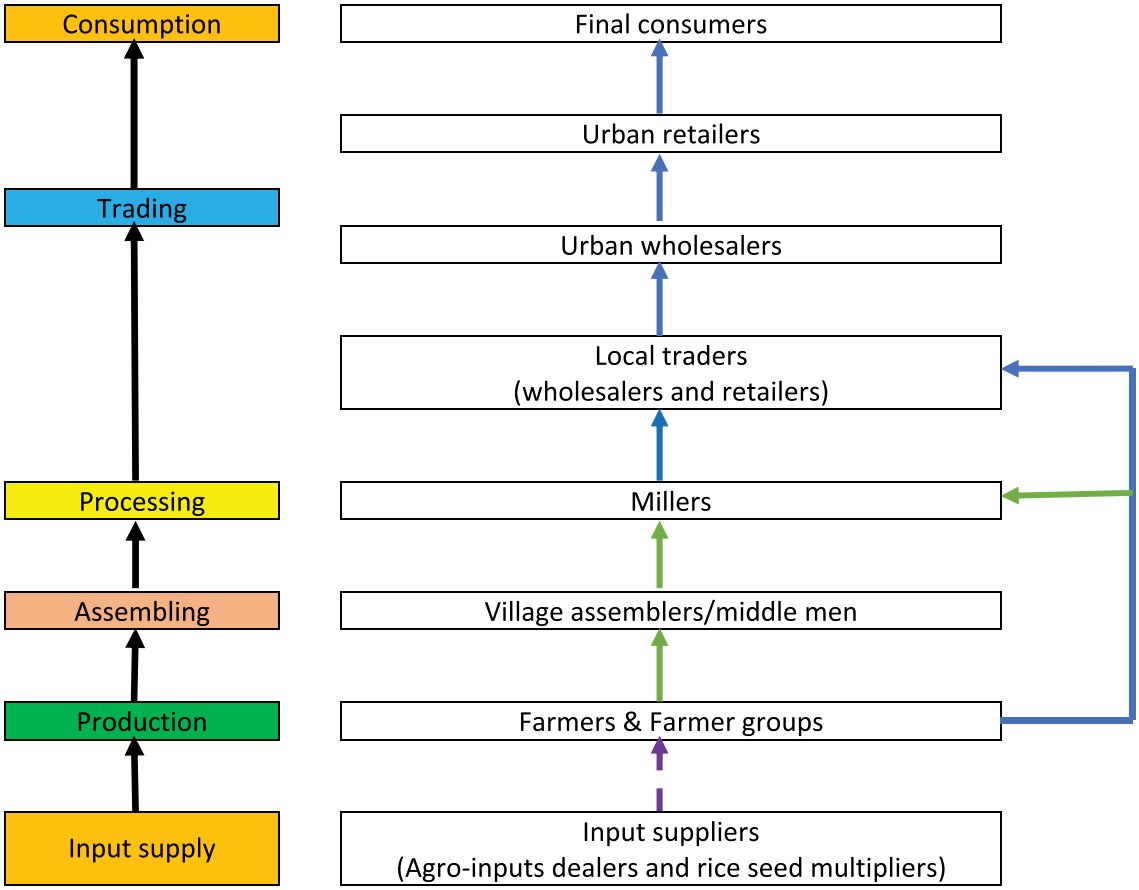
2.2 Study Design

The study followed a descriptive research design given the need to depict study participants (value chain actors) in an accurate manner in order to provide an understanding of what exactly takes place at each node of the rice value chain, and by which actor (participant). Consequently, the value chain approach was adapted (as depicted in sub-section 2.2.1) to enable us identify different actors along the chain and analyse their characteristics, constraints and opportunities encountered, and assess access to and use of rice yield-augmenting inputs.

2.2.1 The Value Chain Approach

Previous studies (Dalipagic and Elepu, 2014; Kilimo Trust, 2012) mapped Uganda's rice value chain and identified input suppliers, farmers, millers, and traders as the key actors. As such, in this study the existing rice value chain maps were adapted (Figure 2), focusing on agro-input dealers, rice seed multipliers, farmers, millers and traders for data collection and subsequent analysis.

Figure 2: Rice value chain map for Uganda



2.2.2 Target population and sampling

Overall, the actors interviewed at each node of the rice value chain included; 35 farmer groups (comprising 366 farmers), 46 agro-input dealers, 4 rice seed multipliers, 82 rice millers (processors), and 97 rice traders. Complete lists of farmer groups were obtained per district (based on IFDC-CATALIST or NAADS formation), and two groups were randomly selected for Focus Group Discussions (FGDs) in each sub-county – one CATALIST and the other non CATALIST. In sub-counties where there was no CATALIST intervention, only one group (non CATALIST group) was considered.

Other than rice farmers, for the rest of value chain actors, a census was conducted. That is, all the known agro-input dealers, rice millers, rice seed multipliers, and rice traders were mapped in each of the study districts with support from relevant stakeholders like; UNADA, IFDC, Africa 2000 Network, SEPSPEL, EPSEDEC, and district production offices. To further enrich the value chain actor mapping and ensure that all actors were traced and covered in the study, farmers during FGDs were asked to identify sources of inputs, and where they mill and sell their rice. Similarly, rice millers were asked during their interviews to identify all fellow millers and traders operating within their locations (sub-county or town council). All the major trading centres (markets) per sub-county (or division / town council) were as well identified and all traders who own rice stores in such centres/markets were mapped. This enabled us to then follow the entire chain. Interviews were then conducted with all the identified actors by administering actor specific questionnaires.

2.3 Types of data collection instruments used

Data were collected using actor specific questionnaires and interview guides. Four different forms of questionnaires specific to agro-input dealers, rice seed producers/multipliers, rice millers, and rice traders were designed and used for collecting data on each value chain actor. For the case of farmer groups, interview guides were used to capture the sought data.

2.4 Sources of data and methods of collection

The main data used for the study were primary data collected at each of the surveyed value chain stage (i.e. production, input supply, seed multiplication, rice processing, and trade). In addition to the data obtained through focus group discussions with farmers, we used the PASIC baseline household socio-economic survey data to triangulate some of the information obtained at rice production level from farmers.

Pertaining to data collection methods, community surveys based on farmer Focus Group Discussions (FGDs) were used to collect data about rice farmers (i.e. actors at the production level). Market surveys were conducted on the rest of the value chain actors (i.e. traders, millers, seed producers, and agro-input stockists).

2.5 Data analysis

Data were collected and analysed on various aspects of the rice value chain including: rice varieties grown, production seasons, farmer's access to and use of rice yield-augmenting inputs, characterisation of rice farmers with respect to intensification, rice value chain financing, employment and gender structure along rice value chain, constraints to intensification along the chain, and investment required to address the most binding constraint to rice intensification. Analysis was based on a qualitative approach and some qualitative data were transformed/coded to make quantitative interpretations and meanings. The quantitative aspect of analysis mainly used descriptive statistics.

3. RESULTS AND DISCUSSIONS

3.1 Description of rice value chain actors

3.1.1 Characteristics of agro-input dealers

Table 1 provides a description of agro-input dealers based on criteria such as age, sex, level of education, age of business, scale of operation, number of employees and business registration status, among others. It is noted that of the 46 agro-input dealers interviewed, about 87 percent were males. The mean age of the agro-input dealers was 35 years with a range of 20 to 60 years. Most agro-input dealers (about 83%) operated at retail level; and 17 percent operated both as retailers and wholesalers. Looking at the business experience, only five out of the 46 agro-input dealers started their businesses before the year 2000. Many were relatively new in the business, with over 54 per cent having joined in the last five years. This particular finding suggests that the network of agro-input dealers is gradually expanding and thus making agro-inputs more accessible to farmers compared to the period before 2000.

The study found that less than half (48%) of the agro-input dealers are registered, mostly with UNADA and the District Local Governments. These findings imply that majority (52%) of agro-input businesses were operating illegally and thus cannot be controlled and regulated by the Ministry (MAAIF) to ensure good quality inputs for farmers. Therefore, there is urgent need for Government (MAAIF) to strengthen the regulatory system, partly through operationalising the Fertiliser Control Regulations 2012.

In terms of education, all agro-input dealers have ever attended schooling. Nine percent (9%) of the dealers had some primary but did not complete primary seven; 15 percent completed Primary Seven; 12 percent attended some secondary but did not complete Senior Four; majority (28%) completed Senior Four; 9 percent completed Senior Six; 17 percent completed post-secondary training; and 9 percent completed Bachelors' Degree.

The number of employees (excluding the business proprietor) per agro-input business generally ranged from 0 to 5. Many (over 65%) of agro-input dealers employed just one person (who in most cases was the proprietor); 23 percent employed 2 people; about 9 percent employed three (3) people; and only 3% employed 4 -5 people. This means that there are not so many job opportunities in agro-input dealership, unless one establishes his or her own business.

Table 1: Characteristics of agro-input dealers

Characteristic	Mean	SD	Min	Max
Age (number of completed years)	35.09	10.56	20	60
Number of employees (excluding the business owner)				
Full-time employees	1.54	0.92	0	5
Part-time employees	1.18	0.98	0	3
Male employees	1.14	0.77	0	3
Female employees	0.40	0.53	0	2
Youth employees	1.03	0.85	0	3
Sex (1 = Male; 0 = Female)	0.87	0.34		
Scale of operation (1 = Retail; 0 = Both retail & wholesale)	0.83	0.38		
When was the business established?				
1 = Before 2000; 0 = Otherwise	0.11	0.31		
1 = Between 2002 - 2009; 0 = Otherwise	0.34	0.48		
1 = Between 2011 - 2015; 0 = Otherwise	0.55	0.50		
Highest grade of education completed				
1 = Completed P2; 0 = Otherwise	0.02	0.15		
1 = Completed P3; 0 = Otherwise	0.02	0.15		
1 = Completed P5; 0 = Otherwise	0.02	0.15		
1 = Completed P6; 0 = Otherwise	0.02	0.15		
1 = Completed P7; 0 = Otherwise	0.15	0.36		
1 = Completed S1; 0 = Otherwise	0.02	0.15		
1 = Completed S2; 0 = Otherwise	0.06	0.25		
1 = Completed S3; 0 = Otherwise	0.04	.0.20		
1 = Completed S4; 0 = Otherwise	0.28	0.45		
1 = Completed S5; 0 = Otherwise	0.02	0.15		
1 = Completed S6; 0 = Otherwise	0.09	0.28		
1 = Completed post-secondary training; 0 = Otherwise	0.17	0.38		
1 =Completed Degree and above; 0 = Otherwise	0.09	0.28		
Are you a registered agro-input dealer? (1 = Yes; 0 = No)	0.49	0.51		
Year of business registration				
1 = Between 2003 - 2010; 0 = Otherwise	0.22	0.42		
1 = Between 2011 - 2015; 0 = Otherwise	0.78	0.42		

Source: Authors' calculations based on the 2015 survey of agro-input dealers in Bugiri, Butaleja and Tororo

3.1.2 Characteristics of rice seed multipliers

Production of rice seed is not a popular activity in the rice sub-sector. Focusing on the study districts, there is no rice seed multiplier in Bugiri, there is only one in Tororo and three in Butaleja. All the four rice seed multipliers are men; three are aged at least 44 years and only one is a youth (aged 29 years old) who started growing rice seed recently (in 2015). In terms of highest level of education completed, two of the seed multipliers completed S.4, one completed S.6, and one holds a Bachelor's Degree. Three out of the four rice seed multipliers multiply seed on their own (i.e. without being contracted) but receive foundation seed from National Agricultural Research Organisation (NARO) and IFDC. They were identified by the two institutions as being capable of multiplying seed and they are expected to sell the seed to farmers within their communities. The one seed multiplier in Tororo district is contracted by Pearl Seeds Company Ltd to multiply seed and sell it to the company. So, basically, even if there is a seed multiplier in Tororo, he does not meet the seed needs of the local farmers.

Important to note is the fact that only the seed multiplier in Tororo, contracted by a seed company is registered and certified by MAAIF, the rest (3) that received foundation seed from NARO and IFDC are multiplying seed without being officially recognised by the Ministry (MAAIF). The non-registered rice seed multipliers claim not to be aware of the registration requirements and the procedures involved[1]. Lack of registration and certification by the three rice seed multipliers raises concerns about the quality/authenticity of seed they produce.

All the four rice seed multipliers reported that there are Government and Non-Government Organisations operating in their communities to promote rice seed production. These organisations include: IFDC, JICA and A2N in Tororo; and NARO, JICA and IITA in Butaleja. These organisations play similar roles which include: training seed multipliers (e.g. on seed selection, sources of seed, proper agronomic practices that should be observed in seed production [e.g. nursery bed preparation and management, line planting, fertiliser application, water management], post-harvest handling [e.g. drying the seed on tarpaulins and ensuring moisture content does not exceed 13%], savings, leadership, record keeping [e.g. inventory of costs/expenditures, sources of financing, sources of foundation seed, etc]; supply of free inputs, particularly foundation seed and fertilisers; testing soils for suitability and distributing soil test kits; and linking seed multipliers to markets and sources of inputs. Rice seed multipliers reported having received the aforementioned forms of support and that they were applying the knowledge and skills they acquired during the trainings.

About inspection of seed multiplication, every growing season, all (except one) seed multipliers' rice seed fields are inspected two (2) to three (3) times. Usually, inspection of rice seed fields is done by the suppliers of foundation seed (NARO/MAAIF, Pearl seeds, and IFDC). The inspection focuses on purity of the rice plants, weed intensity and weed species, growth characteristics of the rice plants (e.g. uniformity in height, number of tillers per plant, plant colour, etc.), disease occurrence, and response of rice plants to extreme weather conditions (e.g. heavy rains or drought), among others. Three out of the four rice seed multipliers said they provide technical support to their clients in terms of field inspections and trainings. The seed multipliers reported that they conduct field visits to their clients; and train farmers in various farming aspects such as land preparation (e.g. levelling fields); seed selection; nursery bed preparation and management; agronomic practices (e.g. planting in lines, applying fertilisers and timely weeding); timely planting and harvesting; and post-harvest handling (e.g. drying rice on tarpaulins).

1 The registration requirements for rice seed multipliers include: attending a training in rice seed production, practicing crop rotation or fallowing, observing an isolation distance of at least 5 metres between fields of different varieties, regularly weeding to eliminate stubborn weeds (e.g. striga), removing off types and keeping only plants of uniform height, practicing proper post-harvest handling (e.g. drying different varieties separately and ensuring the seed is dried to a moisture content of below 12%), and branding/labelling the seed after bagging.

3.1.3 Characteristics of rice farmers and farmer institutions

Farmer characterisation was done in order to provide an understanding of the socio-demographic features of the farmers who participated in the study (FGDs). Findings are presented in Table 2. After characterisation, farmer's characteristics were linked (through cross-tabulations) to use of yield-augmenting inputs, which is the focus of this research.

Table 2: Characteristics of rice farmers (based on focus group discussions)

Variable	Frequency	Percent (n = 35)	Mean	S.D	Min.	Max.
Female participants	155	42				
Male participants	211	58				
Total number of participants	366	100				
No. of female farmers in the groups	625	34				
No. of male farmers in the groups	1,205	66				
Total number of farmers in the groups	1,830	100				
Age (years)			40	12.24	17	77
Years spent in rice production			8	6.74	0	40

Source: Fieldwork / FGD data

Most of the farmer groups interviewed (69%) were formed between 2010 and 2015, and the rest started between 1986 and 2009. The main organizations/institutions that facilitated formation of these groups include: IFDC, NAADS and farmers' own initiatives. Other institutions that also facilitated group formations among others are: Africa 2000 Network, Sasakawa Global 2000, CARITAS, and Uganda Cooperative Alliance (UCA). Majority of the groups (69%) are registered mainly by the district local government (at district or sub-county levels). These findings reflect some degree of formality in group formation and operation. The formality can be harnessed to strengthen farmer institutions (groups), for instance, the organizations behind group formation and registration can be further engaged to for example: initiate or create market or financial access linkage for farmers; and or build farmer group capacity in order for the groups to be able to collectively finance production and market their produce.

In the 2014 baseline household socio-economic survey, the farmer groups that were interviewed had 1,830 members in total (625 females and 1,205 males). In the follow up survey, the 35 farmer groups selected for focus discussions had in total of 366 participants of whom 58 percent were males as shown in Table 2. The average age of participants was 40 years, with the oldest farmer aged 77 and youngest farmer 17 years respectively. In terms of relevant farming experience, the average number of years spent in rice production was 8, with the most experienced farmers having a 40-year experience in production and the least experienced farmers (<1%) had just joined rice production and thus had less than one year of experience.

Descriptive results from the baseline household socio-economic survey data did not reveal wide divergent socio-demographic features (Appendix III). The gender composition in rice producing households was balanced (with 50% males and 50% females). Most (93 percent) rice producing households were male headed. The average age of household heads was 42 years, which is almost the same as that of FGD participants. In terms of education (highest grade completed), majority of the individuals had primary level education (68%), followed by no formal education (16%) and secondary level of education (14%). This level of education suggests that most farmers may not have good knowledge required for rice production or the ability to comprehend some of the agronomic practices involved - this signals the need for strong and effective extension system to improve farmer's knowledge. Most farmers were single in terms of marital status, fol-

lowed by those who were married (monogamous) and married (polygamous). Crop production was the primary activity of most household heads.

