



RTB Report

Current status of knowledge about end-user preferences for boiled potato in Uganda – A food science, gender and demand perspective

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Mayanja, and Diego Naziri

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A food science, gender and demand perspective**

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SUMMARY

This report synthesizes the current state of knowledge about preferred characteristics for boiled potato among the different value chain actors; demand and profitability for the product in urban and peri-urban areas; and the agronomic practices and gender norms surrounding the potato product in Uganda. A literature review as well as key informant interviews were conducted to obtain information. From the findings, preferred physicochemical characteristics of raw and boiled potato are centered on appearance, color, size, texture and dry matter content. This can inform a more demand-oriented breeding by CIP and national partners. Potato is important for food and income generation for both men and women value chain actors, hence new potato varieties have been adopted in the different regions of Uganda. Across the value chain, the potato product has been found to be highly profitable.

KEY FINDINGS

- Preferred raw potato characteristics by producers, traders and consumers include red skin color, yellow flesh color, smooth skin and big size tubers.
- Processors prefer; white/cream flesh color, medium to large size, shallow eye depth, smooth skin and high dry matter content.
- High dry matter content ($\geq 20\%$) and low reducing sugars (≤ 3 mg/g) are physicochemical characteristics that translate into desirable boiled potatoes for processors and consumers.
- Good boiled potato characteristics include; floury texture (mealy), not mashy, good taste, bright yellow color, and good potato smell.
- Potato is an important food and income generating crop grown by women and men farmers in Uganda.
- New potato varieties have been introduced and adopted in Uganda, albeit at varying scales in the growing regions. Popular varieties include Rwangume, Victoria and Kinigi.
- Resource constrained households are still opting for local landraces such as Byumba.
- There are demarcated gender division of roles in production, marketing and processing of boiled potato.
- Women are responsible for seed conservation especially in subsistence production.
- Commercial seed production is the realm of men given the capital outlay required.
- Women dominate in small scale retailing and processing of potato.
- The level of potato marketing and domestic demand of potato products in Uganda is on the increase.
- Potato supply chain commonly ends in almost all the urban markets and restaurants in Uganda.
- Key players along the ware potato value chains include farmers, agents (or brokers), local traders, urban wholesalers, urban retailers, processors, consumers, and institutions.
- Within production areas, processors provide the smallest market outlet for ware potatoes across all of the districts.
- In urban areas, hotels, restaurants and take-aways (fast-food outlets) are the main business enterprises that process potatoes hence providing a large market for the traders of fresh potatoes.
- Urban wholesalers and travelling traders mainly come from towns near the production areas and Kampala districts.
- The potato value chain comprises of people across regions, ethnic groups and religions.
- Potatoes are sold fresh and commonly consumed in boiled, fried, chips or crisps form.

- High transport costs and lack of organized storage make it difficult for value chain actors to successfully market their produce.
- Potatoes flow through a multi-staged marketing channel i.e. through a few different value chain actors before reaching the final consumer hence profits are shared by many players along the chain.

1 INTRODUCTION

Potato is the fourth most important food crop in the world in terms of production with 388 million tons produced in 2017, following rice, wheat and maize (FAOSTAT, 2019). In East Africa, Uganda is the 3rd largest producer of potatoes after Rwanda and Kenya, and its higher altitude areas are well placed to benefit from the growing demand for potato products in the region. Not only is potato an important crop for food and income generation but it is also one of the 16 major food crops prioritized by the Government of Uganda (UBOS, 2018). Due to growing demand, potato has been identified by Uganda's Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in its development strategy and investment plan as a priority crop for strategic intervention. (UBOS and MAAIF, 2011)

