ECONOMIC POLICY RESEARCH CENTRE

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MAIZE

AGRO-INDUSTRIALISATION

State of Uganda's Maize Industry

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1. Background

Maize is one of the most important cereal crops in Uganda. It is part of the 12 agricultural commodities that Government considers to have the potential to remarkably contribute to increasing rural incomes and improving livelihoods, and food and nutrition security.[1] Maize doubles both as a cash and food crop for most smallholder farmers. In addition, it is a major ingredient in poultry and livestock feeds. In terms of food and nutrition security, maize compares favourably with root and tuber crops as an energy source because it contains large quantities of carbohydrates, proteins, vitamins and fats in the kernels. The crop is highly commercialised and is a source of livelihood to farmers, traders and processors. At national level, maize is one of the most traded non-traditional export commodities. Given its importance, it is believed that maize can potentially contribute to attainment of Uganda's agro-industrialisation agenda through deepening of the maize product space. This case study provides deeper insights into the different nodes of the maize value chain.

2. Production

Maize is grown in all parts of the country, with the eastern region ranked as the leading producer. Like many other non-plantation crops, maize production is dominated by smallholder farmers. According to Barungi et al. (2016)[2], the percentage of maize farmers who use improved technologies and practices are as low as: 21 percent for improved seed, 9 percent for pesticides, 8 percent for chemical fertilisers, 7.7 percent for herbicides, about 3 percent for mulching, and less than one percent for irrigation. Due to limited use of productivity-enhancing technologies and practices, the average maize yield was estimated at 1.65 tons per hectare in 2015/16 compared to 5 tons said to be achievable at research stations.[3] This represents a huge yield gap of 3.35 tons per hectare. In terms of production, the country produced about 2.5 million tons of maize in 2016 (**Table 1**), against a national target of 10 million tons by 2020. Given the low and often fluctuating levels of production and productivity, the maize subsector may not fully and sustainably contribute to attainment of the country's industrialisation agenda – job creation for shared prosperity. Therefore, there is great need to significantly enhance production and productivity if Uganda is to fulfil the agro-industrialisation agenda but also to take advantage of high demand for maize grain within the East Africa Community (EAC).

According to USAID (2014), maize producers are categorised into three, namely Commercial - High input and agricultural equipment use; Limited cash input – sell surplus due to enhanced technology use; and No cash input – have small surplus for sale because of low yields associated with limited use of technology. More details about the three categories of maize producers are presented in **Table 2**. It should be noted that maize farmers suffer huge post-harvest losses (on average

Table 1: **Area (hectares) planted and quantity (tons) of maize produced, 20112 - 2016**

	2012	2013	2014	2015	2016
Area planted (Ha)	1,093,786	1,101,453	1,103,105	1,125,168	1,128,543
Production (Tons)	2,734,465	2,748,137	2,647,453	2,812,919	2,482,795
Yield (Tons/Ha)	2.5	2.5	2.4	2.5	2.2

Note: The maize sub-sector targets to annually produce 10 million metric tons by 2020.
The potential maize yield (based on what is achieved at research stations) is 5 tons per hectare.
Source: UBOS Statistical Abstract (2017).

Table 2: **Categorisation of maize farmers in Uganda**

Farmer category	Number of farmers (percentage of all maize farmers)	Average size of maize farm	Percentage of produce sold	Technology use	Yield (tons per hectare)
Commercial	170,000 (About 5%)	>5 ha	100%	Full package	>3.5
Limited cash inputs	1,200,000 (About 35%)	2-5 ha	50%	Limited fertiliser + improved seed	2.1 – 3.5
No cash inputs	2,100,000 (Slightly over 60%)	<2 ha	<50%	No fertiliser + improved seed	1.1 - 2.1