3.1.4 Characteristics of rice millers

At the processing (milling) segment of the rice value chain, majority (98 percent) of the respondents were male. Most of the millers interviewed (58%) were proprietors of the milling plants and the rest were employees. The average age of the millers was 38 years, with the oldest and youngest at 65 and 16 years respectively. On average, the respondents had spent 8 years in the rice milling business at the time of the study, with each milling plant employing an average of 5 people. Most (66%) processing plants are not registered businesses, and therefore operate informally, although many of them (88%) reported that they contribute to trading license. Most millers (72%) do not belong to any rice miller's association, and this perhaps reflects weak organizational capacity of the rice millers. Informal and scattered operation of rice millers (without associations) is likely to breed inefficiencies in rice milling operations. This is because millers who belong to associations (or clusters) and operate formally are more likely to adopt innovative rice milling technology capable of increasing milling efficiency and quality of milled rice (Sukarai *et al.,* 2006). Regarding education, majority of the millers (over 51%) were of primary level, followed by secondary education (about 33%) (Appendix IV).

According to rice miller's rating/perception, majority are operating at small scale (50%), followed by medium scale (44%), and the remaining 6 percent reported that they operate on large scale. This means that the millers in the districts or region do not have the capacity to carry out large scale rice processing. Small scale milling operation is associated with inefficiencies related to milling capacity and absorption of rice from farmers. Results show that large scale operators are capable of absorbing and processing at least 5,000 kilograms of rice per day on average, meanwhile small and medium scale operators cannot absorb/mill even half of the absorption and processing capacity of large scale operators (Appendix VIII).

Due to small scale of operations, inefficiencies related to markets are also created in terms of quality of milled rice. This is because large scale operation is associated with higher likelihood of grading rice according to quality than small or medium scale operations. Results show that all large scale operators grade rice according to quality (considering the past three years – Appendix VIII), hence have a higher likelihood of supplying better quality milled rice to the market.

3.1.5 Characteristics of rice traders

Table 3 presents statistics on selected characteristics of rice traders. Trade in rice is dominated by men who accounted for 96 percent of traders interviewed. The mean age of traders was 37 years and ranged from 23 to 64 years. In terms of education, most rice traders (over 90%) completed a certain level of education and training; about 25% completed secondary four (S4), 15% completed primary seven (P7), 14% completed S3, about 7% completed S2, another 7% completed P6, 4% completed S6, another 4% completed P5, another 4% completed P4, 3% completed S1, 2% are degree graduates, 2% completed post-secondary training, 1% completed post primary training, 1% completed S5 and 1% completed P2.

Most rice traders (over 63%) operate both as retailers and wholesalers; about 24 percent are strictly wholesalers; and 13 percent exclusively operate retail businesses. Many (about 56%) have been in trading rice for over five (5) years. Majority (96%) are not registered and less than half of the rice traders (48%) have trading licenses, implying that most traders are operating informally. At least 32 percent of the traders belong to the rice traders' association and are thus likely to capture the social capital gains. Many (over 77%) have never received training about rice marketing.

Table 3: Characteristics of rice traders

Characteristic	Mean	SD	Min	Max
Age (number of completed years)	36.83	8.90	23	64
Experience in rice trading business (years)	8.88	6.50	2	33
Sex (1 = Male; 0 = Female)	0.96	0.20		
Scale of operation (1 = Retail; 0 = Both retail & wholesale)				
1 = Retail; 0 = Otherwise	0.13	0.34		
1 = Wholesale; 0 = Otherwise	0.24	0.43		
1 = Both retail & wholesale; 0 = Otherwise	0.63	0.48		
Highest grade of education completed				
1 = Some schooling but never completed P1; 0 = Otherwise	0.10	0.30		
1 = Completed P2; 0 = Otherwise	0.01	0.10		
1 = Completed P4; 0 = Otherwise	0.04	0.20		
1 = Completed P5; 0 = Otherwise	0.04	0.20		
1 = Completed P6; 0 = Otherwise	0.06	0.25		
1 = Completed P7; 0 = Otherwise	0.15	0.36		
1 = Completed S1; 0 = Otherwise	0.03	0.18		
1 = Completed S2; 0 = Otherwise	0.06	0.25		
1 = Completed S3; 0 = Otherwise	0.14	0.35		
1 = Completed S4; 0 = Otherwise	0.25	0.43		
1 = Completed S5; 0 = Otherwise	0.01	0.10		
1 = Completed S6; 0 = Otherwise	0.04	0.20		
1 = Completed post primary/specialised certificate; 0 = Otherwise	0.01	0.10		
1 = Completed post-secondary training; 0 = Otherwise	0.02	0.15		
1 =Completed Degree and above; 0 = Otherwise	0.02	0.15		
Is your rice trading business registered? (1 = Yes; 0 = No)	0.04	0.21		
Do you have a trading license? (1 = Yes; 0 = No)	0.48	0.51		
Ever received training about rice marketing? (1 = Yes; 0 = No)	0.23	0.42		
Do you belong to any rice traders' Association? (1 = Yes; 0 = No)	0.32	0.47		

Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

3.2 Trade in agro-inputs used in rice production

3.2.1 Agro-inputs traded and supporting institutions

Examples of agro-inputs used in rice production include: pesticides such as Rocket and Malathion; herbicides like 2-4-D, Butanil S and Supernil 70; and fertilisers like, Urea, Rapid Grow, Super Grow, Booster, Xtra Nguvu, and Vigmax. Most agro-input dealers (89%), mainly deal in insecticides, herbicides and fertilisers; and only 26 percent deal in improved rice seed. Having a small fraction of the agro-input dealers dealing in improved rice seed reflects difficulties in accessing improved rice seed by farmers. Indeed, farmers during the focus group discussions ranked limited access to seed markets as one of the most binding constraints to use of improved rice seed.

In terms of support services, there are State and non-state organisations supporting agro-input dealership and these include: IFDC, A2N, UNADA, Eastern Rice, MAAIF, Agribusiness Initiative (aBi) Trust, NAADS, VECO, NASECO, and Commercial Banks (particularly DFCU and Centenary). The support received by agro-input dealers include: inspection, creating links with input suppliers and financial institutions, and conducting trainings in fields such as; business plan development, record keeping, and proper handling and safe use of agro-inputs, among others. At least 33 percent of the agro-input dealers have received some support from the aforementioned organisations.

All agro-input dealers reportedly provide technical advice to farmers. They advise farmers about the correct inputs to use, how to use the inputs (mixing ratios and application rates), and safe handling and use, among others. However, given the fact that many agro-input dealers (77%) have not benefited from the trainings mentioned above, their ability to effectively transfer correct knowledge and advice to farmers is questionable. Thus, from the forgoing, it is recommended that the support from Government and NGOs towards agro-input dealers be sustained and scaled out so as to ensure consistent supply of quality agro-inputs and accurate accompanying advisory services to farmers.

3.2.2 Gender disaggregated participation in agro-input dealership

Trade in agro-inputs used in rice production is dominated by men and generally the youth. Men contribute the most to all activities involved in agro-input dealership as shown in Table 4: stocking and re-stocking inputs (79%), selling inputs and giving technical advice to clients (72%); as well as cleaning the agro-input shop and the immediate surroundings (89%). Apparently, trade in agro-inputs used in rice production is an engagement that women have not exploited as a source of income. This calls for sensitisation of women about the potential benefits of engaging in trade in agro-inputs and training them in various aspects of agro-input dealership.

Table 4: Percentage contribution of men, women and youth to running agro-input businesses

Activity	Men	Women	Youth (18 - 35 years)	Other ages (>35 years)
Making input purchases (stocking & restocking)	79	21	64	36
Cleaning agro-input shop and immediate environment	89	11	55	45
Selling (also involves stock taking & giving technical advice)	72	28	67	33

Source: Authors' calculations based on the 2015 survey of agro-input dealers in Bugiri, Butaleja and Tororo

3.2.3 Challenges faced by agro-input dealers

Dealers in inputs used in rice production face a myriad challenges as indicated in Table 5. The main challenges are: limited input demand/market, limited capital, existence of fake inputs in the market, seasonality of the business, fluctuations in buying prices, continuous need to provide technical advice to farmers, and untrustworthy debtors. More discussion about these challenges is provided in the subsequent paragraphs.

Table 5: Challenges faced by agro-input dealers

Challenges	Frequency	Percent (valid cases = 45)
Limited demand and use of agro-inputs by farmers	22	48.9
Limited capital	17	37.8
Availability of fake inputs from suppliers and on the market	13	28.9
Business is seasonal (mainly sell during the main growing seasons)	11	24.4
High and unstable buying prices at the point of supply	11	24.4
Continuous sensitisation of farmers is tedious and yet sometimes they ignore the technical advice.	9	20.0
Farmers who buy on credit take long and sometimes fail to pay back.	9	20.0
High transport costs/lack of own means of transport	8	17.8
High levies (cost of business registration and trading licence)	5	11.1
Agro-chemicals emit bad smells that are unhealthy to inhale	3	6.7
High rent – renting only one room and storing there agro-inputs as well as other merchandise (including food items).	3	6.7
Input stock outs (sometimes not available at the point of supply)	3	6.7
There are no suppliers of improved rice seed	2	4.4
Poor packaging of inputs (e.g. leaking bottles)	2	4.4

Source: Authors' calculations based on the 2015 survey of agro-input dealers in Bugiri, Butaleja and Tororo

Close to 49 percent of the input dealers experienced limited demand for their inputs, a factor they partly attribute to: the high cost of inputs; farmers lack knowledge about input use and intensification, the perception by some farmers that some inputs (particularly fertilisers) spoil the soil, and the fact that some NGOs supply free inputs to farmers –hence making them reluctant to demand the inputs on their own.

About 38 percent of the agro-inputs dealers lack adequate capital needed to stock diverse inputs in adequate quantities; yet only about 29 percent access loans from commercial banks, a source that offers sizeable loan amounts.

Almost 29 percent of the dealers reported the challenge of existence of fake inputs (especially fertilisers) in the market and even from suppliers[2]. They noted with great concern that the presence of fake inputs destroys the agro-input dealers' reputation and reduces demand because the fake inputs are ineffective - they do not result into the expected yield increases. The challenge of low quality fertilisers was indeed confirmed by a study done by the Economic Policy Research Centre (EPRC) and MAAIF that assessed the quality of inorganic fertilisers on the Ugandan market. Chemical analysis of

2 Agro-input dealers source inputs both from within the district and neighbouring districts but mostly suppliers located in Kampala. The Kampala based input suppliers include: Bukoola Chemicals Industries Ltd, Nsanja Agrochemicals, Balton Uganda, Evergreen International; Cooper Uganda Ltd, Chapa Meli (T) Ltd, Dynapharm International Africa – Uganda, Nalweyo Seed Company (NASECO), and East Africa Seed (U) Ltd.

fertiliser samples collected from traders (wholesalers and retailers) revealed that the fertilisers contained lower levels of nutrients than what was specified on the packages/labels; and high moisture content, above the acceptable limits of 0.5 – 1.5 percent (Kizza *et al*., 2015).

Also, over 24 percent of the dealers noted that agro-input dealership is a seasonal business – farmers mostly buy during the early stages of the growing season. Over 24 percent of the dealers noted that buying prices at the suppliers fluctuate quite often, a situation that negatively affects the agro-input dealers' profits. Another key challenge reported by 20 percent of the agro-input dealers is that they have to continuously offer technical advice[3] to farmers, yet the farmers sometimes ignore the advice and when the input fails to deliver to the farmer the expected yield benefits, the blame is shifted to the agro-input dealer that he/she sells fake inputs.

In an effort to increase sales, some agro-input dealers supply inputs to farmers on credit; 20 percent of the dealers reported that loan defaults (either in form of delayed payment or total refusal to pay) is one of the key challenges they face.

3.3 Rice Seed Multiplication And Marketing

3.3.1 Rice varieties multiplied for seed

There are variations in rice varieties multiplied for seed in the study districts. Varieties multiplied in Tororo are completely different from those multiplied in Butaleja. In Tororo, five varieties are multiplied for seed and ranked in the order of quantity of seed produced they are: NERICA (1, 4 & 10), Namuche (1, 2, 3 & 4), CH, GRS10057 and WITA9. In Butaleja, six varieties are multiplied for seed and ranked in the order of quantity of seed produced they are: WITA9 Purple, K98, Kombuka, Jaribu, Zaina and Basmati (Table 6). The reasons for preference of NERICA varieties (1, 4 & 10) by the multiplier in Tororo include: they are the varieties he is contracted to multiply; varieties are resistant to pests and diseases; and they are not easily suppressed by weeds. On the other hand, WITA9 purple is preferred in Butaleja because: multipliers received significant amounts of foundation seed of this new variety from IFDC and NARO; the variety is high yielding, has heavy grains and is resistant to pests and diseases. Findings further show that the one seed multiplier in Tororo accounts for 64 percent (26,420kg) of the total rice seed produced in the study districts (41,328kg), hence, the rest of the rice seed multipliers in Butaleja are operating on a comparatively small scale.

3 Agro-input dealers provide technical advice on the following among others: the correct input to apply, how to apply the input, timing of application, how to store the input and the maximum recommended duration of storage, and precautionary measures.

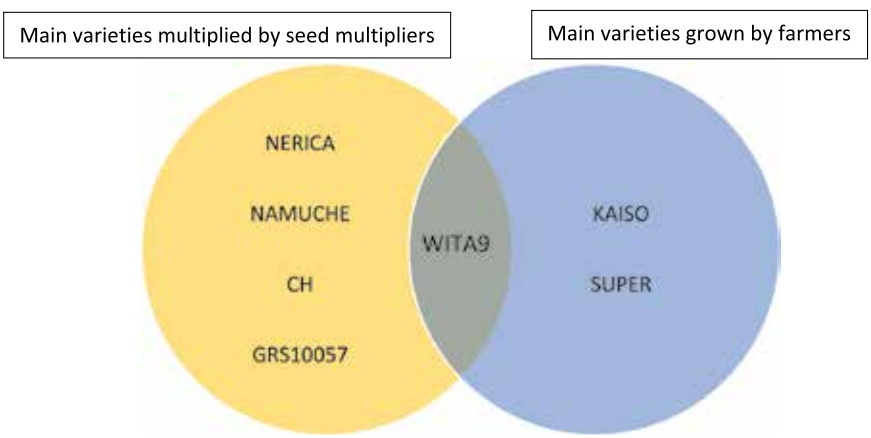
Table 6: Variations in quantities of rice seed produced across varieties and multipliers

Variety	Tororo	Butaleja			*Total*	% of each variety to total seed produced
	Seed multiplier	Seed multiplier 1	Seed multiplier 2	Seed multiplier 3		
NERICA (1,4, & 10)	9,200				*9,200*	22%
Namuche (1,2,3 & 4)	6,000				*6,000*	15%
CH	6,000				*6,000*	15%
GRS10057	5,000				*5,000*	12%
WITA9	220				*220*	1%
WITA9 Purple		1,118	3,850	2,000	*6,968*	17%
Zaina		516	280		*796*	2%
Kombuka		344	630	1,100	*2,074*	5%
K98			1,470	1,400	*2,870*	7%
Jaribu				1,600	*1,600*	4%
Basmati				600	*600*	1%
Total quantity of seed	**26,420**	**1,978**	**6,230**	**6,700**	**41,328**	**100%**
Proportion of seed produced	**64%**	**5%**	**15%**	**16%**		

Source: Authors' calculations based on the 2015 survey of rice seed multipliers in Butaleja and Tororo

Presently, none of the rice seed multipliers multiply Kaiso or Super, which are some of the commonly grown varieties by farmers. This implies that there is a mismatch between the rice varieties commonly multiplied for seed and those grown by farmers (see details in Figure 3). This points to the need to multiply seed according to farmers' preferences lest farmers continue planting recycled seed.

Figure 3: Rice seed varieties multiplied versus those grown by farmers



Source: Fieldwork – survey of rice seed multipliers and FGDs with rice farmers

When asked to comment on the extent to which they meet their clients' demand for rice seed, two of the four said they always meet the demand because most farmers still recycle their own seed continuously. Therefore, this implies that the seed multipliers sell seed to very few farmers since majority of the farmers use (recycle) their own seed saved from the previous season(s).

About technology upgrade, two of the four rice seed multipliers noted that in the last three years, they have adopted the use of fertilisers. Nonetheless, they are not certified by MAAIF, implying that the authenticity of the seed they produce is uncertain. Still related to technology upgrade, two seed multipliers in Butaleja have expanded their market base. For example, one farmer who exclusively used to sell to individual farmers in Butaleja now sells to farmers in other nearby districts, namely Tororo and Sironko; and another one who used to sell to individual farmers only has expanded the scope of his clients to include IFDC, NARO and farmer groups.

3.3.2 Gender disaggregated participation in rice seed production

The findings reported are based on the census of the four rice seed multipliers and accordingly it is noted that in all the activities involved in rice seed production, the contribution of men was more than that of women. The youth contribute generally the most labour used in seed production activities, except for land hiring, nursery bed preparation and planting (Table 7).