The report is divided into 3 sections – I. Food science, II. Gender and socio-cultural context, and III. Demand-assessment. Food research studies in Africa have for a long time put emphasis on physicochemical, nutritional and safety aspects of food while making minimal consideration for sensory preferences of consumers. (Rakotosamimanana and De Kock, 2020). In light of this, the main objective of the food science section is to provide insight and understanding of the current status of research related to end-user preferred sensory characteristics of raw and boiled potato via a value chain approach. This will set the foundation to guide subsequent field studies on food preferences disaggregated by gender and specific value chain end users such as producers, processors, traders and consumers. The section on gender and socio-cultural context focuses on the potato agronomic practices and associated norms in Uganda; the new varieties associated with boiled potato which have been introduced in the country; and whether there is expertise or evidence about the factors influencing adoption in this context. It reveals the main and the alternative uses of potato; the gender dimensions in the potato value chain; and the trade-offs between different uses of potato and how these affect different groups of people regarding their participation, workload and benefit from boiled potato. The demand assessment enlightens on the potato value chain, size of the different demand segments and general demand for potato in Uganda's urban and peri-urban areas. It also provides information on geographical and demographic characteristics of the different value chain actors, and their preferred potato characteristics.

2 METHODOLOGY

A desk study was conducted to identify and analyze relevant literature on the end-user preferred sensory characteristics of raw and boiled potato; gender roles; the potato value chain and demand in urban and peri-urban areas of Uganda. For validation purposes, key informant interviews were conducted, not only to obtain information on important quality characteristics of boiled potato at different stages from raw, during preparation and at consumption, but also to obtain information on demand and profitability of the potato product. Key informants were purposively selected and these included food scientists, breeders and experienced potato traders. Female respondents with experience in boiled potato preparation and consumption were also interviewed because they are the ones mostly involved in food preparation. Some interviews were conducted at National Agricultural Research Laboratories, Kawanda, while others were conducted in market areas. The gender and socio-cultural section is based on general knowledge on the role of women and men in potato production and marketing in Uganda, and Sub Saharan Africa at large. The Gender Dimensions Framework (Rubin et al., 2009) was used to structure and analyze information obtained from various resources related to gender and the socio-cultural context for boiled potato in Uganda. This report also draws on findings from previous State of Knowledge reports developed in Uganda and West Africa, which focused on both boiled and fried sweetpotato.

3 SECTION I: FOOD SCIENCE

3.1 Varieties

South western and Eastern region represent the leading production areas for potato in Uganda, however potato is also grown in West Nile, Central and Western Uganda (Sebatta *et al.*, 2014; IFDC, 2017). Rwangume (NAROPOT 4), Victoria and Kinigi predominate in the Kigezi sub-region (South western Uganda) (**Fig. 1**). Other varieties in this region include Rwashaki, Mumba, Sutama, Kimuli, Rutuku, Cruza, Mitare and Kachpot 1 (Mbowa and Mwesigye, 2016).



Figure 1 Priority potato varieties in Kigezi Highlands (South western Uganda)

(Source: PASIC, 2015)

Kabale red, Victoria and Wanale are the leading potato varieties grown in Eastern Uganda. Other varieties are; Rwangume, Nakpot 1, Sankena, Civilian, Megabond, Cruza and Kachpot 1 (Tatwangire and Nabukeera, 2017). According to Namugga *et al.* (2017), Rwangume and Victoria are the commonly grown varieties in South Western, Eastern and Central regions. A list of selected potato varieties with their sensory, post-harvest and morphological attributes is shown in **Table 1**.

Table 1 Sensory, post-harvest and morphological attributes of selected potato varieties grown in Uganda

Variety Name/ Characteristic	Rutuku	Cruza	Sangema	Victoria	Kisoro	Kabale	Nakpot 1 to 5	Kachpot 1 and 2
Tuber size	Large	Large	Medium	Large	Medium	Large	Medium - large	Medium
Skin color	Light red	White mottle	Pink	Red	White	Purple mottled	White, rose red, red	Red, white
Flesh color	Cream	White ringed	Yellow	Light cream	Cream	White	White, cream	Cream
Tuber shape	Oval round	Oval	Oval long	Round	Oval large	Round	Oval long, round, oval	Round
Storability	Good	Fair	Good	Good	Good	Excellent	Good	Good

Source: Tindimubona *et al.* (2014); NARO (2017)

More recently, a number of improved varieties imported from the Netherlands have been released, namely Arizona, El Mundo, Sagitta, Markies, Connect, Sarpomira and Voyager (NARO, 2017).