Source: USAID, 2014

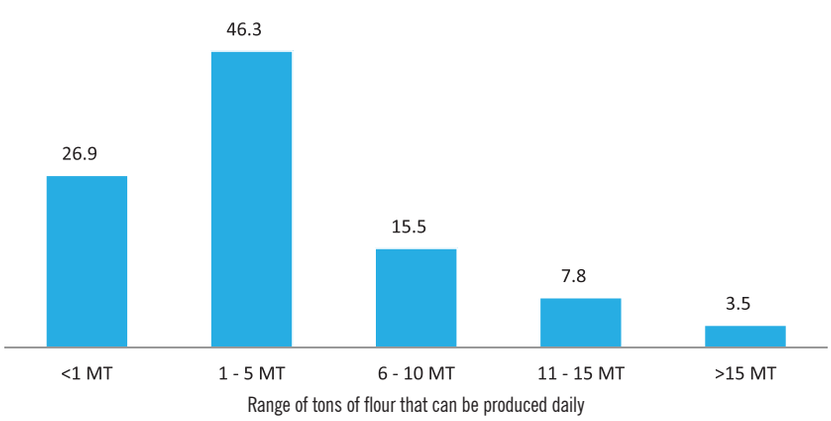
30% of production), retain 20 percent of maize produced for own consumption (including seed), and sell the remaining 50 percent. Post-harvest losses mainly stem from inadequate drying and poor storage techniques[4]. Currently, most of the functional grain processing and storage facilities available are owned by private companies and so farmers are expected to pay for cleaning, drying and storage services. Out of the grain storage capacity of 750,000 tons, at least 70 percent of this capacity belongs to members of the Grain Council of Uganda—a private multi-stakeholder members organisations. Thus, Government should invest in storage infrastructure at community level to increase farmers' access to affordable proper post-harvest handling services and there by minimise post-harvest losses.

3. Processing and manufacturing

There are several small and medium scale millers in all maize growing areas. Large-scale maize millers are few and concentrated in big urban centres. Maize flour (unblended) is the main product obtained from maize processing. Other processed products from maize grain that are produced and consumed locally include cornflakes, dog feed, blended flours (e.g. maize bended with millet and maize blended with soy bean), fortified flour, oil, and maize bran.

A national wide mapping of maize millers conducted by SPRING (Strengthening Partnerships, Results, and Innovations in Nutrition Globally)[5] in 2017 revealed that there were at least 780 maize milling plants in Uganda. Most of them are in the central region (38 percent), followed by eastern and northern regions both at 22 percent and lastly western region (18 percent). Most (96.5%) of the maize mills produce not more than 15 tons of flour per day (Figure 1), yet, the installed capacities are high countrywide. Specifically, the average daily flour production per mill is 104.7 tons for eastern region, 74.5 tons for central, about 56 tons for western and 20.5 tons for northern region. This means there is still large room for expanding flour production capacity by utilising all of the installed capacities of the maize mills. This calls for stable production and supply of quality maize grain throughout the year. It is also important to stimulate and enable firms to add more value (beyond flour) by providing enablers such as cheap electricity and tax wavers

Figure 1: **Percentages of maize millers disaggregated by actual quantities of flour produced daily**



Source: (SPRING, 2017).

4. Marketing

In terms of domestic marketing, most smallholder farmers sell grain or cob maize directly to rural traders (middle men) and small- and medium-scale millers due to a lack of reliable formal buyers and a lack of strong farmer cooperatives engaging in group marketing. It is reported that traders (middle men) often engage in unscrupulous practices such as; using inaccurate weighing scales to 'cheat', and fixing low prices. Nonetheless, middle men play a critical role in aggregating maize at village level and moving it to higher nodes of the maize value chain. Further we note, individual farmers are price takers, not price makers. Maize grain prices are largely determined by traders in the informal sector.

Most of the maize flour is consumed locally, partly because there is high demand from prisons, schools, hospitals, households and individuals. Indeed, Maganjo Grain millers Ltd, one of the large scale maize grain processors in the country reported that they are unable to meet the local demand for flour. Also, a report by SPRING (2017) revealed that maize millers mostly target the local market, and that on average 83 percent of the flour is sold within the country.

At regional level, Uganda mainly exports maize grain to EAC member states, where it is used as a raw material for their industries. This is because, available domestic demand aside, the biggest buyer of Uganda's maize in the EAC (i.e. Kenya) prefers to buy grain since it has a more advanced milling industry that is able to produce more nutritious (fortified) composite flour types compared to what is currently produced in Uganda (personal communication from the Country Programs Manager, Eastern Africa Grain Council, Uganda office). In Uganda, only four maize mills are engaged in maize flour fortification (SPRING, 2017), i.e. adding key vitamins and minerals to the flour to improve its nutritional value. As indicated in **Table 3**, the product space for maize in Uganda is not yet fully exploited, and can be expanded by improving the quality of grain and processing higher volumes of flour, oil, and cake, and other high-end products that meet the EAC harmonised standards. According the Chairperson of the Grain Council of Uganda, there are processors who would be willing to do a lot of value addition but currently in Uganda, there is very little demand for certain value added maize products like cornflakes. Thus, there is need for Government to negotiate for and safeguard regional markets for maize grain and other high-end manufactured maize products.