Table 7: Percentage contribution of men, women and youth to rice seed production

Activity	Men	Women	Youth (18 - 35 years)	Other ages (>35 years)
Hiring land	100	0	0	100
Bush clearing (slashing)	97	3	97	3
Ploughing (usually done twice)	93	7	77	23
Nursery bed preparation	100	0	50	50
Making ridges and pathways	83	17	83	17
Transplanting (transferring seedlings to the main field)	80	20	85	15
Planting	80	20	50	50
Slashing bands	99	2	90	10
Weeding (by herbicide application and/or manually)	90	10	86	14
Fertiliser application (usually DAP and Urea)	75	25	60	40
Application of pesticides	100	0	100	0
Scaring away birds	97	3	90	10
Harvesting	83	18	76	24
Transporting threshed rice from fields	90	10	90	10
Drying	67	33	87	13
Threshing	67	33	62	38
Winnowing	100	0	100	0
Bagging	83	17	83	17
Storing (carrying to the store)	100	0	100	0

Source: Authors' calculations based on the 2015 survey of rice seed multipliers in Butaleja and Tororo

3.3.3 Challenges faced in rice seed production

As earlier noted, very few farmers are engaged in the rice seed production business venture. During the survey, each of the four seed multipliers was asked to mention and rank the most pressing challenges he faces in this business of multiplying rice seed. The challenges are presented in Table 8 and discussed in the subsequent paragraphs.

Pests and diseases: Rice is attacked by pests such as snails, worms, rats and birds; and diseases, particularly the rice yellow mottle virus and rice blast fungus. These, if not controlled, destroy the crop while still in the garden leading to severe pre-harvest losses. Thus, there is need to: promote growing of disease resistant rice varieties; train seed multipliers to use screen needs at the water inlet points so as to minimize the incidence of snails; and perhaps do aerial spraying of bird nests – this is an expensive exercise that would require Government intervention.

Table 8: Challenges faced by rice seed multipliers

Seed production challenge	Number reporting	Rank given to the challenge by individual seed multipliers			
		Multiplier 1 (Tororo)	Multiplier 2 (Butaleja)	Multiplier 3 (Butaleja)	Multiplier 4 (Butaleja)
Pests and diseases	3	2	3		1
Inadequate capital	2	4	2		
Lack of modern farming equipment	2	1		2	
Drought & floods	2	3	1		
Limited local seed demand (market)	2		4	3	
High labour demand and shortage	2	5			2
Stubborn weeds	1	6			
Low soil fertility	1	7			
Cross pollination with inferior varieties in the neighbourhood	1				3
Inadequate technical knowledge on rice seed production	1			1	

Source: Authors' calculations based on the 2015 survey of rice seed multipliers in Tororo and Butaleja

Limited capital: Seed multipliers lack adequate capital needed to buy inputs such as fertilisers and pesticides; and to put up infrastructure like stores. One way of dealing with this constraint is for seed multipliers to leverage on the support of Government and NGOs – the role of these organisation would include providing credit in form of improved quality farm inputs (e.g. foundation seed, fertilisers, insecticides and herbicides) to seed multipliers.

Limited mechanisation: Like most other farmers, rice seed multipliers lack modern farm implements (such as tractors for ploughing the land, rice planters, weeders and combine harvesters), which would otherwise ease farm operations and minimize the need for human labour. Rice seed production is labour intensive yet labour input is scarce and pricy. It is recommended that Government through the Operation Wealth Creation Programme under NAADS should facilitate the rice seed multipliers to acquire labour-saving farm equipment such as tractors, planters, weeders, peddling machines/ irrigation pumps and improved rice dying technology.

Unfavourable weather conditions: Sometimes there is drought and yet seed multipliers lack irrigation facilities; other times heavy rains (floods) wash away the seedlings after being transplanted to the main fields. Hence, there is need for seed multipliers to establish and maintain irrigations canals to sidestep the effects of drought conditions; and to put in place water control and conservation measures such as water diversion channels and ridges. Also, the GoU during the planning period 2015/16 – 2019/20 intends to prioritise development of early warning systems to prevent and mitigate shocks (NPA, 2015).

Limited local demand for improved rice seed: Most farmers use seed saved from own production (recycled seed). Hence, most seed multipliers pre-dominantly sell the rice seed to the seed companies (e.g. Pearl Seeds Company) and organisations (IFDC and NARO) that contract them or provide them with foundation seed. Given the negligible local demand for rice seed, there is need to sensitise farmers about the existence and need to always plant improved rice seed if they are to increase both productivity and production. Also, the District production departments of Local Governments need to organise exposure visits to encourage rice farmers to begin using improved seed.

Emergence of stubborn weeds: Difficult to eliminate weeds such as striga necessitate weeding at least three times. This requires hiring more labour and it has cost implications. Weed control/management is inevitable partly because one of the conditions that any genuine seed multiplier must fulfil is to avoid contaminating rice seed with stubborn weed.

Low soil fertility: Soils are nutrient deficient and thus require regular use of fertilisers, yet they are expensive. Indeed, even agro-input dealers reported that agro-inputs are generally pricy, a factor that partly explains the low demand and use of such inputs.

Cross pollination among garden of different rice varieties leading to mixed varieties: Although rice is pre-dominantly self-pollinated, cross-pollination also sometimes occurs. That is why, seed multipliers are required to maintain an isolation distance of at least 5 metres between fields of different rice varieties.

3.3.4 Rice seed marketing

The largest rice seed multiplier (located in Tororo) mainly sells to the seed company that supplies him with foundation seed (Pearl Seeds Co. Ltd.) and to NGOs (like IFDC). The smaller rice seed multipliers in Butaleja mainly sell to NGOs and farmer groups. In Tororo district, the price of a kilogram of rice seed irrespective of the variety is uniform (UGX 1,500) except for WITA9, which is higher by UGX 500. In Butaleja, the price of rice seed generally varies by the multiplier and variety – prices range from UGX 2,000 to UGX 5,500 (Table 9). Prices tend to be relatively high for seed multipliers who sell the largest proportion of their seed to seed companies and NGOs.

Table 9: Prices of rice seed by variety and across multipliers

	Tororo	Butaleja		
Variety	Seed multiplier	Seed multiplier 1	Seed multiplier 2	Seed multiplier 3
NERICA (1,4, & 10)	1,500			
Namuche (1,2,3 & 4)	1,500			
CH	1,500			
GRS10057	1,500			
WITA9	2,000			
WITA9 Purple		5,500	4,000	2,000
Zaina		3,000	2,000	
Kombuka		2,000	5,000	2,000
K98			4,000	2,000
Jaribu				2,000
Basmati				3,000

Source: Authors' calculations based on the 2015 survey of rice seed multipliers in Butaleja and Tororo

3.3.5 Estimates of the rice seed supply gap

Comparing improved rice seed and fertiliser, it was found that lack of access to rice seed presents the most pressing challenge to farmers. This is an obstacle to rice crop intensification in Eastern region and particularly the three districts under the study. Farmers hardly have access to improved rice seed[4]; partly because it is expensive but also not readily available on the local markets given that the very few agro-input dealers stock rice seed for sale. They mostly stock and sell fertilisers and other agro-chemicals. Besides, the rice seed multiplier with the highest seed multiplication capacity (based on volume of seed produced) mainly sells the seed to the seed company, hence making it harder for farmers to access the locally produced improved seed. Given the challenges of inaccessibility and unavailability, analysis of improved rice seed supply gap and the necessary investment required to bridge this gap was done and the results are discussed below.

The total area under rice cultivation in the three study districts during the major season is estimated at 5,495 hectares[5] which translates to about 13,578 acres. According to the recommended seed rate for rice growing, one acre requires 30 kilograms of seed. This implies that the total volume of rice seed required by farmers for rice cultivation is therefore 407,340 kilograms. However, rice seed multipliers are producing less than the required seed based on the different varieties multiplied in the three districts (i.e. 41,328 kgs of seed), which is about 10% of what is required in a major season (Table 10). The deficit is worsened by the fact that most of the rice seed produced by the existing seed multipliers is sold to seed companies under contractual arrangements and the seed companies distribute part of the seed to other regions in the country and export considerable volumes to countries such as; South Sudan, Kenya, Zambia and Djibouti. Furthermore, majority of the available agro-input dealers are not dealing in (stocking and selling) rice seed given that they too can hardly access this input.

4 Difficulty in accessing improved seed is explained in terms of more time taken by farmers to access seed compared to the rest of inputs. Details are in section 3.4.5, Figure 6.

5 Computed based on the currently available nationally representative data – Uganda Census of Agriculture 2008/09 (3,603 Ha for Bugiri, 903 Ha for Butaleja, and 989 Ha for Tororo districts).

Table 10: Rice seed production in the main season of 2014

District	Rice Variety multiplied	Acres planted (acres)	Total quantity produced (Kgs)	Yield (Kgs/acre)
	NERICA 4	6	9,200	1,533
	WITA9	0.125	220	1,760
Tororo	GRSI 0057	4	5,000	1,250
	CH	5	6,000	1,200
	Namuche	8	6,000	750
	SUB-TOTAL	**23.125**	**26,420**	
	WITA9	5	6,968	1,330
	Jaribu	1	1,600	1,600
Butaleja	Kubuka	1.125	2,074	2,070
	Basmati	0.5	600	1,200
	K98	1.75	2,870	1,669
	Zaina	0.375	796	2,624
	SUB-TOTAL	**9.75**	**14,908**	
	GRAND TOTAL	**32.875**	**41,328**	

Source: Fieldwork – survey of rice seed multipliers in Tororo, Butaleja and Bugiri districts (May, 2015)

Note: Bugiri district had no rice seed multiplier at the time of the survey.

Accordingly, farmers in the three districts do not benefit from the entire 41,328kgs of seed (10% of the required) that is produced by the existing rice seed multipliers, implying that the amount of rice seed left for farmers who can afford is inconsiderable. Moreover, some farmers in Tororo and Butaleja are even not aware of the existence of the rice seed multipliers while in Bugiri there is no rice seed multiplier at all.

The results obtained clearly suggest that the existing rice seed multipliers in the two districts are therefore not capable of meeting local farmers' demand for improved rice seed. Partly because of the huge improved seed deficit (90%) in the region, farmers are compelled to use local and recycled rice seed – therefore, they are unable to increase harvest per unit of cultivated land and so are missing the income benefits that come with intensification, as earlier reported by Kilimo Trust (2012) .

3.3.6 Level of investment deemed necessary to close the seed supply gap

To estimate the level of investment required to establish additional seed multiplication enterprises to supplement the existing four, it is pre-supposed that the following conditions hold:

i. A given programme invests in rice seed multiplication with additional seed multipliers who have almost the same production capacity as the already existing seed multipliers;
ii. Proposed additional seed multipliers will supply the seed they multiply strictly to the local communities (farmers) within the three districts;
iii. Proposed additional seed multipliers will adjust the rice varieties they will multiply depending on farmer's demand/ preferences such that there is no mismatch between the rice varieties multiplied and those preferred by farmers

for production;

iv. Almost all rice farmers will embrace use of improved rice seed after awareness creation and change of mind-set from use of recycled seed to use of improved seed;

v. The existing four seed multipliers will continue with their contractual arrangements of multiplying improved rice seed primarily for sale to seed companies and NGOs[6]; and

vi. Rice seed multiplication will be primarily carried out during the main production season, during which most farmers engage in rice production.

As already noted, the current rice seed production capacity is 41,328 kilograms (Table 10) in a major season, with an average of about 1,252 kilograms of rice seed produced per acre. The average seed production capacity per seed multiplier is estimated at about 10,332 kilograms in a major season, and total demand for seed from farmers in the three districts is estimated at 407,340 kilograms of rice seed in a major season.

It is estimated that if the current four seed multipliers continue to multiply rice seed primarily for sale to seed companies and NGOs (as per their contractual arrangements), then an additional 40 new seed multiplication sites (of the same capacity) are required in order to meet farmers' demand for improved rice seed every major rice production season. The 40 additional seed multiplication sites can be spread across the three districts depending on the number of rice farmers per district (proportionately).

From the total of 407,340 kgs of rice seed required per season and based on the current yield of 1,252 kg of seed produced per acre, then the proposed investment requires at least 325 acres of land. Given that the estimated cost of seed production per acre in a major production season is UGX 3, 083, 300 (Table 11), then producing seed on 325 acres would cost slightly over one billion shillings (UGX 1,002,072,500)[7].

Table 11: Cost of rice seed production per season, per acre (per seed multiplier)

Cost Item	Quantity per Acre	Unit Cost (UGX)	Total Cost (UGX)
Land preparation	-	-	120000
Planting	-	-	40000
Weeding	-	-	60000
Bird scaring	-	-	60000
Harvesting	-	-	40000
Post-harvest handling (drying)	-	-	20000
Cleaning & bagging	-	-	35000
Fertiliser purchase - DAP	20	4000	80000
Fertiliser application - first (DAP & Urea)	-	-	4000
Herbicide purchase	5	27000	135000
Spraying herbicide	4	5000	20000
Fertiliser purchase - Urea 1st application	20	2000	40000
Fertiliser purchase - Urea 2nd application	20	2000	40000
Fertiliser - Urea 2nd application	-	-	4000

6 We have ignored the two seed multipliers who reportedly sell to farmers because their seed production capacity was too low at the time of the study. So we have assumed that the rice seed supply gap currently stands at almost 100 percent.

7 The average official exchange rate reported by the Central Bank (Bank of Uganda) at the time of the study (month of May 2015) was shillings 3,000 per US$.

Threshing			
-			
-			
200000			
Seed purchase	30	3500	105000
Land hiring	-	-	300000
Labour cost for manager (seed multiplier)	-	-	1500000
Contingency (10%)	-	-	280300
		GRAND TOTAL COST	**3,083,300**

Source: Fieldwork data from rice seed multipliers in Tororo and Butaleja, based on major rice season of 2014

3.4 Rice production and marketing

3.4.1 Production seasons and rice varieties grown

The study found that almost all farmer groups grow rice based on two production seasons (Table 12). The first and main season begins from around January/February and ends between June and July. Rice harvest from the main season is in large quantities and this makes the months of July to around October - December have much rice in the market at relatively lower prices. The second season begins from around July-September and mainly ends in December. Given low production activities and fewer farmers involved in production in the second season, the volume of rice in the market is usually low around the months of March to June/July, and this makes the price of rice to rise during that period.

Table 12: Rice production seasons in Eastern Uganda

Season	From (month)	To (month)
1st (main)	January/February	June/July
2nd	July – September	December

Source: Fieldwork / FGD data

The main rice varieties grown in the three Eastern region districts are Kaiso (reported to be grown by farmers in all the farmer groups interviewed), Super (reported by 77 percent of the farmer groups) and WITA9 (reported by 54 percent of the farmer groups) (Table 13). Individual farmers in the different groups also reported that they grow other varieties such as; NERICA, Upland rice, Bukasolo, Abenego, China, Nigeria, and others (like Namuche, Kibimba, Kibuyu, and Kabonge). A farmer group that reported growing a given rice variety means that at least one of the group members grows that particular rice variety.

Individual farmers in FGDs confirmed that the most grown rice varieties are Kaiso, Super and WITA9, which was confirmed by perception of FGD participants on the proportion of farmers who grow particular rice varieties at community level. Similarly, results revealed that most farmer groups ranked Kaiso, Super and WITA9 as the most grown rice varieties in the entire community (Table 14). Thus, any intervention targeting to strengthen the rice value chain in the three districts should take into account expected rice outputs from those areas in terms of the three prime varieties being grown by most farmers. With the exception of Bukasolo, Abenego and Nigeria varieties, we observe consistencies in the reported figures by FGD participants and their perceptions about the entire community (Table 13). The inconsistencies in Bukasolo, Abenego and Nigeria may be due to the fact that few FGD participants were engaged in growing the varieties so they might have not had fairly accurate perception or knowledge about the entire community regarding these particular rice varieties.

Table 13: Farmers who reported growing particular rice varieties

Variety	Focus Groups (n = 35)		Individual FG members (n = 366)		Perception about the community (Percent)
	Frequency	Percent	Frequency	Percent	
Kaiso	35	100	263	72	70
Super	27	77	76	21	21
WITA9	19	54	99	27	26
NERICA	5	14	30	8	20
Upland	10	29	34	9	12
Bukasolo	2	1	11	3	70
Abenego	5	14	48	13	86
China	1	0.03	10	3	-
Nigeria	1	0.03	3	0.01	40

Source: Fieldwork / FGD data

Table 14: Perceptions on rice varieties mostly grown at community level

Rice variety	Ranking (Rank 1 = most grown variety in community)					
	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Total
Kaiso	28	5	1	0	0	34
Super	2	13	6	5	0	26
WITA9	1	10	7	1	0	19
NERICA	1	2	0	1	1	5
Upland	0	2	6	1	1	10
Bukasolo	1	1	0	0	0	2
Abenego	4	1	0	0	0	5
China	1	0	0	0	0	1
Nigeria	0	1	0	0	0	1
Other	2	0	3	1	1	7
Total responses	40	35	23	9	3	110

Source: Fieldwork / FGD data

3.4.2 Gender disaggregated participation in rice production

The results presented in Table 15 reveal that at production level, men contribute the most to all activities, except drying and cleaning the rice (winnowing and sorting). In terms of age groups, there are activities that are mainly done by non-youth adults and these include: hiring land (65%), selecting and buying seed (83%), constructing ridges/bunds (57%), weeding (57%), drying rice (65%), cleaning -winnowing and sorting (72%), and marketing/selling (70%). Activities where youth make the greatest contribution are: ploughing (51%), nursery bed preparation (51%), transplanting (62%), planting (59%), fertiliser application (56%), pesticide application (61%), bird scarring (54%), harvesting (59%), threshing (67%), transporting from fields (69%), bagging (65%), and storage (62%). Once the rice is ready for milling, transportation to the mill and subsequent sale are pre-dominantly done by men and non-youth.