3.2 Raw Potato Characteristics

Preferred characteristics of raw potato tubers vary among different end-users and regions however, they are largely interlinked. Agronomic and economic attributes such as high yield, early maturity, disease resistance and, crucially, market demand (traders and consumers) usually inform farmers' decisions about varietal selection. Consumers are reported to prefer red over white skin color, good taste and big size tubers. In parts of Eastern Uganda (Kapchorwa), key varietal attributes according to farmers include: storability, high dry matter and flesh color while in South Western Uganda (Kabale and Kisoro) it was tuber size (CIP, 2018). According to Namugga *et al.* (2017), preferred attributes by farmers include red skinned and yellow fleshed potatoes which are associated with good eating quality. Katundu *et al.* (2010) reported that consumers look out for potatoes with smooth skin, no sprouting, no blemishes and no greening when purchasing at the marketplace.

On the contrary, small size tubers were identified as one of several characteristics leading to abandoning certain varieties such as Bumbamagara and Cruza (Wachira *et al.*, 2008). Namugga *et al.* (2017) reported that Cruza and Marierahinda were increasingly rejected in all major potato growing regions due to their white skin, low marketability and, in the case of Cruza, development of a mashy texture when cooked. Potato farmers in Eastern Uganda sort out poor-quality potatoes on the basis of size (small), physical damage (cuts and bruises), greening of tubers and off-type varieties (Tatwangire and Nabukeera, 2017).

Among traders engaged in grading of potatoes prior to sale in South Western Uganda, some of the criteria used include: variety, skin and flesh color, tuber size, maturity level, water content and damage (Bonabana-Wabbi *et al.*, 2013; Mbowa and Mwesigye, 2016). The market is a key driver of preference trends where red skinned varieties are preferred over white despite color and quality traits not being correlated (Wachira *et al.*, 2008). Kachpot 5 is reported to be a high yielding variety preferred for its shape by processors and yet, farmers do not like it because of its white skin color (FAO, 2015). Victoria is preferred by traders and consumers in this region because of longer storability, good cooking properties and red skin color. In addition, traders prefer varieties which have heavy tubers, good mashing and taste attributes (Tatwangire and Nabukeera, 2017). Similarly, in a report by Sikuku and Ogemah (2005), Victoria was reported to be the most popular improved variety in Eastern Uganda, and this was attributed to the consumer-preferred red skin color. Susceptibility to post-harvest degradation is also an important varietal attribute. As reported by Tatwangire and Nabukeera (2017), Sebei, Singo and Mbale are more prone to post-harvest deterioration compared to Kenya, Kisoro and Wanale. Desirable characteristics of fresh/raw potato from Key Informant Interviews (KIIs) are summarized in **Table 2**.

3.3 Physicochemical characteristics

Regarding physicochemical properties, potatoes which are high in dry matter content ($\geq 20\%$) and low in reducing sugars (≤ 3 mg/g) provide desirable sensory properties for processing and consumption (Katundu *et al.*, 2007; Abong *et al.*, 2009; Pedreschi, 2012). Physicochemical properties of selected varieties are shown in Table 3.