5. Efforts towards organising maize production, marketing and processing

There are efforts by both Government and non-state actors to boost maize production and ensure sufficient supply of grain for processing. Currently, Government interventions largely focus on production level and they include: producing and distributing improved maize seed; improving access and use of fertilisers; increasing pest and disease control measures; promoting mechanisation; improving access to extension services; supporting post-harvest handling; and supporting processing and value addition including household cottage industries[6]. The specific interventions are being implemented through programmes and projects, such as Operation Wealth Creation (OWC), Agricultural Credit Facility (ACF), and the Agricultural Cluster Development Project (ACDP).

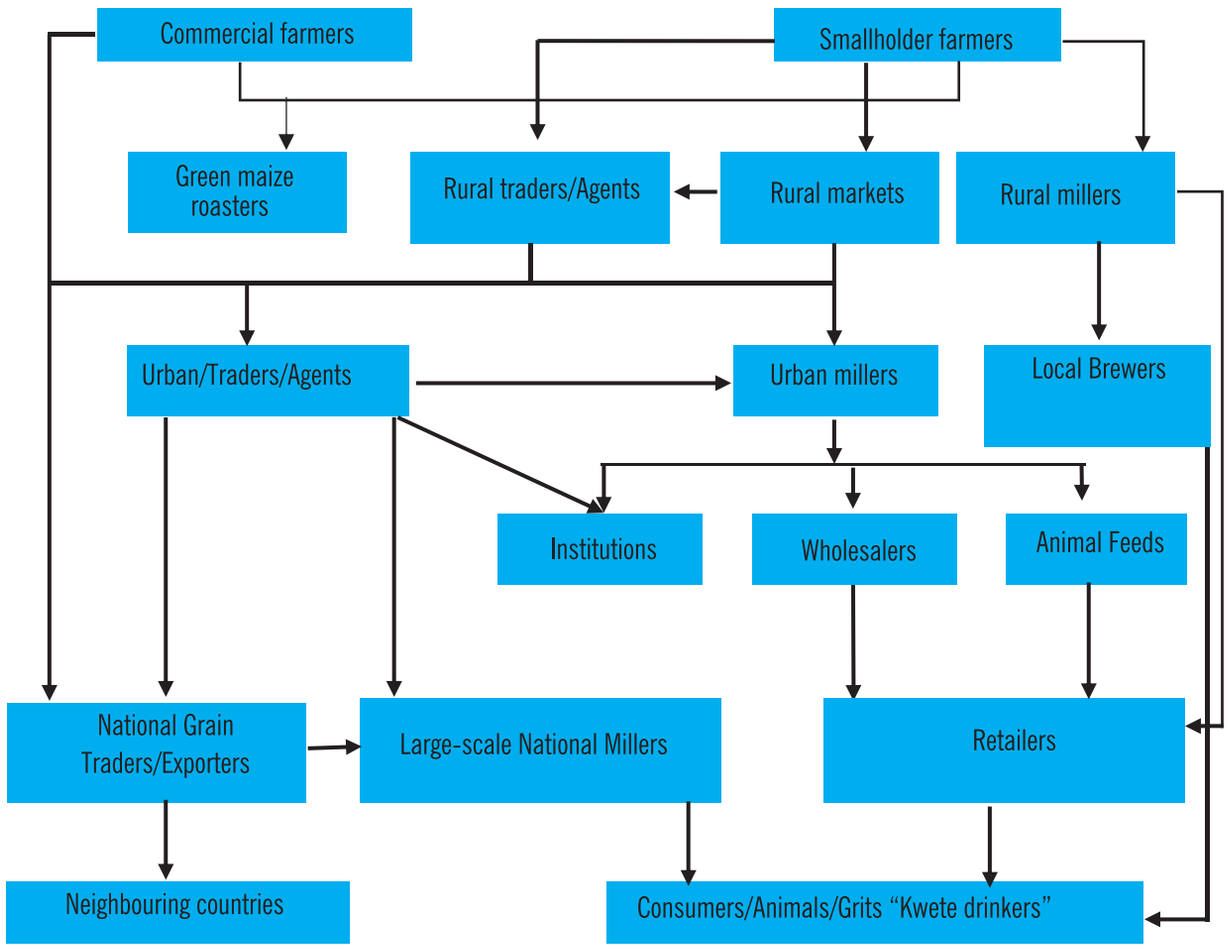
Additionally, there are initiatives by private actors to support the maize value chain. Notable among them is the Joseph Initiative (JI) and the Eastern Africa Grain Council (EAGC).