Table 15: Contribution (percent) of men, women and youth to rice production and marketing

Activity	Men	Women	Youth (18 - 35 years)	Other ages (>35 years)
Hiring land	77	23	35	65
Bush clearing (slashing)	76	24	50	50
Ploughing (usually done at least twice)	58	42	51	49
Selecting/buying seed	70	30	18	83
Nursery bed preparation	73	27	51	49
Transplanting	55	45	62	38
Planting	54	46	59	41
Constructing ridges/bunds and irrigating	81	19	43	57
Slashing around the ridges and rice fields	77	23	57	43
Weeding (by herbicide application and/or manually)	51	49	43	57
Fertiliser application	80	20	56	44
Pesticide application	89	11	61	39
Scaring birds and controlling other pests (e.g. rats)	54	46	54	46
Harvesting (cutting)	68	32	59	41
Threshing	61	39	67	33
Transporting from fields to home	75	25	69	31
Drying rice	28	72	35	65
Cleaning rice (winnowing and sorting)	12	88	28	72
Bagging/packing	77	23	65	35
Storing	94	6	62	38
Marketing(taking rice for milling and selling it)	84	16	30	70

Source: Authors' calculations based on the 2015 focus group discussions with farmers in Butaleja and Tororo

Note: We did not capture data from individual farmers. The figures presented for farmers are based on perceptions of members (farmers) of 35 focus groups that were representing 35 different farming communities.

The findings reveal that generally speaking, women and youth minimally participate in rice selling and thus they may not receive a fair share of the rice proceeds. This might mean that majority of women and youth do not participate in rice production and marketing in an economically gainful manner. Consistent with this finding, MAAIF (2012) concurs that women are the main contributors to agricultural production and productivity, and yet they are usually marginalised when it comes to decision making concerning the revenue generated from agricultural products. The limited participation of women and youth in commercial rice farming is perhaps explained by the limited access to land, which affects these two categories of farmers disproportionately. For example, majority (78%) of women farmers lack ownership and control over land (NPA, 2015). Thus, the plan by Government to establish a Women Enterprise Initiative that enhances women participation along the agricultural value chains should be expedited.

3.4.3 Extent of use of yield augmenting inputs in rice production

This section discusses findings about access and use of key production inputs that are necessary for improving rice yield. The key inputs discussed are those that are of major focus for intensification under the PASIC project – that is, improved rice seed and fertiliser.

Out of the communities (represented by farmer groups) interviewed, about half (51 percent) reported that members of their groups use improved rice seed in rice production (Table 16). This implies that the rest of the communities (almost half) have very few or no farmers using improved rice seed in rice production. Further analysis of the farmer groups by looking at individual farmers who participated in the FGDs revealed that only 22 percent of the farmers indeed use improved rice seed. The perception of FGD participants (farmers) about community level use of improved rice seed shows similar results, with only about 21 percent of farmers reported as users of improved rice seed in the entire communities represented. When farmers in the groups were asked to list all rice varieties that they grow and to indicate whether they perceive the varieties they grow are local or improved, majority (74 percent) indicated that farmers were using local rice seed.

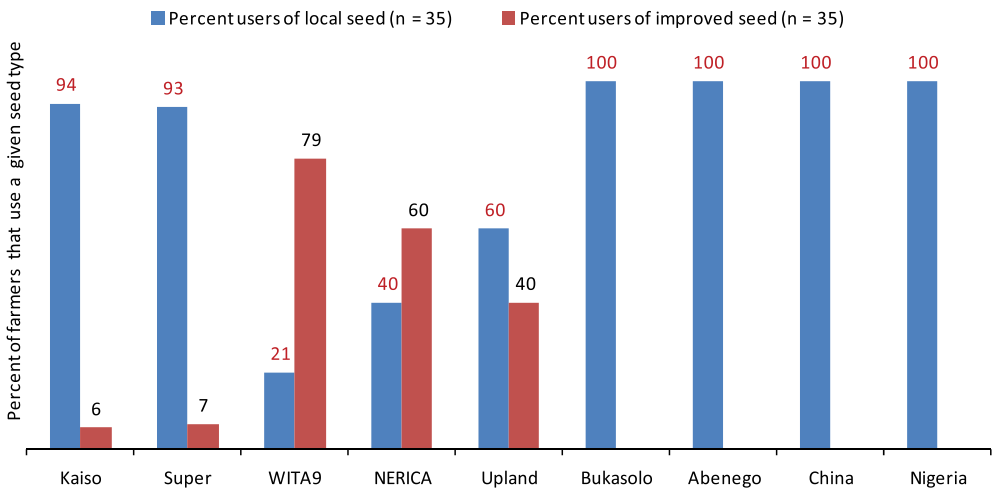
Table 16: Percent of farmers that use yield-enhancing inputs in rice production

Input	Focus Groups (n = 35)		Individual FG members (n = 366)		Perception about the percent input users in the community
	Frequency	Percent	Frequency	Percent	
Improved rice seed	18	51	80	22	21
Inorganic fertiliser	24	69	124	34	37
Organic fertiliser	9	26	52	14	17
Herbicides	22	63	117	32	31
Fungicides/insecticides	27	77	187	51	50

Source: Fieldwork / FGD data

Results based on disaggregation by rice variety (Figure 4) still showed similar pattern with most farmer groups indicating that group members were using local seed in rice production for most of the rice varieties grown. This is true for the case of the mostly grown rice varieties (Super and Kaiso) although with exception of WITA9, and even the least grown varieties as shown in Table 16. It was observed that for WITA9, most farmer groups (79%) reported that their members use improved rice seed. This perhaps can be partly attributed to some of the visible interventions by some NGOs such as IFDC that were distributing improved rice seed of WITA9 to farmers.

Figure 4: Type of rice seed used by variety, based on group responses



Source: Fieldwork / FGD data

Information from the baseline household socio-economic survey reveal that for those who reported that they have ever used improved rice seed, most of them (81%) recycle the seed (Appendix V (A)). The major reasons for recycling seed are: lack of knowledge on where to buy new seed; and high cost of the new seed. Other reasons for recycling seed include: farmers' perceptions that the seed from the previous season is still good (especially if the variety is improved), high yielding, disease resistant, and early maturing.

The main reasons for not using improved rice seed (for those who have never used) according to the baseline socio-economic survey are: high cost of improved seed (i.e. farmers are constrained to access improved seed because they can't afford it); and lack of knowledge by farmers on how to grow improved seed (Figure 5). For example, farmers lack knowledge of recommended agronomic practices when using improved rice seed; the practices relate to proper spacing, row planting, and effective weed control, among others. Another reason for not using improved rice seed is that some farmers are not sure about the quality of the seed sold by input stockists due to previous experience of counterfeits, this was reported by about 34 percent of the rice producing households (Appendix V (B)). Counterfeit seed experience is worsened by the fact that the most affected rice varieties in terms of fake seed are the ones that are majorly grown (Super and Kaiso), as well as Abenego.

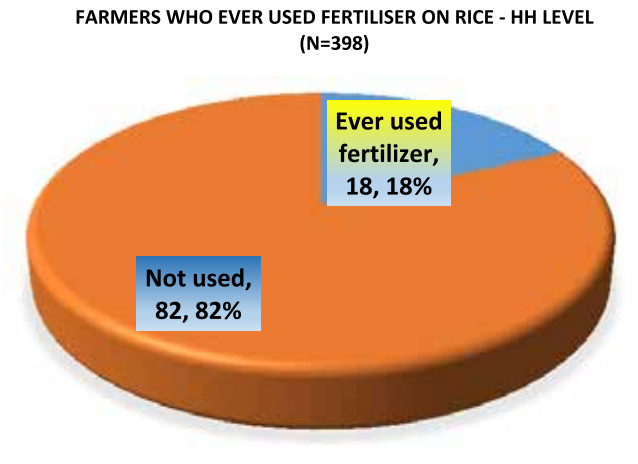
Figure 5: Reasons for not having ever used improved seed

From the farmer groups interviewed, 69 percent and 26 percent reported that members of their groups use inorganic and organic fertilisers respectively in rice production (Table 16). However, when individual farmers in the different groups were examined, we noted that use of fertiliser was very low at individual farmer level. For inorganic fertiliser, only 34 percent of the individual farmers reported that they use it and 14 percent reported use of organic fertiliser. The perception of FGD participants (farmers) about use of fertiliser in the communities represented also shows low levels of fertiliser use, with 37 percent and 17 percent of farmers reported as users of inorganic and organic fertilisers respectively. Farmers in the focus groups explained why the use of organic fertiliser was much lower than that of inorganic fertiliser by noting that application of organic fertiliser is labour intensive. For instance, accessing, collecting and carrying cow-dung from homes to the gardens and applying it in the gardens are highly laborious activities.

The above findings on fertiliser use are corroborated by information from the baseline household socio-economic survey from the same communities. The survey evidence show that proportion of rice producing households who have ever used fertiliser in rice production is as low as 18 percent (Figure 6), suggesting that most rice farmers in different households are not using fertiliser to intensify rice production.

The majority who have never used fertiliser in rice production (82 percent) cited the following reasons as major deterrents: unaffordability of fertiliser by farmers (fertiliser is expensive), farmers fear that use of fertilisers will damage their soil, unavailability of fertiliser in areas where farmers are located (i.e. not readily available in the local markets), lack of knowledge on how to use fertiliser, fertiliser use perceived as unprofitable, and the belief that there is no need to use fertiliser because the soil is still fertile.

Figure 6: Use of fertiliser in rice production



Source: Baseline PASIC household socio-economic survey data

3.4.4 Characterisation of farmers by use status of yield-augmenting inputs

This section discusses the extent to which farmers are involved in rice crop intensification (use of rice yield-augmenting inputs) in relation to selected farmer characteristics captured in the data. The results (Table 17) are based on household level analysis of the baseline socio-economic survey data.

Gender: The extent of intensification by gender is fairly balanced (male = 56 percent, female = 55 percent), suggesting that gender is not a vital factor in influencing intensification efforts in regard to the use of improved seed and fertiliser in rice production. Further, we observe that the extent of fertiliser use among men and women is much lower than use of improved seed by more than half. In relation to recycling of rice seed, we observe similar results for both male and female farmers.

Literacy: In terms of literacy, intensification also seems to be almost at an equivalent extent among farmers who can read and write, read only, and neither read nor write. There is therefore no strong evidence, which reflects that literacy drives rice crop intensification. This may be related to the fact that knowledge entailed in proper agronomic practices is much more than simply knowing how to read and write.

Farming experience: We approximate farming experience based on years spent in rice production. Farmers who have more experience in rice production seem to be intensifying more than those with lesser rice farming experience. This is for example evidenced in the case of the farmers who started rice production between 1970 and 1995, with experience ranging from about 23 to 25 years. In this cohort of farmers, majority of them use improved rice seed (Table 17). The cohorts with lesser experience of about 4 to 18 years use improved rice seed at a lesser extent compared to the more experienced ones. Regarding fertiliser use, only the top most experienced cohorts of farmers have more farmers using fertiliser (the

1970 – 1985 cohort), and the rest of the cohorts with lesser experience (with exception of the 1991 – 1995 cohort) have smaller proportions of farmers using fertiliser for intensification. These findings are expected given that with more experience, farmers are more likely to appreciate the importance of improved rice seed and fertiliser in rice production, hence more usage of such yield-augmenting inputs. Thus, programmes or interventions aiming to increase intensification of the rice crop via improved seed and fertiliser use should leverage on the more experienced farmers (perhaps as lead farmers) to provide lessons for the rest of the farmers through peer-to-peer learning or demonstration arrangements that advocate for the use of yield-augmenting inputs.

Agricultural training and extension: Results in Table 17 reveal that households whose member(s) received agricultural training or extension services use improved rice seed more than those who have not received. The difference is more pronounced for fertiliser use where the proportion of those who received training/extension services and use fertiliser is more than double that of those who have not received the training. These findings suggest that the use of improved seed and fertiliser in rice production is likely to increase with effective training and extension services offered to farmers.

Table 17: Characterisation of rice farmers and intensification

Farmer characteristics	Indicators of intensification (n=398)						
	Ever used improved rice seed (%)			Ever used fertiliser (%)		Recycles rice seed (%)	
	Yes	No	Don't know	Yes	No	Yes	No
Gender: Male	56	28	16	18	82	16	84
Female	55	27	18	21	79	10	90
Literacy: Read & write	57	25	18	17	83	13.5	86.5
Read only	57	39	4	35	65	20	80
Neither read nor write	56	30	14	16	8	18	82
Farming experience: 1970-1975	66.67	0	33.33	33	67	50	50
1976-1980	75	25	0	50	50	33	67
1981-1985	67	0	33	33	67	0	100
1986-1990	75	12.5	12.5	6	94	23	77
1991-1995	68.75	16.67	14.58	33	67	25	75
1996-1999	55.17	24.14	20.69	28	72	17	83
2000-2004	48.15	37.04	14.81	20	80	10	90
2005-2009	55.32	30.85	13.83	17	83	6	94
2010-2014	54.17	27.50	18.33	8	92	18	82
Agric. training/extension: Received	64	24	12	30	70	11	89
Not received	56	28	16	14	86	17	83

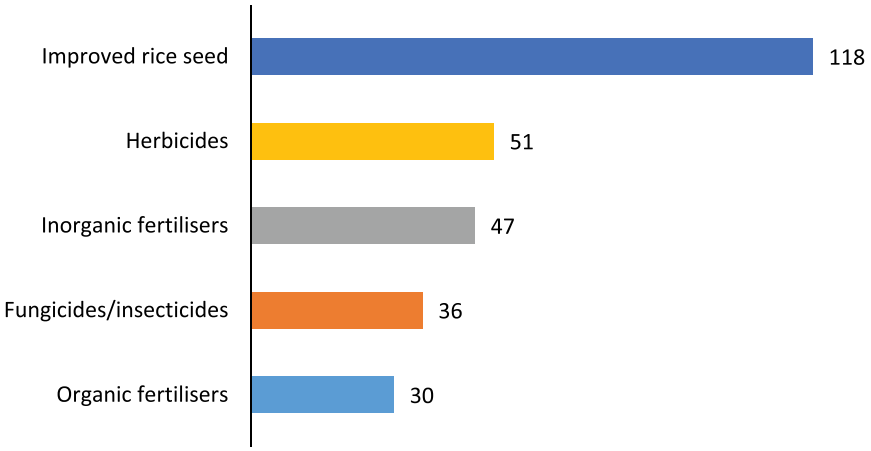
Source: Author's computation from baseline PASIC household socio-economic survey data

3.4.5 Farmers' access to rice yield augmenting inputs

When accessibility is considered in terms of the distance (measured by travel time) farmers have to travel in order to obtain required inputs for rice production, then the hardest input to access compared to all other inputs is improved rice seed. Figure 7 shows that in order to access improved rice seed, farmers have to travel on average far longer distances

compared to the distances travelled to obtain fertiliser and other inputs. The results show that it is more than twice harder to access improved rice seed compared to fertiliser and other inputs. This finding is not surprising, first, due to unavailability of improved rice seed in most of the communities. Secondly, most agro-input stockists in the three districts do not deal in improved rice seed. The finding is also supported by the fact that there are few improved rice seed multipliers on the ground, with majority of farming communities not having any rice seed multiplier.

Figure 7: Access to critical agro-inputs (travel time [minutes] to suppliers)



Source: Author's computation based on fieldwork data

The major sources of improved rice seed as reported by farmers who used improved seed are IFDC and other NGOs, NAADS, lead farmers, and individuals in the communities. For inorganic fertiliser, the main sources include; agro-input shops, IFDC, and individuals in the communities. Based on the sources of inputs mentioned by farmers, it is clear that farmers mostly rely on NGOs for supply of improved seed. Agro-input dealers in the districts rarely supply farmers with improved rice seed, hence making it difficult for farmers to access improved seed whenever they need it. Additionally, other farmers rely on fellow rice farmers for rice seed and this is worrisome because the quality of such seed is not guaranteed.

3.4.6 Constraints to use of yield-augmenting inputs

Table 18 presents reasons given by farmers for not using appropriate technologies, particularly fertilisers, improved seed and pesticides (fungicides, insecticides and herbicides). The results show similar limitations as those earlier discussed in the sub-section on access to and use of rice yield-augmenting inputs. The major factors that limit the use of improved inputs as per the analysis of information gathered through focus group discussions with farmers are: the inputs are expensive to buy; they are not readily available on the local markets; farmers lack capital to purchase the inputs; farmers have negative (wrong) perceptions about the inputs (for example, some believe that fertilisers spoil soils, improved seed yield rice of low nutritional value, etc.); and farmers have no or little knowledge about the inputs.