Kinigi and NAROPOT 3 were the varieties reported to have the highest dry matter content (Muhumuza *et al.*, 2020). A previous study by Nuwamanya *et al.* (2011) reported relatively higher dry matter content for three potato varieties; Kinigi (28.4%), Victoria (28.3%) and Kachpot (30.5%). Starch is a major component of dry matter, constituting 65-80% (Pedreschi, 2012). Furthermore, according to Nuwamanya *et al.* (2011), increased firmness of roots, tubers and cereals is associated with high amylose starch content. This could impact on the texture of boiled potato. More so, potatoes with high starch content are associated with a

desirable floury texture (Katundu et al., 2007). High reducing sugar content in potatoes instigates the undesirable non-enzymatic browning caused by the Maillard reaction especially during frying (Pedreschi, 2012). In addition, high total sugar content (>12.5 g/kg) gives potatoes an undesirable sweet taste and soggy texture (Katundu et al., 2007)

Table 2 Good raw potato characteristics

Characteristic	Description
Tuber form/general appearance	<ul style="list-style-type: none"> No physical damage Smooth skin Has few buds/eyes
Tuber size	<ul style="list-style-type: none"> Big size tubers
Color	<ul style="list-style-type: none"> Dirty brown peel color - pale yellowish flesh No discolored patches Creamy flesh color White for mashed potatoes, yellow for chips
Texture	<ul style="list-style-type: none"> Hard/Firm
Smell	<ul style="list-style-type: none"> Smells fresh Odorless

Table 3 Physicochemical characteristics of selected potato varieties released in Uganda

Variety	Dry Matter Content (%)	Reducing Sugars (mg/g)	Average Tuber Weight (g)
Rutuku	17.2	5.8	109.9
Cruza	19.5	2.4	61.8
Rwangume	17.7	6.6	68.8
Kinigi	20.3	2.6	87.4
Rwashaki	19.2	2.1	80.7
NAROPOT 1	18.4	1.9	59.1
NAROPOT 3	20.6	2.1	81.0
NAKPOT 1	19.7	4.8	101.0
NAKPOT 5	18.9	3.1	77.2

Source: Muhumuza et al., (2020)

3.4 Processing characteristics

In Uganda, ware potato is mainly consumed as a boiled vegetable and is widely processed as shown in Fig. 2. Processed products from potato include; chips, fried or grilled, crisps, mashed and mixed sauce (local name 'katogo') (Tesfaye et al., 2010; CIP, 2018).