Table 3: **Quantities of maize exports and imports by type; 2010 - 2015**

Item	Quantities (tons)	2010	2011	2012	2013	2014	2015
Maize grain	Export	127,314	54,978	177,952	103,950	112,927	281,086
	Import	1,457	17,243	16,100	5,033	790	2,447
Flour, maize	Export	57,221	32,768	40,174	37,223	46,743	66,390
	Import	3,858	2,862	170	352	708	408
Bran, maize	Export	6,143	8,192	12,634	25,707	7,545	182
	Import	8	441	28	0	0	104
Oil, maize	Export	0	0	0	276	0	54
	Import	70	48	60	585	31	13

Source: http://www.fao.org/faostat/en/#data/TP

Figure 2: **Uganda's maize value chain**



Source: Adopted from USAID, 2014

We elaborate on the aforesaid private companies in the subsequent write-up.

The Joseph Initiative (JI) is a private company that became operational during the January 2013 harvest season in Masindi and Mubende, two of the major maize producing districts in Uganda. JI received a long term loan of US$ 500,000 from the Common Fund for Commodities (CFC), which was used to finance infrastructure investments. The company's operations span across the maize value chain, including farm-gate procurement, logistics, drying, cleaning, bagging, storage, warehousing, and distribution. JI has established a network of village-level grain procurement and service distribution centres, known as Joseph Centers. The JI centres offer smallholders an 'ecosystem' where farmers can: procure inputs, obtain knowledge through demonstration plots and extension services, apply for loans, and trade their maize with JI (see details in **Box 1**). JI plays a vital role in that the company supplies high quality maize grain to large-scale traders and millers in Kampala, Nairobi, Kigali, and Juba. JI is able to trade maize grain widely in the East African Community (EAC) partly because of the free trade agreement among member states.

Still looking at efforts by the private sector, we note that there are institutions whose major role is to facilitate structured maize grain trading, an example is the Eastern Africa Grain Council (EAGC). The EAGC operates in 10 countries, namely Uganda, Kenya, Tanzania, Rwanda, Burundi, South Sudan, DRC, Ethiopia, Malawi and Zambia. In Uganda, this umbrella organisation currently has 42 members comprising relevant Government ministries (such as Ministry of Agriculture, Animal Industry and Fisheries [MAAIF], Ministry of East Africa Community Affairs [MEACA] & Ministry of Trade Industry and Cooperatives [MTIC]), registered smallholder farmer groups, large-scale farmers, processors, millers, financial institutions, NGOs, seed companies, and agro-input dealers. Members of

Box 1: **The role of the private sector in the maize value; the case of Joseph Initiative (JI)**

The Joseph Initiative Limited, an agricultural trading company, focuses on delivering dried maize grains sourced directly from Ugandan farmers to both local and international markets. The company has operations centres located in rural communities, and have been strategically situated around 2.5 – 4kms from each other in order to conveniently serve smallholders. Currently JI manages a network of 60 Joseph Centres, with 40 around Masindi and a further 20 in Mubende. Joseph Centres give JI a very local presence, and are each staffed by two trained Village Procurement Officers from the same village.

Joseph Centres feature a basic 'crib' storage facility where purchased maize is aggregated. The advantage of the crib storage is that it allows for natural drying and safe storage of grain until it reaches sufficiently low moisture levels for shelling and transportation to the large-scale JI processing facility. Joseph Centres also sell quality inputs such as improved seed and fertilizer, which smallholders purchase at competitive prices.

Maize demonstration plots have been established adjoining each Joseph Centre. The JI Village procurement Officers provide extension services to farmers from the demonstration plots, offer advice on production practices and demonstrate the effectiveness of using quality inputs in different combinations. The trainings usually focus on land preparation, planting, weeding, fertilizer application, spraying, and harvesting. Each training targets up to fifty farmers at one time". Demonstration plots are central to transferring technologies to farmers and encouraging them to invest in proven technologies and practices.

JI offers a route to more affordable and accessible smallholder financing through its partnership with Opportunity Bank. JI is able to track smallholder's maize farming performance over several seasons and judge their ability to repay the loan, thereby reducing risk for both lender and borrower. This enables Opportunity Bank to offer loans at a lower interest rate of 30% p/a (15% over a six month season). In return to its services, JI requires smallholders to also supply the company with quality maize, for which they too receive a premium price.