Table 18: Challenges to use of yield-augmenting inputs

Challenge to input use	Percent responses (n = 35 focus group discussions)		
	Fertilisers	Improved seed	Pesticides
Negative beliefs about the input	14.3	2.9	8.6
Input is expensive	88.6	48.6	77.1
Lack of money/capital	37.1	17.1	22.9
Input use has to be continuous	5.7		2.9
Limited access to input markets[8]	2.9	48.6	2.9
Application of input is labour intensive	8.6		
Limited awareness/knowledge gap about the input	5.7	11.4	11.4
Improved seed has long maturity period		5.7	
Improved seed tends to have low germination percentage		2.9	
Low yield unless good agronomic practices are observed		5.7	
Improved seed is susceptible to pests and diseases		5.7	
Improved seed doesn't grow well in water logged areas		2.9	
Grain of improved seed break a lot when milling		2.9	
Expired pesticides in agro-input shops			2.9
Lack of equipment needed to apply input (e.g. spraying pumps and protective gear)			25.7
Inputs are dangerous for humans in case of an accident (e.g. inhaling or swallowing the chemical)			5.7

Source: Authors' calculations based on the 2015 survey of rice growers in Bugiri, Butaleja and Tororo

3.4.7 The economics of intensification in rice production

The results in Table 19 show that application of best practices (such as use of fertilisers and improved seed, pest control, and minimum tillage, among others) by farmers in rice production yields about 4.3 MT/Ha[9]. On the other hand, farmers who do not apply the best practices realise less than half of the yield obtained by their counterparts who apply best practices (only 2 MT/Ha). If the national area under rice cultivation of 75,085[10] Ha is considered, then use of best practices would result into production level of 322,866 MT of rice per annum valued at UGX. 1,020 billion. Without the best practices, national production level would be about 150,170 MT per annum, translating into revenue of about UGX. 473 billion. Thus, If the current national status quo is maintained at productivity of 2.5 MT/Ha, production will remain at about 187,713 MT annually resulting into revenue of about UGX. 591 billion.

Table 19: Indicative national rice productivity and revenue with and without intensification

	Estimates from the 2015 FGDs with farmers		UCA 2008/09
	With improved practices	With conventional practices	National Average
Yield (MT/Ha)	4.3	2.0	2.5
Revenue (billion shillings)	1,020	473	591

Source: Author's computation from field data (2015), UCA (08/09), and Info trade[11] (2015)

8 According to farmer's responses, "limited access to input market" is defined as lack of/unavailability of markets in the community from which given inputs can be bought (e.g. no markets selling fertiliser in the community).

9 The yield of 4.3 MT/Ha was reported by rice farmers who apply the best practices

10 Based on UBOS – Uganda Census of Agriculture (UCA), 2008/09.

11 http://www.infotradeuganda.com/index.php/market-information/food-prices.html. (Info trade price data were accessed on 15th/April/2016) and average rice price was considered based on different rice varieties.

The findings suggest that application of intensification technological options (such as fertiliser, improved seed, pest control, minimum tillage) potentially doubles rice productivity and revenue from rice production. The results also suggest that due to limited intensification efforts, Uganda's rice sub-sector is losing a potential revenue approximately in the range of UGX. 429 billion to 547 billion per year. The findings thus demonstrate that productivity enhancement through intensification of specific crop commodities like rice is critical for growth of the agricultural sector and the economy at large.

3.4.8 Rice production challenges

Findings presented in Table 20 indicate the constraints to rice production as reported by farmers in focus group discussions. The top eight production challenges are:

a) Lack of mechanisation (reported by 66% of farming communities): The reason why farmers have continued to use rudimentary tools in their farm operations is because they lack capital needed to acquire appropriate modern farm implements such as tractors for ploughing land, planters, weeders, spraying pumps, and combine harvester among others. The opportunity is that Government (MAAIF) recognises the challenge of minimal agricultural mechanisation and the Ministry has indeed set as one of its priorities to increase access to farm inputs that are critical for mechanisation (MAAIF, 2015). Therefore, Government through the Ministry of finance should demonstrate commitment to promoting agricultural mechanisation by allocating funding to implementation of strategic interventions that will promote acquisition of modern farm machinery and tools.

Table 20: Rice production challenges

Production challenge	Frequency	Percent (n = 35)
Use of rudimentary tools	23	65.7
Weather uncertainty (floods & drought) and lack of water reserviours	23	65.7
Birds and rodents (particularly rats)	20	57.1
Pests and diseases; and limited knowledge on how to get rid of them	20	57.1
Rice production is labour intensive	18	51.4
Transport challenges (e.g. high cost of transport & poor road network)	14	40.0
Inadequate capital	11	31.4
Worms and parasites (e.g. leeches) that affect farmers feet	10	28.6
Other (e.g. accidents during harvesting, &theft of rice in the fields)	10	28.6
inadequate land	9	25.7
Lack of protective gear (e.g. during times of chemical application)	6	17.1
Lack of or inadequate market for rice	6	17.1
Low and fluctuating prices	5	14.3
Stubborn weeds which require weeding at least thrice in a season	5	14.3
Lack of improved seed in the community - use of recycled seed	5	14.3
Poor agronomic practices (e.g. poor ridge construction, delayed weeding)	4	11.4
Poor or lack of proper post-harvest handling facilities (e.g. tarpaulins)	3	8.6
Milling machines are far away and are of low technology	3	8.6
Low soil fertility and limited use of productivity enhancing inputs	4	11.4
lack of or poor storage facilities	2	5.7
Limited or lack of knowledge about the different rice varieties	2	5.7

Source: Authors' calculations based on the 2015 survey of rice growers in Bugiri, Butaleja and Tororo

b) Unpredictable weather (floods, droughts and hail stones), reported by 66% of farming communities: In some seasons the rains are too heavy that they cause floods, which wash away the seedlings or submerge short rice varieties; other times there is prolonged drought which again reduces yields remarkably. Hence, there is need for Government to invest in construction of large and promotion of small scale irrigation facilities such as pedal-powered irrigation equipment.

c) Rice destruction by birds (particularly Quelea birds) and rats (reported by 57% of farming communities): The birds and rats destroy rice fields massively and lead to significant pre-harvest losses. Unfortunately, many farmers do not have the financial capacity to afford effective measures like aerial spraying of bird nests. The Head of Research and Farming at Tilda Uganda Ltd reported that birds can eat up to 25% of the potential harvest if not managed, and yet physically warding off birds is time-consuming and a difficult task. Therefore, it is critical that MAAIF through the Department of Crop Protection, establishes and operationalises effective pest control measures.

d) Pests and diseases (reported by 57% of farming communities): Farmers reported that they lack knowledge of how to control the pests and diseases, implying inadequate access to extension. Thus, the ministry of Agriculture through the Directorate of Agriculture Extension Services should facilitate provision of relevant information and knowledge to farmers.

e) Rice growing is labour intensive (reported by 51% of farming communities): Rice production involves a series of activities such as: acquiring land (preferably swamps); ploughing the land at least twice; preparing seed beds (for farmers who plant rice in lines); transplanting and planting rice seedlings or broadcasting rice seed in the prepared land; weeding at least twice; warding off birds and other pests; harvesting/cutting; and threshing rice in the field; bagging and transporting threshed rice home; drying the rice; and bagging and transporting threshed dry rice to the mills for milling and subsequent sale. In all these activities, labour as an input must be employed. Government (perhaps through partnership with the private sector) needs to facilitate farmers to acquire labour-saving farm equipment and tools.

f) Transport related challenges (reported by 40% of farming communities): Some farmers lack personal means of transport and yet use of hired means is expensive. Moreover, the poor road network, especially during the rainy seasons increases transport costs. Hence, the call upon Government ministries and Local Governments responsible for rural infrastructure development to prioritise investment in improvement of stock and quality of rural roads. Regarding ownership of transport means, farmers are encouraged to market their rice collectively as a cost-cutting measure.

g) Inadequate capital needed to finance farm operations (reported by 31% of farming communities): Since rice production is labour intensive, more often farmers need capital to hire extra labour to be able to undertake the major agronomic practices such as weeding and application of inputs like fertilisers and pesticides.

h) Occurrence of worms and other parasites (e.g. leeches) in the rice fields, reported by about 27 percent of the represented farming communities: The parasites together with the water logged conditions of the rice fields affect farmers' feet in terms of infections and rotting feet. Despite facing this challenge, farmers lack appropriate protective gear (particularly gum boots and gloves). Hence, farmers are encouraged to use part of the rice proceeds to purchase protective gear in order to remain healthy and fit to continue farming.

3.4.9 Rice marketing by farmers and associated challenges

According to field observations, farmers do not properly package neither label the milled rice - this is a hindrance to marketing in a competitive environment. Farmers package rice after milling without grading. But also, rice is put in packages (mainly polythene bags) that are not convenient to handle and easily get torn. Because the packages are not labeled, the packed rice is not easily identifiable, for example, in terms of quantity (pack-size), grade/quality, name and address of packer, variety, and date of packing among other required attributes of good marketing.

As reflected in Table 21, most of the farmer groups and farmers who participated in FGDs revealed that the main buyers of rice are agents/collectors or middlemen, followed by rice traders (retailers and wholesalers). However, the farmers we interacted with during FGDs complained of being cheated by such buyers (middlemen and traders). For instance, it was discovered that *"a rice farmer in Butaleja borrows UGX 30,000 from a middleman to finance rice production, and after harvest, the farmer pays back in kind using a full bag of rice (worth about UGX 230,000)",* which is over seven times what the farmer borrows, hence making farmers losers in such pacts.

Table 21: Buyers of rice

Main buyer	Percent of total rice sold to each buyer category	No. of Farmer groups that reported	No. of Farmers (FGD participants) who reported	Percent of farmers in the community selling to buyer
Traders	54.9	22	151 (41%)	58
Millers / processors	54.8	16	119 (33%)	53
Agents (middlemen)	64.6	22	165 (45%)	66
Individual consumers	13.2	8	29 (8%)	16
Others	8.3	4	20 (6%)	7

Source: Fieldwork data – FGD with farmers

In terms of marketing method, majority of farmer groups (30 out of 35) and individual farmers who participated in FGDs (79%) revealed that marketing of rice is mostly done individually rather than in groups. This confirms later findings where majority of rice millers and traders report that they are mainly supplied by individual farmers. Similarly, the perception of FGD participants place most farmers in the entire community (92%) to be marketing rice on individual basis (Table 22). In addition to being cheated when farmers borrow from middlemen as mentioned above, the majority who market individually are disadvantaged. When selling rice, the price fetched by those who market individually is lower than that fetched by those who market on group basis, this applies to all rice varieties and particularly those that are majorly grown by farmers (see Table 23).

Table 22: Rice marketing methods

Marketing method	# Farmer groups where use of method was reported	# Farmers (FGD participants) who reported use	Percent of farmers in the community using the method
Individual marketing	30	289 (79%)	92
Group marketing	21	167 (46%)	19
Both individual & group	7	70 (19%)	44

Source: Fieldwork data – FGD with farmers

Because of marketing as individuals, farmers have less bargaining power while marketing rice thus, a higher likelihood of being cheated especially by the middlemen (agents). The reasons for marketing rice at individual level as advanced by farmers in FGDs are contained in Information Box 1. A few farmers indicated that they carry out group marketing and some of the motivating factors behind group marketing are also contained in information **Box 1**. Thus, it is important that government implements its plan to strengthen farmer group formation and cohesion so as to reap from economies of scale.

Table 23: Selling prices of milled rice by variety and marketing method

District	Kaiso			Super			WITA9		
	Individual	Group	*Difference*	Individual	Group	*Difference*	Individual	Group	*Difference*
Bugiri	2,250	2,333	*83*	2,933	-	-	-	-	-
Tororo	2,220	2,350	*130*	2,920	3,000	*80*	1,600	5,000	*3,400*
Butaleja	2,100	2,350	*250*	2,833	-	-	-	-	-
All districts	*2,201*	*2,343*	*142*	*2,830*	*2,900*	*70*	*2,217*	*3,625*	*1,408*

Source: 2015 Focus Group Discussions with rice farmers in Bugiri, Butaleja and Tororo

Note: The study did not capture transaction costs.

Information Box 1: Reasons for choice of marketing method by farmers

Reasons for individual rice marketing	Motivating factors behind group marketing
• Farmers have personal and differing needs which sometimes require money urgently, hence compelling them to sell at harvest time or shortly after harvest. • Ignorance about other marketing methods (particularly group marketing). • Lack of storage facilities discourages rice bulking hence forcing many farmers to sell individually, immediately after harvest. • Lack of trust among farmers in groups and/or lack of transparency. • Lack of access to markets makes many farmers to sell individually to rice collectors (middlemen). This calls for the need to initiate or strengthen interventions that can link farmers to available markets within and outside the districts or region. Existing interventions for market linkage such as that of IFDC can be strengthened. • Some farmers don't appreciate working in groups and are not aware about the benefits of selling rice as a group. • Weak farmer group organisation e.g. poor mobilisation, lack of cooperation among members, poor leadership, highly limited financial capacity of farmer groups, and lack of exposure of farmer group members, etc.	→ Group marketing attracts better prices due to selling in bulk. → Farmers have high bargaining power when selling as a group. → Some NGOs (e.g. IFDC) encouraged farmers to sell in groups. Hence, such interventions that encourage farmers to market in groups or linking farmers to markets should be strengthened. → Group marketing offers additional benefits such as ease in obtaining agricultural credit. → Some farmers borrow money in groups from traders for rice production and after harvest, they have to sell the rice as a group as well.

Source: Field data – farmer FGDs

Farmers face several challenges when marketing their rice. Table 24 presents the corresponding percent of farming communities, represented by farmers in focus groups that reported each challenge. According to the analysis, the major marketing challenges are as follows:

a) Low and often fluctuating prices (reported by over 94% of the farming communities): Middlemen, traders and some millers exploit farmers by offering them very low prices. Farmers are price takers and usually sell as indi-

viduals. When farmers sell as individuals, they have less bargaining power and do not enjoy economies of size. Suggested solutions include: collective/group marketing to increase bargaining power; construction of warehouses to enable farmers store their harvest during peak season and sell when prices are relatively high; price information should be available to farmers to enable them search for buyers with better price offers; and Government should put in place price controls that favour farmers.

Table 24: Marketing challenges faced by farmers

Marketing challenge	Frequency	Percent (n = 35)
Low and fluctuating prices	33	94.3
Lack of transport means & high transport costs	23	65.7
Inaccurate (adjusted) weighing scales to cheat farmers	22	62.9
Limited access to good markets	13	37.1
Lack of handling facilities (e.g. tarpaulins) - often compromises the quality of rice	10	28.6
Lack of stores	07	20.0
Unfavourable loan terms (restrictions on whom to sell to & high interest rates)	06	17.1
Distant milling points	06	17.1
High milling charges	03	08.6
Low-tech and ill-maintained milling machines which break the rice excessively	03	08.6
Sampling large quantities of rice to test for quality reduces volumes	02	05.7
Power outages causing farmers to make several trips to and from the mills	02	05.7
Fake/counterfeit money	02	05.7
Delays in repair of milling machines	02	05.7
Delayed payments from buyers	02	05.7
Language barrier	02	05.7
Lack of capital	02	05.7

Source: Authors' calculations based on the 2015 Focus Group Discussions with farmers in Butaleja and Tororo

b) Transport related challenges (reported by about 66% of the rice farming communities): Some farmers lack their own means of transport and yet use of hired means is quite expensive; also the poor road network, especially during the rainy season exacerbates transport costs. Therefore, there is need for Government to invest in construction of rural roads; and support farmers to acquire community trucks to ease transportation.

c) Use of inaccurate (faulty) weighing scales (reported by approximately 63% of the farmers): Buyers (traders) intentionally adjust their weighing scales (contrary to the standardized weights) to read lower weights and by so doing they cheat farmers (e.g. the weighing scale reading can be 95kg when in actual sense the true weight of the rice is 100kg). To overcome this challenge, the Uganda National Bureau of Standards should regularly inspect traders' weighing scales for conformity to standard weights and enforce the set weight standards to protect farmers from being cheated.

d) Limited access to reliable markets that can offer relatively high prices (reported by 37% of the rice farming communities): Farmers mainly sell their rice individually to millers and middle men, who exploit them by offering lower prices. There are very few organisations that are attempting to link farmers to markets. These include IFDC, which was mentioned by at least 37 percent of the focus groups representing rice farming communities; and NAADS, this

was mentioned by 9% of the respondents. From the foregoing, we note the need to strengthen farmer organisations to promote group marketing. This can be done by strengthening the role of Agri-Business Clusters (ABCs) to build farmer's capacity to carry out group marketing and also linking farmers to markets, or by building stronger farmer organisations through cooperative movements.

e) Lack of proper post-harvest handling facilities leading to production of low quality rice (reported by about 27% of the rice farming communities): Many farmers have not invested in buying materials such as tarpaulins on which they can spread rice to allow drying without getting contaminated with foreign matter. Although millers have come in to address this challenge by lending tarpaulins to farmers, usually the tarpaulins are inadequate and farmers end up drying some of the rice on bare ground. Due to insufficient drying facilities, the rice gets mixed with dirt (especially stones) and sometimes it does not dry to acceptable moisture content levels. Poor post-harvest handling of rice compromises the quality of the rice – the milled rice comes out dirty, broken and sometimes with a bad colour (cream/yellow) and odour. Of course, the poorer the quality of milled rice the lower the price the farmer receives for such rice. Indeed, this finding confirms the complaint made by both rice millers and traders that farmers take to them low quality rice. Therefore, there is need for farmers to pool resources and either purchase tarpaulins or construct concrete communal drying yards.

f) Lack of storage facilities (reported by 20% of the rice farming communities): Many farmers have limited storage facilities and so they are forced to sell their rice immediately after milling, irrespective of whether the prevailing market price is low. This challenge can partly be overcome by Government constructing warehouses where farmers can store their rice until such a time when prices are appreciably high.

g) Unfavourable loan terms (reported by 17% of the rice farming communities): Buyers of rice (especially millers and middle men usually engage farmers in unfavourable (exploitative) credit and production agreements. For example, when a farmer receives a loan from the miller, they are required to strictly sell to that particular miller, even when he/she is offering a lower price compared to other available buyers. The interest rate charged is also often high. Thus, linking farmers to credit facilities that offer low interest rate loans is necessary to facilitate rice production. On the other hand, it should also be noted that even millers and traders reported that breach of agreements made after advancing payments to farmers was mentioned as one of their biggest challenges.

h) Distant milling facilities (reported by 17% of the rice farming communities): The available rice processing facilities are not evenly distributed within the districts, which forces many farmers in some parts of the districts to travel long distances looking for rice millers. Thus, there is need to create awareness to the private sector to invest or increase investments in rice value addition, given the opportunity that exists in rice growing regions. We observed during fieldwork that a modern large scale rice processing plant, called *EASTERN RICE* had recently be established and so will probably increase/ease farmers' access to quality milling services remarkably.