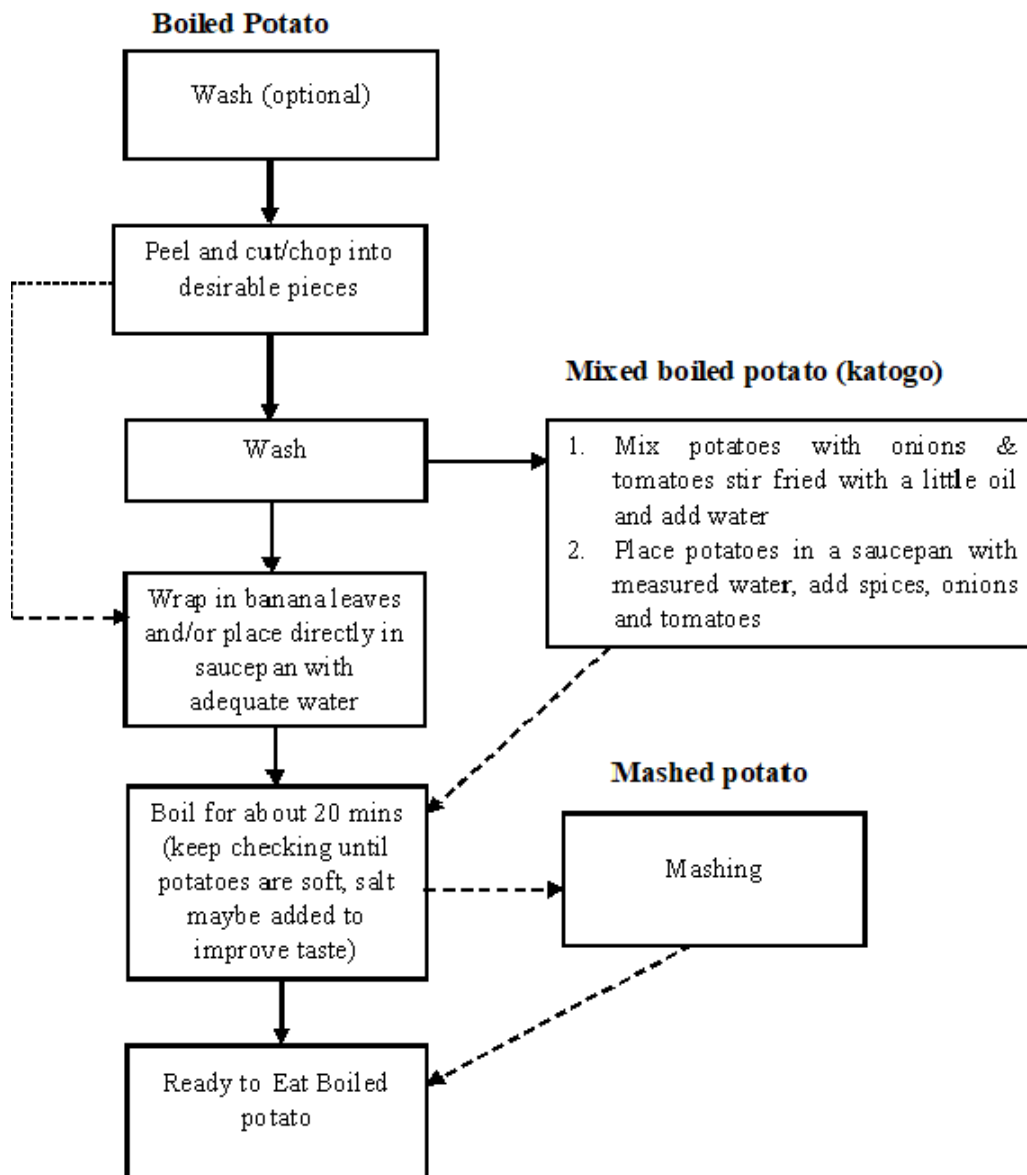


Figure 2 Preparation of boiled potato and related products

Generally, processing of potato into value added products is still minimal, due to some constraints such as fluctuating prices, low quality of ware potato and inadequate capital (FAO 2015). Low quality of potatoes encompasses immature tubers, thick skin, deep eyes, inconsistency in tuber sizes and varieties, cuts and bruises due to poor harvest and post-harvest practices (Tatwangire and Nabukeera, 2017). More recently, processing into chips and crisps is gaining traction in response to growing demand from urban population, fast food restaurants and schools among others (Aliguma *et al.*, 2007; CIP, 2018). Important quality attributes for potato chip processors in descending order include: high dry matter content, smooth skin, shallow eye depth, medium to large size and white/cream flesh color. Varieties associated with these attributes include: Kachpot 1, Kachpot 2, Rutuku, Nakpot 1 and Nakpot 5. In Kampala and Eastern Uganda, the preferred varieties for processors in descending order are: Victoria, Mbale, Singo, Kisoro, Kapchorwa, Wanale and Kabale red (Tatwangire and Nabukeera, 2017). In addition, they reported that preferred characteristics by processors were big size of tubers, easy to process and good for chips. Mbowa and Mwesigye (2016) also reported that Rwangume, Kinigi and Kachpot 1 are among the most preferred varieties by processors because of their big size. Quality losses along the post-harvest and marketing

chain are mostly related to potato tubers which are; rotten, cut, bruised, greened, soft and sprouted (CIP, 2018). The Cruza variety is reportedly unsuitable for chips processing due to coloration of the vascular ring during frying (Wachira et al., 2008). Mbowa and Mwesigye (2016) reported that although varieties such as Kachpot 1 are recommended for industrial processing of chips and crisps, they are not prioritized by farmers and this could potentially curtail the potato supply chain for value addition at industrial scale.