Source: Key informant interview & http://www.josephinitiativeltd.com/

the EAGC are required to pay an annual subscription of US$ 300, which is used to implement activities under four program areas: grain trading system, agricultural trade intelligence network, advancing expertise and innovation in grain industry, and agricultural trade advocacy for eastern and southern Africa.

The EAGC plays a vital role in connecting stakeholders in the maize sub-sectors. Specifically, the Council;

- Links farmers to certified warehouses: EAGC establishes maize aggregation centres in rural areas where maize is stored temporarily before it is sold to certified warehouses owned by EAGC members. The warehouses ensure proper drying, cleaning and storage of maize grain so as to meet the market requirements in the region.
- Creates market linkages through its market intelligence: EAGC Links warehouses to maize traders in Uganda and in any of the 10 member countries. Traders in member countries inform EAGC about the quantities and quality of maize they want to buy and the price offer. EAGC in turn informs warehouses and other sellers of the available markets.
- Conducts trainings on various aspects including post-harvest handling, export procedures, and sensitise maize handlers about the EAC harmonised quality standards. This helps to improve Uganda's competitiveness in the regional maize market.
- Links farmers to seed companies for supply of quality seed of particular improved maize varieties that the buyers in the region are demanding. By so doing, EAGC contributes to increased access and uptake of improved technologies.
- Does market intelligence through monitoring of major maize markets within Uganda and at the border points. Volumes of maize produced and traded, prices, players, and available stocks are some of the data that EAGC collects, analyses and uses to inform policy decisions.
- Contributes to harmonisation of policies across the region, for example, during the African Grain Trade Summit that is held biennially.

6. Research and development

Maize research in Uganda is spearheaded by the National Agricultural Research Organisation (NARO). Other non-government organisations, particularly seed companies are instrumental in the development of improved maize varieties. In Uganda, through research and development, over 71 improved maize varieties have been developed; the latest ones (released after 2014) include: CKCH 10773, CKCH0616, TA/WL429-12, WH505, WH401, SC637 and SC719. The improved maize varieties are said to possess special attributes such as resistance to pests and diseases, high yielding, early maturing, drought tolerance, and tolerance to acidic soils, among others. This means that farmers have a wide range of varieties from which to choose for adoption. However, like noted earlier, most of the released varieties are yet to be adopted by the intended end-users.

During key informant interviews with Maganjo Grain millers Ltd and APONYE (U) Ltd, we learnt that private companies that buy maize grain from farmers have no collaborations with research organisations. Maize processors do not have preference for specific maize varieties, instead, they are concerned about the grain being able to meet the minimum quality standards in terms of grain colour, moisture content, broken grain, foreign matter, and signs of aflatoxins and infestation by storage pests. Indeed, processors accept all maize grain that meets the minimum standards.

7. Key challenges in the maize industry

At production level: Low yields remain the biggest challenge. Production constraints that contribute to low yields include:

a) Poor input quality: This challenge is partly being addressed through contract farming. Some private companies such as Joseph Initiative (JI) and FICA Seed Ltd contract maize farmers and facilitate them with the right quality and quantities of inputs like seed, fertilisers and extension. While contract farming ideally should benefit both producers (assured grain market) and processors (stable supply of grain), contract enforcement is often difficult when there is better market elsewhere.
b) Planting of low yielding varieties;
c) Low input use (fertiliser, pesticides, irrigation, herbicides, etc);
d) Pests, especially stem borers, and recently fall army worms; and
e) Drought stress, despite there being maize varieties that are tolerant to drought.

Thus, there is still need to address constraints at this node since it affects other nodes of the maize value chain. Government efforts such as provision of productivity-enhancing inputs subsidies are commendable and should be scaled up.

At processing and manufacturing level: The challenges faced by maize processors include:

1) **High electricity tariffs and unreliable supply:** Large scale maize millers rely on electricity to operate their machines yet the price of electricity is considered to be very high. The high electricity tariffs increase the cost of operations, especially for large-scale processors. Due to high electricity tariffs, many small-scale millers to use simple diesel operated hammer mills—which are associated with frequent mechanical breakdown, and are not sophisticated enough to produce high quality flour. In addition, the electricity supply is unstable—occasioned by frequent power cuts and load shedding.