3.5 Rice processing

3.5.1 Gender disaggregated participation in rice processing

Rice processing involves activities such as buying threshed rice, loading and offloading, transporting threshed rice to the mill, drying the rice to appropriate moisture content before milling, and milling, among others. Results presented in Table 25 indicate that rice processing is largely done by men and generally the youth. The only activities in which women play a significant role is collecting water and preparing lunch for the workers at the mill (50%), cleaning the mill premises (31%), and winnowing and sorting the milled rice (31%). Clearly, women are simply playing a supportive role – they are not participating meaningfully in rice processing. Thus, like earlier mentioned, Government needs to expedite establishment and implementation of the Women Enterprise Initiative to enhance economically meaningful participation of women in rice processing.

Table 25: Percentage contribution of men, women and youth to rice processing activities

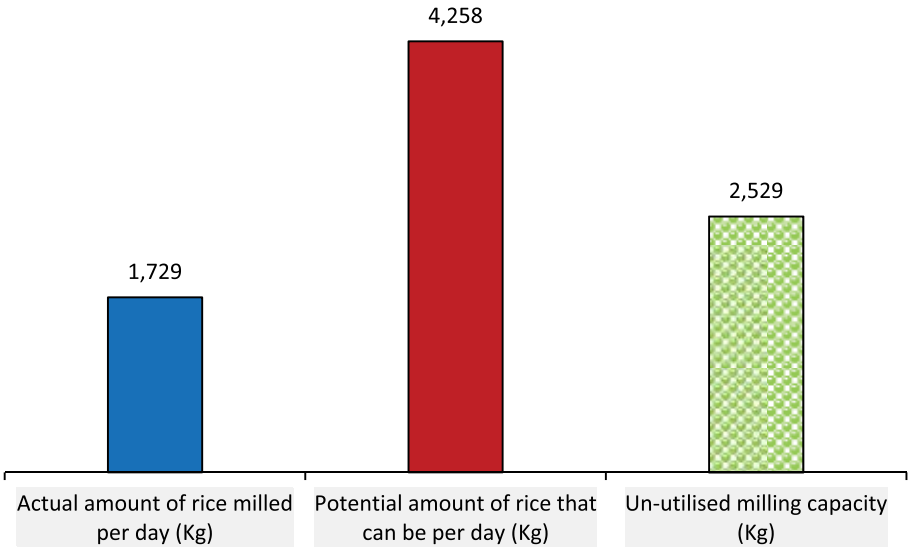
Activity	Men (%)	Women (%)	Youth (18 - 35 years)	Other ages (>35 years)
Loading and offloading rice	100	00	81	19
Store keeping (transporting to store, arranging bags in store & ensuring the store is secure)	97	03	77	23
Rice milling	98	02	73	27
Record keeping and management	84	16	56	44
Cleaning the mill premises	69	31	74	26
Machine cleaning, servicing and maintenance (checking nuts, greasing, & fuelling).	100	00	69	31
Bagging milled rice for storage and selling	96	04	75	25
Drying rice to an appropriate moisture content before milling.	81	19	72	28
Buying and selling rice	95	05	61	39
Weighing rice before and after milling	99	01	78	22
Cleaning milled rice (winnowing, sorting and grading)	69	31	67	33
Supervising workers at the mill	75	25	00	100
Collecting water and preparing lunch for the workers at the mill	50	50	80	20

Source: Authors' calculations based on the 2015 survey of rice millers in Bugiri, Butaleja and Tororo

3.5.2 Rice suppliers and milling capacity

Approximation of milling capacity of rice millers reveal that the millers are on average operating below optimal level by 59% - on average, the volume of rice milled per day is only 41 percent of what the available milling machines can ably mill daily. Rice millers on average mill only 1,729kgs of rice per day compared to 4,258kgs of rice that they can potentially mill (Figure 8). The main reasons advanced by rice millers for operating sub-optimally are; power (electricity) shortages, frequent machine break down and/or poor quality machines, inadequate rice supply from farmers e.g. due to bad weather (drought or flood) or due to off season, and poor rice quality from farmers (e.g. not properly dried and/or unsorted paddy rice).

Figure 8: Milling capacity (used and unused) of rice millers



Source: Fieldwork data – survey of rice millers

Pertaining to innovations, a larger fraction of the rice millers (76%) reported that they have not upgraded their milling technology in the past three years. This shows no or little effort by rice millers in terms of being innovative. The limited upgrade of milling technology could be attributed to financial constraints faced by millers. Nonetheless, some few millers (24%) indicated that they have upgraded their technology for example by installing new milling machines or parts (such as a polisher, engine, and huller); and packaging rice according to specific weights (e.g. 5kg, 10kg, 25kg, and 50kg packs) so as to appeal to a wide range of customers.

In terms of rice supply to the millers, majority of the millers are supplied by individual farmers (Table 26). This finding is consistent with the previous report that most farmers sell their rice on individual rather than group basis. Indeed ranking of suppliers by the rice millers reveal similar finding, with majority ranking individual farmers as their main suppliers of rice.

Table 26: Ranking suppliers according to who supplies the highest volume of rice

Rice supplier category	Percent of millers supplied	Ranking of suppliers: (Rank 1= supplier of biggest volume i.e. main supplier) Frequencies of rice millers by rank			
		Rank 1	Rank 2	Rank 3	Rank 4
Individual farmers	95	62	4	0	0
Farmer groups	18	1	12	2	0
Collectors/traders	43	3	24	6	1
Other	11	1	3	2	1
Total		67	43	10	2

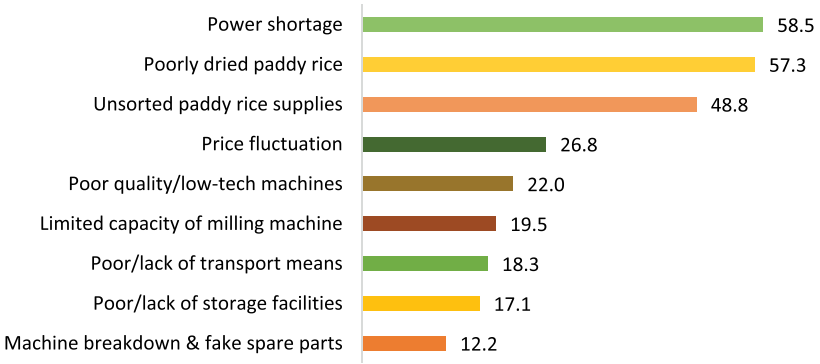
Source: Fieldwork data – survey of rice millers

3.5.3 Challenges faced by rice millers

Rice millers face several challenges but the top five (5) most frequently reported ones are: Electricity outages (about 59 percent); farmers bring poorly dried paddy rice which is an additional cost to the miller to dry the rice to right moisture

content before milling (57 percent); suppliers bring unsorted paddy rice to the millers (about 49 percent); price fluctuations (about 27 percent); and lack of appropriate milling machines that are able to minimise grain breakage and grade the milled rice (Figure 9). Other challenges reported by rice millers include: high electricity tariffs, unreliable farmers to supply rice for which they have received advance payment, stiff competition from other millers, a lot of dust is generated during milling and yet millers lack protective gear (masks), inadequate drying facilities (drying yards and tarpaulins), limited storage capacity, limited capital, high taxes, theft, and seasonal nature of the business – during the growing seasons farmers don't seek milling services.

Figure 9: Key challenges faced by rice millers; n = 82



Source: Authors' calculations based on the 2015 survey of rice millers in Bugiri, Butaleja and Tororo

3.6 Rice trading

3.6.1 Gender disaggregated participation in rice trading

Most (about 87%) rice trading business entities employ 1-5 people; the average number of employees is 3 but the mean for male employees is approximately 4. About 56 percent of the rice businesses did not have any female employee. There are series of activities involved in trading rice, and they include: buying both milled and paddy rice, milling, winnowing and sorting, weighing, packaging and selling, among others. In terms of gender, men contribute the most to all rice trading activities; while in terms of age groups, the youth contribute the most to all trading activities (Table 27).

Table 27: Percentage contribution of men, women and youth to rice marketing

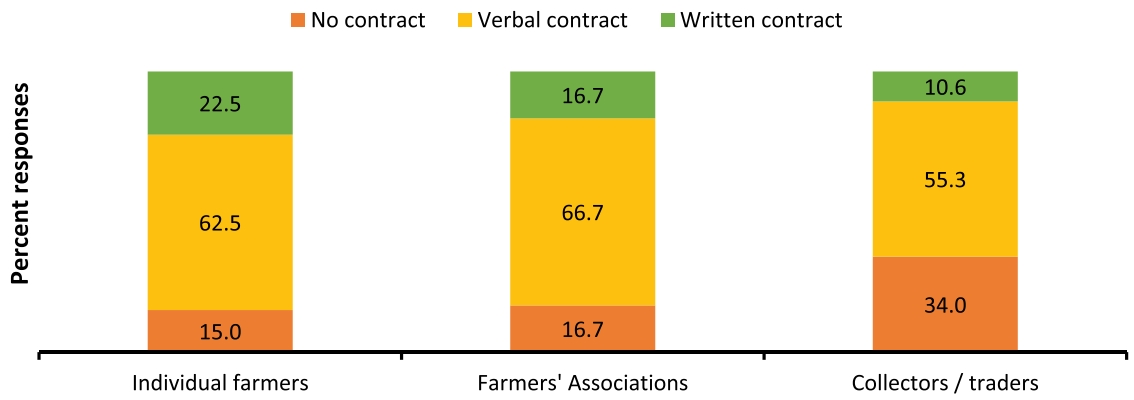
Activity	Men	Women	Youth (18 - 35 years)	Other ages (>35 years)
Weighing, packing and sealing packs	95	5	88	12
Storing rice (carrying to store & arranging bags)	100	0	89	11
Checking rice quality	100	0	86	14
Milling rice	98	2	80	20
Buying and selling rice	90	10	68	32
Collecting and transporting from suppliers	97	3	73	27
Supervising	100	0	75	25
Winnowing, sorting	63	37	85	15
Loading and off-loading	98	2	93	7
Cleaning premise	69	31	85	15
Drying the rice	84	16	87	13
Providing security	100	0	100	0

Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

3.6.2 Sources of rice and relationships between suppliers and traders

Traders mainly obtain their rice from individual farmers (reported by about 84% of traders), collectors/fellow traders (reported by 52%) of the traders, own production (reported by 25% of the traders), farmers' associations (reported by 12% of the traders), and other sources (reported by 2% of the traders)[12]. Two main reasons that make individual farmers the major rice suppliers are: they continuously supply the traders (make repeated supplies) (mentioned by 38% of traders supplied by individual farmers), and they are reliable (reported by 26% of traders supplied by individual farmers). Fifty (50) percent of traders who are supplied by farmers' associations report that the associations are among the key suppliers because they are flexible. Collectors (other traders) are also considered among the major rice suppliers mainly because they are reliable (reported by 24% of traders supplied by collectors) and flexible (reported by 24% of traders supplied by collectors). Majority of the traders agree that it is possible to make advance requests for rice from the various suppliers. This was reported by 93 percent of traders who are supplied by individual farmers; 83 percent of traders who are supplied by farmers' associations; and 80 percent of traders who are supplied by collectors/traders. In most cases, when a trader makes an advance request for rice, the agreement is usually verbal (Figure 10). The commonest practice is that prices are not set/fixed before the rice is delivered to the trader by the supplier. This was reported by 79 percent of traders who make advance requests for rice from individual farmers; 70 percent of traders who make advance requests for rice from farmers' associations; and 55 percent of traders who make advance requests for rice from collectors.

Figure 10: Type of contractual relationship between traders and their major rice suppliers



Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

Further, it is noted that traders offer certain services and goods to their rice suppliers either for free or at a price. The services include: credit (in form of advance payment), advisory services (e.g. on quality improvement, choice of rice variety, etc), transport, storage, and packaging. The goods they provide to their suppliers and mainly on credit are: agrochemicals, fertilisers and rice seed (Table 28). The mutual relationships between traders and farmers are advantageous because to some extent they: ease the credit constraint; improve rice quality by promoting proper post-harvest handling; and could promote intensification since farmers can obtain critical farm inputs from traders on credit.

12 The percentages do not add up to 100 because a trader can be supplied with rice by more than one sources.

Table 28: Services rice traders provide to their suppliers

Service or Input	Traders that offer service/input		Terms of offer	
	Frequency	Percent (n = 97)	At a cost	For free
Credit (in form of advance payment)	78	80.4	76.9	23.1
Advisory services on quality improvement	32	33.0	0.0	100.0
Transport	23	23.7	82.4	17.6
Packaging	22	22.7	92.9	7.1
Storage	17	17.5	28.6	71.4
Agro-chemicals pesticide/ fungicide	15	15.5	73.3	26.7
Paying for loading & off-loading	13	13.4	0.0	100.0
Sorting and grading services	11	11.3	25.0	75.0
Fertilisers	8	8.2	100.0	0.0
Seeds	7	7.2	100.0	0.0

Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

3.6.3 Volume of rice purchases, grading and implications on price received by the supplier

Traders usually source rice for their business from farmer groups, collectors, individual farmers and own production. The major sources of rice supply tend to vary depending on the season. At the peak of the season, the two major contributors to rice supply to traders are farmer groups and collectors respectively; the weekly average volume of rice supplied to any given trader is 16 MT from farmer groups and 11.7 MT from collectors. On the other hand, during off season, collectors become the most important contributor to rice supply to traders followed by own production (Table 29). This particular finding indicates that traders' engagement in rice production plays an important role in sustaining rice flow to their trading businesses.

Table 29: Variations in volumes (Kilograms per week) of milled rice purchased by traders

Rice supplier	Peak season			Off-season		
	Mean	SD	Max	Mean	SD	Max
Average for all suppliers	*8,890.9*	*24,250.0*	*170,000*	*1,099.3*	*2,254.3*	*20,000*
Own production	2,932.8	5,618.3	30,000	1,093.6	1,797.7	7,000
Individual farmers	9,557.2	20,811.5	150,000	1,020.7	1,473.9	10,000
Farmers' Association/Group	16,136.6	44,516.8	150,000	994.1	1,489.3	5,000
Collectors/middle men	11,663.4	31,915.6	170,000	1,246.4	3,425.2	20,000

Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

All traders grade the rice they buy according to the level of cleanliness, extent of brokenness of the grains, and colour, among others. Traders estimated that at least 30 percent of the rice they receive from their suppliers (mainly farmers) is graded as "low quality rice". There is a price for supplying low quality rice; the traders pay a relatively lower price per kilogram of rice that is regarded to be of low quality. Table 30 makes a comparison of prices at which traders buy rice depending on whether it is of acceptable or low quality. On average, farmers lose over UGX 300 per kilogram due to low quality of rice. On a positive note, Government has identified building capacities of farmers in quality standards and market requirements as one of the key priority actions to spur growth.