2) **Grain price fluctuations:** According to Maganjo Grain millers Ltd, the price for maize grain usually fluctuates between UGX 600 - 850 per kg, yet product prices cannot be frequently adjusted to reflect grain price changes. Besides fluctuations, grain prices are determined by the informal traders, who do not invest much in sorting and cleaning the grain. Formal large-scale grain buyers and sellers e.g. APONYE (U) Ltd set and buy grain at a price that is slightly above the prevailing price in the informal market.

3) **Poor quality of grains:** Grain quality is affected by both pre- and post-harvest handling practices. A few farmers and grain dealers have received training in proper agronomic practices and post-harvest management of maize. This calls for increased access to extension services. Additionally, the challenge of poor quality grain is exacerbated by its high demand for grain from traders in the informal sector. Efforts by aBi Trust and USAID in training farmers in proper post-harvest management are noted; these organisations also provide farmers with simple maize shellers and moisture metres to monitor and ensure that they dry their grain to the right moisture content (13.5%). Government should learn from these organisations and target financing towards construction of silos.

4) **Storage pests:** Weevils destroy the grains and lower the quality of processed products. Although private companies like the EAGC train farmers in effective

control of storage pests, among other aspects, many processors have not taken a deliberate step to attend these trainings, perhaps because they are not free of charge.

5) **Under capacity utilisation in seasons of limited supply of grain:** Firms like Maganjo Grain Millers have the capacity to produce 20 tons of maize flour per day, however, when the growing season has been unfavourable (mainly due to drought) the company processes 10 – 15 tons per day. This underscores the fact that over reliance on natural seasons, with very limited adoption of irrigation hinders stable supply of grain to millers.

6) **Presence of aflatoxins:** Poor pre-harvest and post-harvest techniques can cause maize grain to develop aflatoxins, which are harmful to humans when consumed. The formal test for aflatoxins is expensive (estimated at UGX 800,000) and therefore most maize grain processors do not do this test but simply rely on visual signs (usually the colour of the grain) to reject suspect grain. Some large consumers (e.g. UN agencies) demand that a formal test for aflatoxins be conducted and are willing to pay for it. Partly in order to address this challenge, local ordinances should be passed; they specifically should prohibit farmers from harvesting premature maize and drying it on bare ground. The ordinances should require every maize farmers to have a crib for proper drying and storage of maize. Under the OWC programme, farmers are given tarpaulins and silos are being constructed for farmers to help them uphold the maize grain quality—such public investments should be scaled up.

8. Conclusion and key recommended actions

In light of the EPRC's proposed integrated model, we note that the would-be game changers (i.e. large scale maize millers) are weakly/indirectly linked to farmers. Most farmers sell their maize (grain) to traders and the few available warehouses, who in turn sell it to millers. Indeed, the General Manager of Maganjo Grain Millers reported that their company does not purchase grain directly from farmers. Rather, the company's procurement department sources grain from traders who deliver the grain at the factory. Other large-scale companies like APONYE (U) Ltd are also mainly involved in buying, cleaning, sorting, bagging and selling maize grain. This company occasionally produces maize flour only on order. Thus, the current large scale millers may not be considered in the category of game changers for agro-industrialisation, they provide ready market for farmers.

Companies that are into the business of processing maize as their primary activity should in this case be the game changers because they have the potential to create and sustain agro-industrialisation. We also note the recent entry of new large scale miller—specifically Mandela Millers who are producing the Supreme brand of maize. Based on the identified constraints through literature review and discussions with EAGC, Maganjo Grain Millers Ltd and other stakeholders in the maize sub-sector, we put forward the following recommendations for an integrated agro-industry maize value chain:

a) Expansion of the product space in the case of maize by, for example, investing in equipment/machinery that can produce high quality and fortified maize products. Otherwise, with the current status where most maize mills lack machinery for fortification, within the region, Uganda remains better placed to majorly trade in grain.

b) Government of Uganda should scale up investment in establishment of warehouses that meet the EAC harmonised standards. This will improve Uganda's competitiveness and ensure safe storage of excess grain as it awaits further processing. An effective warehouse receipt system will also help stabilise maize grain prices.

c) Government should improve transmission of power and the functionality of institutions put in place to minimise power thefts. This might help lower electricity tariffs for the millers.

d) Government needs to step up efforts to implement the strategic interventions in the 2015 National Grain Trade Policy.This policy aims at promoting agro-processing and value addition, information sharing and marketing, storage and post-harvest handling services.

Endnotes

1 NPA. (2015). *Second National Development Plan (NDPII) 2015/16 - 2019/20.* Kampala, Uganda: National Planning Authority.
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