Table 30: Price paid by traders depending on the quality of rice brought by sellers

Rice variety	Unit buying price (UGX)		Price difference
	Good quality rice	Low quality rice	
Super	2,500	2,200	-300
WITA-9	2,200	2,000	-200
Kaiso	2,150	1,800	-350
Abenego	2,150	1,750	-400
K25	2,000	1,800	-200
Upland	1,800	1,500	-300
NERICA	1,550	1,200	-350
Kibuyu	1,500	1,100	-400
Kabonge	1,300	1,000	-300

Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

3.6.4 Challenges faced by rice traders

Like other actors in the rice value chain, traders face many challenges but key among them are: breach of agreements between traders and farmers[13], low and unstable prices, limited capital, limited market access, low quality of rice supplies, high transport costs, and limited supplies preceding unfavourable weather during the growing season (Table 31). More than half of the traders (about 51%) complained of untrustworthy farmers who receive advance payment for rice but refuse to sell to the traders who advanced the payment. The reason why some farmers breach the agreements is because usually traders who advance payment offer relatively low prices to farmers; so when farmers get a buyer who is willing to offer a better price, they sell to him/her, hence breaking the agreement.

About 51 percent of traders reported that the prices at which they sell the rice are usually low and often fluctuate, something which negatively affects their profit margins. The reasons advanced to explain the low and fluctuating prices include: low quality rice, peak season when supply is high, competition from other traders, cheap rice imported from Kenya, lack of market information, and being price takers – usually the price is set by wholesalers from Kampala.

Table 31: Challenges faced by rice traders

Challenges faced by rice traders	Frequency	Percent (n = 97)
Breach of agreements between traders and farmers & customers	49	50.5
Low and unstable selling prices	49	50.5
Limited capital	36	37.1
Limited and unreliable market - especially during the peak season	33	34.0
Low quality rice supplies	31	32.0
High transport costs/lack of own means of transport	22	22.7
Rice scarcity (limited supplies) preceding droughts or floods	20	20.6
Poor or lack of proper stores	9	9.3
Use of faulty weighing scales	6	6.2

13 Some farmers default on advance payments, particularly by not selling rice to the traders who made advance payments. Usually, farmers take advance payments to facilitate harvesting and post-harvest operations. The farmers agree to sell all their rice to the trader who has offered some advance payment. All this happens mainly because farmers are capital constrained and lack access to formal sources of credit.

Power shortage	4	4.1
High buying price	4	4.1
Theft of rice (especially when traders share the same store)	3	3.1
High milling charges	2	2.1
Lack of proper packaging materials	2	2.1
Distant milling machines	2	2.1

Source: Authors' calculations based on the 2015 survey of rice traders in Bugiri, Butaleja and Tororo

Over 37 percent of the traders face a challenge of limited capital and yet few of them have access to formal sources of credit. Many traders (34%) reported that they lack markets that can offer them high prices. Another key challenge reported by 32 percent of the traders is the low quality supplies from farmers; the rice that traders buy from farmers is sometimes unsorted, not well dried and with tainted colour. Many traders (about 23%) also reported that they incur high transport costs and lack own means of transport. Also ranked among the top challenges by over 21 percent of traders is unreliable and limited rice supply from farmers when rice fields are destroyed by unfavourable weather conditions (usually heavy rains or prolonged drought).

3.7 Rice value chain financing

From the previous sections, we noted that most actors in the rice value chain cited inadequate capital as one of the key challenges limiting expansion. The findings presented in Table 32 indicate that all actors along the rice value chain largely depend on personal savings to invest in their rice related activities. The two commonly mentioned challenges of relying on personal savings are: it takes quite some time to accumulate reasonable amounts, and it is difficult to accumulate adequate funds due to other competing financial needs.

At production level, the two mostly accessed sources of credit are farmer groups (used by 56 percent of farmers) and informal saving schemes (used by 51 percent of farmers). The two major limitations of informal saving schemes and farmer groups are: these sources offer relatively small loans, and when the debtor fails to pay back on time, he/she is mistreated by members of the scheme who also wish to borrow from the limited fund. The mistreatment can be in form of property grabbing or mounting too much pressure on the debtor that he/she is forced to pay back sometimes by selling personal property at low prices.

Table 32: Sources of financing investments in the rice value chain

Source of credit	Seed multipliers (n = 4)[a]	Agro-input dealers (n = 45)	Traders (n = 97)	Millers (n = 80)	Farmers (community level)[b]
	Frequency	**Percent**	**Percent**	**Percent**	**Percent**
Personal savings	4	86.7	87.6	82.5	75.6
SACCOs	0	6.7	3.1	6.3	31
Micro Finance Institutions	0	6.7	3.1	6.3	0
Informal saving schemes	0	6.7	7.2	6.3	51.4
Commercial Banks	2	28.9	24.7	32.5	13
Farmer groups	0	2.2	0	0	56
Private money lenders	0	0	0	1.3	36.7
Other sources	0	6.7	15.5	5	57.4

Source: Authors' calculations based on the 2015 survey of rice value chain actors in Bugiri, Butaleja and Tororo

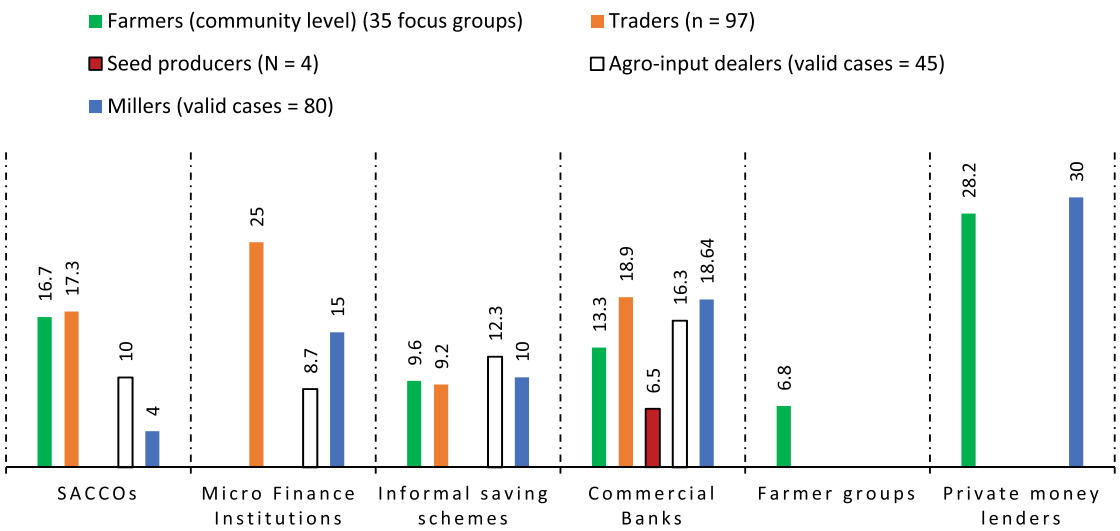
[a]By the time the survey was conducted (May 2015) there were four (4) seed multipliers (1 in Tororo and 3 in Butaleja)

[b]We did not capture data from individual farmers. The figures presented in Table 1 under the column of farmers are based on perceptions of members (farmers) of 35 focus groups that were representing different rice farming communities.

At other levels of the rice value chain, the second commonest source of financing (after personal savings) is commercial banks. We found that two (2) out of the four (4) seed multipliers usually get loans from commercial banks. The other actors who usually borrow from commercial banks are: about 33 percent of rice millers; approximately 30 percent of agro-input dealers; and close to 25 percent of rice traders. Generally, the findings revealed that there are remarkable variations in the levels of access to formal sources of credit among the value chain actors. The following challenges are advanced to explain the generally limited access to formal sources of credit: high interest rates; short pay back periods; collateral requirement and the fear of losing property in case one fails to pay back; and lengthy procedures involved in processing loans, among others.

The monthly interest rates charged on loans are indeed high and they vary by source and type of borrower. Expectedly, private money lenders charge the highest interest rates compared to other sources of credit (Figure 11). Commercial banks too charge relatively high monthly interest rates yet that is where actors in the value chain borrow significant amounts of money (see Table 33). Thus, there is need to relax the interest rates in order to expand access to the much needed credit. Concerning intensification and fertiliser use in particular, Okoboi and Barungi (2012) reported that access to affordable credit is pertinent in increasing availability and use of yield enhancing inputs.

Figure 11: Cost (monthly interest rate (UGX)) of financing investments in the rice value chain



Source: Authors' calculations based on the 2015 survey of rice value chain actors in Bugiri, Butaleja and Tororo

Note: We did not capture data from individual farmers. The figures presented for farmers are based on perceptions of members (farmers) of focus groups that were representing 35 different farming communities.

Table 33: Amounts[14] of money (million shillings) typically borrowed to finance rice related investments

Source of credit	Seed multipliers (valid cases = 3)		Agro-input dealers (valid cases = 45)		Traders (n = 97)		Millers (valid cases = 80)	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
SACCOs			0.50	1.00	1.00	2.00	0.50	1.00
Micro Finance Institutions			1.50	3.00	1.10	5.00	3.00	5.00
Informal saving schemes					0.20	0.40	0.90	1.75
Commercial Banks	2.50	4.75	3.00	5.50	1.50	3.25	2.50	7.00
Farmer groups					0.45	1.25		
Private money lenders							0.20	0.40
Other sources			100.00	100.00			0.65	2.65

Source: Authors' calculations based on the 2015 survey of rice value chain actors in Bugiri, Butaleja and Tororo

14 The amounts of loans indicated in the table are medians. This is because there were a few extreme values (outliers) that would have greatly influenced the mean, hence distorting what might be considered typical.

4. SUMMARY OF EMERGING ISSUES IN THE RICE VALUE CHAIN

Information Box 2: Key emerging issues in the rice value chain

VALUE CHAIN NODE	KEY MESSAGES
INPUT SUPPLY: a) **Rice seed production**	• There are few rice seed multipliers and in some districts like Bugiri there is none at all. • Only one out of the four rice seed multipliers is registered and certified by MAAIF, implying that the authenticity of seed produced by the other three multipliers cannot be guaranteed. • If most farmers were to embrace use of improved rice seed, the existing four seed multipliers would not be able to meet farmers' seed demand. • Seed supply deficiency is aggravated by the fact that currently, the rice seed multipliers rarely sell seed to farmers within their communities – rather they mainly sell to seed companies and other organisations that provide the foundation seed. • There is need to establish at least 40 new rice seed production enterprises to serve the local farmers' seed need. • Seed multipliers face many challenges including: pests and diseases, lack of modern farm tools, unfavourable weather extremes (drought and floods), emergence of stubborn weeds, and limited inputs markets.
INPUT SUPPLY: b) **Agro-Inputs supply**	• Agro-input dealership is dominated by men. • Majority of agro-input dealers neither stock nor sell improved rice seed, partly because they lack suppliers of this vital input. • Few agro-input dealers have received training in safe handling and use of agro-inputs, implying that their ability to effectively transfer correct knowledge and technical advice to farmers is questionable. • Field observation reveal that some agro-input dealers mix agro-chemicals with other items like foodstuff in the same shop, a practice that is not recommended for safety reasons. • Presence of fake agro-inputs in the market is partly to blame for the low levels of intensification – it discourages farmers from buying and using agro-inputs. • Less than half of the agro-input dealers are registered (mostly with UNADA and the District Local Governments), implying majority are operating informally and illegally – hence, they are less likely to be inspected by MAAIF to ensure conformity to set standards. • The core constraints faced by agro-input dealers are: inadequate market due to limited demand and use of agro-inputs, limited capital to facilitate stocking of diverse inputs in adequate quantities, and presence of counterfeit inputs from suppliers.

Information Box 2: Key emerging issues in the rice value chain … continued

VALUE CHAIN NODE	KEY MESSAGES
PRODUCTION: Rice farming	• The main rice varieties grown by farmers are Kaiso, Super and WITA9. • A significant proportion of farmers grow local (unimproved) rice varieties. • Rice seed recycling is a common practice amongst farmers - majority of farming households use recycled rice seed. • There is low access and use of rice yield-augmenting inputs (fertilisers and improved rice seed), hence low level of intensification. • It is more than twice harder to access improved rice seed compared to fertiliser and the rest of inputs. • More farmers groups (49%) cited limited access to improved rice seed markets, compared to only 3 percent who cited limited access to fertiliser and other inputs (like pesticides). • There is a huge mismatch between the main rice varieties grown by farmers and those multiplied by rice seed multipliers. • Farming experience and access to agricultural extension and training are potential catalysts to rice crop intensification. • Existence of counterfeit input is affecting some farmers – they don't get the expected yield increment and are thus discouraged to continue buying and applying inputs. • Weather uncertainties (particularly heavy rains and prolonged drought) present one of the key challenges affecting rice production. • There is lack of appropriate or poor post-harvest handling facilities, which compromises the quality of rice during drying and hence attracting a low price at the time of sale.
RICE PROCESSING	• Most rice milling businesses are not registered, however, they have trading licenses. • Most millers do not belong to any rice miller's association, which reflects weak organisational capacity of the rice millers. • Rice millers are on average operating sub-optimally i.e. only about 41 percent of potential processing capacity is being utilised. • Frequent power outages and high electricity tariffs negatively affect rice processing business. • Majority of rice millers in the districts or region do not have the capacity to carry out large scale rice processing. • Most millers are using low-tech milling infrastructure such that majority are unable to grade or sort rice, and packaging rice poorly. • The quality of rice brought by farmers for processing is sometimes of poor quality - poorly dried (high moisture content), and unsorted (containing foreign matters like stones). • The available rice processing facilities are not evenly distributed within the districts, which forces many farmers in some parts of the districts to travel long distances in search for milling services.

Information Box 2: Key emerging issues in the rice value chain … continued

VALUE CHAIN NODE	KEY EMERGING MESSAGES
RICE TRADING	• Most traders (96%) are not registered and less than half of them have trading licenses, implying that majority are operating informally. • There is poor packaging of rice by farmers, rice millers and traders. • Majority of farmers market and sell rice on individual rather than group basis. The farmers who sell individually fetch lower prices than those who sell using the group marketing approach. • Cheating of farmers by traders through middlemen (collectors) is rampant. Farmers are cheated through unfair lending arrangements and low price offers. • Farmers are also cheated by traders who deliberately adjust their weighing scales to show lower reading than the actual weight of the rice being measured. Indeed, this was ranked among the top marketing challenges faced by farmers.
SUPPORT SERVICES (financial institutions, training and extension)	• There is inadequate capital and limited access to formal sources of credit along the entire rice value chain. Actors largely depend on personal savings and loans from informal sources of credit. • The key factors that limit access to credit include high interest rates, short pay-back period and collateral requirements. • Access to appropriate agricultural extension and training is a potential booster of rice crop intensification. • There are organisations operating in the study districts to promote agro-input dealership by for example; training agro-input dealers, and linking them to input sources and financial institutions. • Other organisations provide foundation seed and train selected farmers to produce rice seed. They also provide market for the rice seed. • Agro-input dealers provide technical advice to their clients and so do the rice seed multipliers.

5. CONCLUSION AND RECOMMENDATIONS

This study was motivated by the need to intensify rice production and strengthen the rice value chain in Uganda, particularly in the Eastern region. It was undertaken to: assess farmers' access to and use of rice yield-augmenting inputs; and identify core constraints and opportunities for improving efficiency in the rice value chain. We used data from surveys of rice value chain actors in three leading rice producing districts of Eastern Uganda (Bugiri, Butaleja and Tororo).

Findings show that the main rice varieties grown by farmers in the three Eastern region districts are Kaiso, Super, and WITA9. Other varieties grown include; NERICA, Upland rice, Bukasolo, Abenego, China, Nigeria, and others (like Namuche, Kibimba, Kibuyu, and Kabonge). Apart from WITA9, the other rice varieties that are commonly multiplied for seed by seed multipliers are not what farmers usually/primarily grow (i.e. NERICA, Namuche, CH, and GRS10057). Therefore, there is a mismatch between the commonly multiplied rice seed varieties and the varieties commonly grown by farmers. This mismatch suggests that rice seed multipliers do not multiply seed according to farmers' preferences, rather their choices are driven by the contracting companies or suppliers of foundation seed.

Generally, there is low use of rice yield-augmenting inputs (improved seed and fertiliser) amongst farmers, and most farmers recycle rice seed. Even for the farmers who reported that they grow improved rice varieties, majority of them do recycle the seed. Use of unimproved (local) rice seed is common even for the most grown rice variety, with the exception of WITA9 whose seed is primarily distributed to farmers by Non-Governmental Organisations operating in the three districts. The limited use of improved rice seed is partly explained by absence of seed markets, unaffordability of improved seed by farmers (i.e. improved seed is generally expensive) and lack of knowledge by farmers on how to grow improved seed. Another reason for not using improved rice seed is that some farmers are worried about the quality of the seed sold by input stockists, which is partly attributed to previous experience of having ever bought counterfeit seed.

Pertaining to intensification through use of fertiliser, the main stumbling blocks are: unaffordability of fertiliser by farmers (high cost of fertiliser), farmers fear that use of fertiliser will damage their soil (caused by lack of or limited knowledge about fertiliser use), unavailability of fertiliser in areas where farmers are located, lack of knowledge on how to use fertiliser, fertiliser use is perceived to be unprofitable, and the belief that there is no need to use fertiliser because the soil is still fertile. Further, we find that farming experience and access to agricultural training and extension are associated with increased intensification in terms of use of improved rice seed and fertiliser.

Now focusing broadly on the entire rice value chain, we note that at all levels of the value chain, actors face several challenges and some of them cut across all or most of the actors. Below we provide a synthesis of the major constraints that should be addressed if the rice value chain is to be upgraded. Value chain upgrading requires that key constraints faced by the chain actors be limited or minimised in order to improve efficiency in production, commercialisation and competitiveness.

Lack of reliable markets: Agro-input dealers have limited market for the inputs mainly because the would-be users (farmers) have misconceptions about the inputs (for example, that fertilisers spoil the soil, and improved varieties are of low nutritional value), hence there is little demand for the inputs; and the cost of inputs is generally high and unaffordable. Rice seed multipliers lack market within the communities where they produce; yet, as mentioned already, farmers also report they lack market for improved rice seed. Traders and farmers too lack reliable markets for rice and rice by-products (rice bran and husks).

Price related challenges: At input supply level, the prices of agro-inputs are high and often fluctuating; this affects the dealers' margins. Similarly, farmers and traders face a challenge of low and often fluctuating selling price. On the part of farmers, low prices are partly explained by poor quality rice and limited bargaining power, especially when the farmer has received advance payment or is selling individually. For the traders the low prices are partly explained by the fact that their major clients (wholesalers usually from Kampala) are the price makers. The price levels and fluctuations are a disincentive because they reduce the margins of the affected value chain actors.

Limited capital: This constraint cuts across all levels of the rice value chain. All actors in the value chain largely rely on personal savings to invest in rice related activities. Usually, the savings are inadequate due to other competing demands. Lack of capital limits investment in modern technologies such as improved seed, tractors, planters, weeders, harvesters, and high-tech milling machines, among others. Especially at production level, activities involved are labour intensive and therefore, a shift from rudimentary to modern improved farm implements would greatly reduce the demand for human labour. Thus, lack of or limited access to capital might hinder upgrade of the rice value chain.

Fake agro-inputs: There exist fake/counterfeit inputs (particularly fertilisers, pesticides and herbicides) on the market; this affects both agro-input dealers and farmers. The fake inputs are not effective and thus discourage farmers from buying and applying inputs. Thus, as way to increase demand and use of agro-inputs, there is need to ensure distribution of genuine inputs.

Pests and diseases: Farmers (both seed and grain producers) face a challenge of pests and diseases, which remarkably lower yields. The commonest diseases are rice yellow mottle virus and rice blast fungus while the most problematic pests are rats and birds. Farmers lack knowledge and resources to effectively control rice pests and diseases.

Weather uncertainty: This is one of the key challenges that affect all actors in the rice value chain but especially farmers (both seed and grain producers). Extreme weather conditions (prolonged drought and heavy rains) usually destroy rice fields hence reducing output in terms of harvested rice. Consequently, there is limited supply to millers and traders to keep them in operation at such times. Also, the farmers' capacity to repay loans diminishes since they mostly depend on rice revenues to offset loan.

Lack of proper post-harvest handling facilities: Some farmers lack appropriate drying yards and tarpaulin sheets on which to dry the rice. Yet proper drying of rice is one of the most important post-harvest practices that greatly impacts on the quality of the milled rice. For example, if the threshed rice is not well dried, the percentage of broken grain will be high and the grains may not have a uniform colour; and if threshed rice is dried on bare ground and if it is not properly winnowed and sorted before being taken for milling, the milled rice will contain stones. Milled rice with high percentage of broken grain and containing stones is graded as low quality rice and it attracts a lower price.

Power outages and high tariffs: Electricity outage is a common occurrence that affects both millers and farmers. In the absence of electricity to run the milling machines, millers close down or turn to more expensive alternative of using diesel engines. It also inconveniences farmers seeking milling services – sometimes they have to travel back home and return at a later time or look for other distant mills to have their rice milled. The high electricity tariffs increase cost of operation and reduce margins; they also cause millers to charge high milling fees hence reducing the farmers' proceeds.

Turning to employment opportunities, we found that participation in activities along the rice value chain is generally dominated by men, especially trade (stocking and selling inputs, selling rice seed, and selling rice). Therefore, there is need to

put interventions in place to empower women so that they can also participate in an economically gainful manner in the rice value chain. Specifically, the plan by Government to establish a Women Enterprise Initiative that enhances women participation along the agricultural value chains should be expedited.

Majority of farmers sell rice on individual rather than group basis yet group marketing approach is associated with relatively higher prices received by the farmer. Therefore, fundamentals at community level that cause farmers to shun group marketing need to be comprehensively dealt with for farmers to earn the relatively high revenues that accrue from group marketing. Thus, promoting group marketing could be one of the pathways to accelerate poverty reduction efforts among agricultural communities.

Lastly, we observe that lack of/limited access to improved rice seed is one of the most binding constraints to rice intensification and thus requires urgent action. Results show that it is more than twice harder to access improved rice seed compared to fertiliser and other agro-inputs. There is a huge deficit in the supply of improved seed and this would get worse if most farmers embraced the use of improved seed. The rice seed supply deficit is further widened by the fact that the largest rice seed multipliers rarely supply seed to farmers within their communities- they mainly sell to seed companies and other organisations that provide the foundation seed. In order to meet farmers' future demand for improved rice seed, the study has estimated that at least 40 new seed production enterprises should be established in the communities; this venture is estimated to cost slightly over one billion Uganda shillings only.

Based on the findings, we recommend that interventions aiming at increasing rice crop intensification should focus on the following:

i. Addressing the factors leading to inaccessibility and restraint to the use of rice yield-augmenting inputs. High costs and unavailability of improved seed and fertiliser in the local communities (or markets) can for example, be checked through input subsidy programmes; or establishment of at least 40 new rice seed multiplication sites within the three districts. The suggested new seed production enterprises should serve the seed needs of local farmers in the communities such that they multiply specific rice seed varieties demanded/preferred by the local farmers.
ii. Strengthening the inspection arm of MAAIF in order to address issues of counterfeit inputs sold by agro-input stockists.
iii. Utilising farmers with richer farming experience as examples to showcase and advocate for intensification.
iv. Strengthening the Directorate of Agricultural Extension Services (MAAIF) to provide relevant services to rice farmers as a means to promote intensification. Through effective extension service provision, the knowledge gap on farmer's side will be reduced. Also, sensitization and awareness creation campaigns can be embarked on in order to counteract the negative beliefs that farmers have concerning use of yield-augmenting inputs particularly fertilisers.

Given that there are income benefits from economies of scale in rice marketing that accrue to farmers that opt to market their rice as a group, the following measures are suggested to strengthen farmer groups as institutions:

a) Widely educate and popularise the advantages (associated benefits) of group marketing of rice. This will strengthen the ability of farmers to link and access rice markets within and outside their districts or region. Already some NGOs (particularly IFDC) started linking some farmer groups to markets, so Government and other non-state actors can leverage on such existing efforts.

b) Encourage all rice farmers to join groups and through education and training, remove inefficiencies (such as poor mobilisation and mistrust) from existing groups to encourage collective action/marketing. Capacities within these groups can be gradually developed into rice growing communities with owned and managed SACCOs that can extend credit to off-set urgent family needs of farmers.

c) Encourage farmers to grow premium and high value rice varieties like WITA9. This can achieved through creation of more awareness about such improved varieties and creating effective and efficient seed systems.

d) Individual marketing is partly blamed on the shortage of appropriate storage facilities. Thus, Government and NGOs should consider investing in storage facilities to enable farmer groups to store and market rice collectively and in bulk. Therefore, implementation of government led projects such as the "produce storage facilities development project"[15] that is still in the pipeline need to be expedited.

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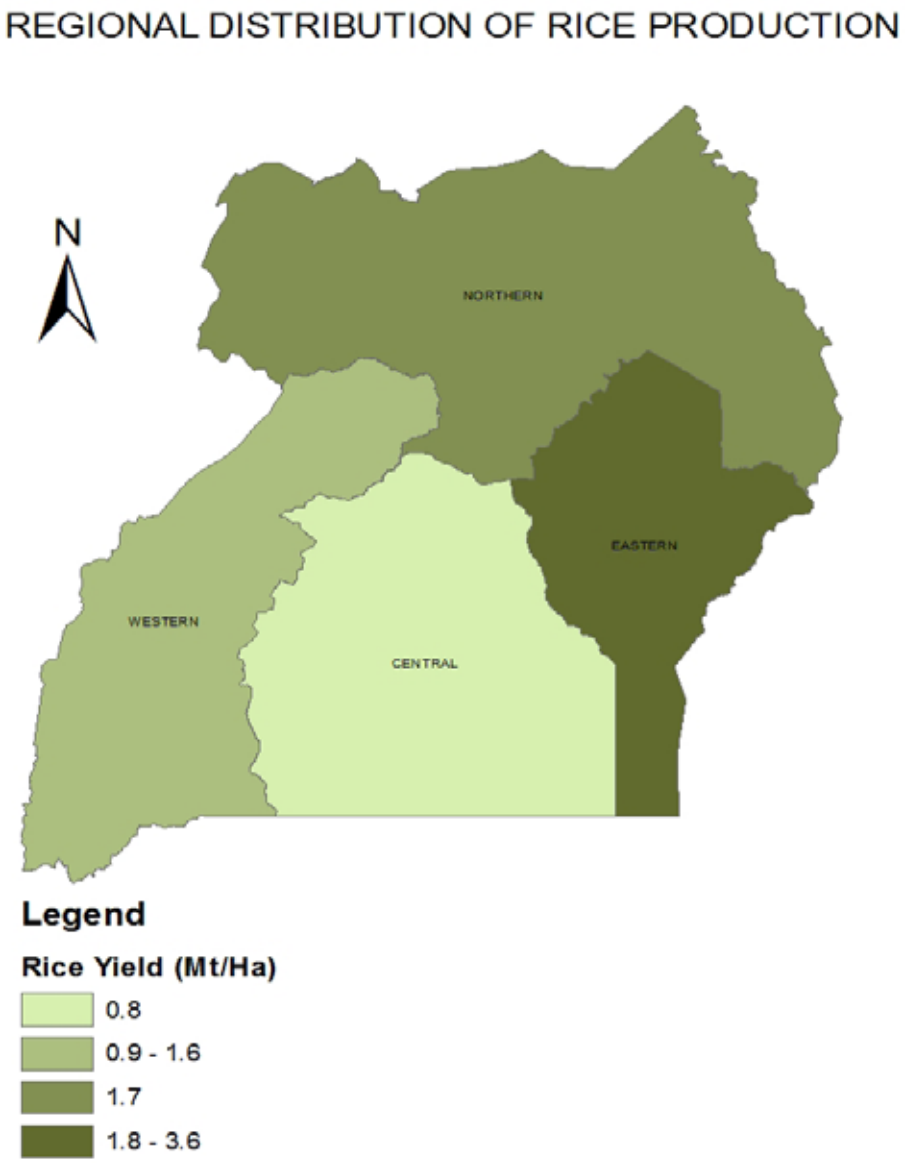
APPENDIXES

Appendix I: Variation in rice yields (MT/Ha) across regions in Uganda



Appendix II: Study sites and number of respondents by district

District	Sub-counties covered in the socio-economic survey	Sub-counties included due to CATALIST	Total number of sub-counties covered in this study	Number of Rice seed multipliers	Number of Agro-input dealers	Number of Focus Group Discussions (FGDs)	Number of Rice millers	Number of Rice traders
Tororo	▪ Osukuru ▪ Merikit ▪ Mulanda ▪ Iyolwa ▪ Paya ▪ Nabuyoga ▪ Rubongi ▪ Kirewa	▪ Molo ▪ Magola ▪ Nagongera	11	01	15	16	16	28
Bugiri	▪ Kapyanga ▪ Budhaya ▪ Buwunga ▪ Iwemba ▪ Nankoma ▪ Bulesa	Bugiri Town Council[16]	07	00	21	11	38	34
Butaleja	▪ Naweyo ▪ Mazimasa ▪ Kachonga ▪ Butaleja Town Council		04	03	10	08	28	35
TOTAL	**18**	**04**	**22**	**04**	**46**	**35**	**82**	**97**

16

16 We included Bugiri Town Council because it is an area with the highest concentration of rice millers, traders, and input dealers in the district.

Appendix III: Socio-demographics based on household survey data in rice growing districts

Variable	Frequency	Percent (%)	Obs.	Mean	S.D	Min.	Max.
Female – All	1,450	50	2,903	-	-	-	-
Male – All	1,453	50	2,903	-	-	-	-
Female headed households	29	7	398	-	-	-	-
Male headed households	369	93	398	-	-	-	-
Age – All individuals	-	-	2,881	19	16.08	0	96
Age – Household Heads (HH)	-	-	398	42	12.92	16	86
Education (All): No formal education	436	16.37	2,664	-	-	-	-
Primary level	1,803	67.68	2,664	-	-	-	-
Junior level	9	0.34	2,664	-	-	-	-
Secondary level	374	14.04	2,664	-	-	-	-
Tertiary & postgraduate	42	1.58	2,664	-	-	-	-
Marital status: Single	1,019	54.40	1,873	-	-	-	-
Married (monogamous)	632	33.74	1,873	-	-	-	-
Married (polygamous)	161	8.60	1,873	-	-	-	-
Widowed	35	1.87	1,873	-	-	-	-
Separated/divorced	26	1.39	1,873	-	-	-	-
Primary activity of HH head: Crop production	346	87.15	397	-	-	-	-
Livestock Production	1	0.25	397	-	-	-	-
Trader	13	3.27	397	-	-	-	-
Artisan	14	3.53	397	-	-	-	-
Agricultural paid job outside the holding	1	0.25	397	-	-	-	-
Non-agricultural paid job	17	4.28	397	-	-	-	-
Others	5	1.26	397	-	-	-	-

Source: Author's computation from baseline PASIC household socio-economic survey data

Appendix IV: Miller characteristics

Variable	Observations	Frequency	Percent	Mean	SD	Min	Max
Male	82	80	98	-	-	-	-
Female	82	2	2	-	-	-	-
Designation: Owner/Proprietor	81	47	58	-	-	-	-
Employee	81	34	42	-	-	-	-
Age	81	-	-	38	10.866	16	65
Experience (years)	80	-	-	8	6.077	1	25
Business registration: Yes	79	27	34	-	-	-	-
No	79	52	66	-	-	-	-
Presence of trading license: Yes	58	51	88	-	-	-	-
No	58	7	12	-	-	-	-
Perceived scale of operation: Small scale	80	40	50	-	-	-	-
Medium scale	80	35	44	-	-	-	-
Large scale	80	5	6	-	-	-	-
Ownership of transport means: Yes	77	27	35	-	-	-	-
No	77	50	65	-	-	-	-
Ownership of storage facility: Yes	72	70	97	-	-	-	-
No	72	2	3	-	-	-	-
Number of employees	82	-	-	5	3.113	1	20
Member of rice millers association: Yes	79	22	28	-	-	-	-
No	79	57	72	-	-	-	-
Education: Below primary/none	80	1	1.25	-	-	-	-
Primary level	80	41	51.25	-	-	-	-
Junior (J1-J3)	80	0	0	-	-	-	-
Secondary level	80	26	32.50	-	-	-	-
Post-primary/specialized certificate	80	1	1.25	-	-	-	-
Post-secondary/degree	80	11	13.75	-	-	-	-

Source: Author's computation of fieldwork data (survey of rice millers) – 2015

Appendix V (A): Is the seed certified or recycled (For those who have ever used improved seed)

	Frequency	Percent
Certified	27	12
Recycled by HH	128	59
Recycled by another input provider	24	11
Certified and recycled	39	18

Source: Author's computation from baseline PASIC household socio-economic survey data

Appendix V(B): Use of improved rice seed (Household level) and experience with counterfeit rice seed

Ever used improved rice seed	Frequency	Percent
Yes	224	56
No	110	28
Don't know	64	16
	398	100
Experience with counterfeit rice seed		
	Percent	
Yes	34	
No	66	

Varieties where counterfeit is majorly experienced include: Super, Kaiso and Benenego

Source: Author's computation from baseline PASIC household socio-economic survey data

Appendix VI: When HH started rice farming (experience in rice farming)

Year	Freq.	Percent
1970-1975	3	0.75
1976-1979	4	1.01
1980-1984	3	0.75
1985-1989	16	4.02
1990-1995	48	12.06
1996-1999	29	7.29
2000-2004	81	20.35
2005-2009	94	23.62
2010-2014	120	30.15
Total	398	100

Source: Author's computation from baseline PASIC household socio-economic survey data

Appendix VII: Main sources of inputs in order of prominence amongst farmers

Sources of improved rice seed	Sources of fertiliser - inorganic
• IFDC • Other NGOs (Africa 2000 network, etc.) • NAADS • Lead farmers • Individuals in the community • Farmer's shop	• Agro-input shops (e.g. Bafranko, TODIFA, Okuyat, Ngono pawere magodesi, etc.) • IFDC • Individuals in the community

Source: Fieldwork data – FGD with farmers

Appendix VIII: Rice miller's scale of operation versus rice grading and milling capacity

Scale	Applies grading to rice		Volume of rice processed in a day on average – Kgs
	Yes (%)	No (%)	
Large	100	0	5,060
Medium	87	13	1,100
Small	91	9	1,943

Source: Author's computation from rice miller's survey data

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