At each processing step of boiled potato, the important quality characteristics as indicated by KIIIs are summarized in the **Table 4**.

Some differences in processing/preparation of potatoes are location-specific e.g. in urban centers frying into chips or balls is a common processing/preparation method whereas in the rural areas it is boiling and steaming. A key informant also indicated that some potato varieties from the Eastern region tend to be soggy when boiled and are thus less preferred.

Also, processing or preparation method may vary depending on the age group of the final consumer e.g. mothers usually prepare mashed potato for their young children, the youth and unmarried people enjoy fast food like chips.

Table 4 Good characteristics of potato at each processing step for boiled potato product

Preparation method	Processing step	Quality characteristics
<ul style="list-style-type: none"> Boiled in water 	Peeling	<ul style="list-style-type: none"> Uniform pale yellow/cream flesh color Firm and stable No pungent or off-odor Has few buds/eyes Big size potatoes No dark spots inside
	Washing	<ul style="list-style-type: none"> Hardness (firm in the hands) Cream flesh color No physical damage No bad odor
	Boiling	<ul style="list-style-type: none"> Brighter yellow color Soft in the middle when ready Strong boiled potato smell Maintains cream flesh color when boiling Cooks well (gets ready in a reasonable time) Does not get mushy in the boiling water Firm but not hard
	Mashing (optional)	<ul style="list-style-type: none"> Soft Easy to mash (Mashable)

3.5 Boiled potato characteristics

Studies on consumer preference of potato with regard to sensory characteristics in Africa are still minimal compared to other parts of the world (Anderson and Gugerty, 2015). Katundu et al. (2007) conducted acceptability studies on stored potatoes in South Africa. From their findings, preferred potatoes were characterized as having floury texture and good taste while those with bitter taste, sweet taste and soggy texture were not preferred. Sweet taste of potatoes is due to presence of reducing sugars arising from enzymatic hydrolysis of starch (Sowokinos, 2000). Bitter taste in potatoes is attributed to presence of glycoalkaloids which are associated with exposure to natural light and high temperatures especially during extended storage (Şengül et al., 2004; Katundu, 2007).

In Uganda, potato taste is one of the key attributes for farmers during varietal selection as it impacts market demand and consumption. According to CIP (2018), farmers opt for low yielding potato varieties as long as they have big tubers and good taste, especially for domestic consumption. Varieties reported to have good taste include Rwangume (NAROPOT 4), Kimuli, Bumbamagara, Kinigi and Cruza (Wachira et al., 2008). More so, potatoes that do not develop a watery texture when cooked are desirable as they do not mash when cooked (CIP, 2018). Tatwangire and Nabukeera (2017) also reported that consumers prefer varieties with good taste and do not mash during cooking. Desirable characteristics as described by key informants are shown in **Table 5**.

Table 5 Characteristics of good boiled potato

Characteristic	Requirement/specifications
Color	<ul style="list-style-type: none"> • Bright yellow color like apple banana (<i>sukali ndizi</i>) • Creamish color • White color (for mashed potato)
Texture	<ul style="list-style-type: none"> • Soft in the hands and mouth (easy to swallow) • Mealy - crumbles at slight pressure in the hands, floury • Firm in the hands (neither too soft nor too hard) • Not mashy between fingers
Taste	<ul style="list-style-type: none"> • Good taste of boiled potato (a little bland) • Not bitter
Smell	<ul style="list-style-type: none"> • Strong potato smell

According to Montouto-Grana et al. (2011) and Seefeldt et al. (2011) texture and appearance are key sensory characteristics that influence acceptance among boiled potato consumers. Similarly, Seefeldt et al. (2011) reported yellowness, hardness, adhesiveness and moistness as important quality descriptors across three potato culinary preparations that is, boiled, mashed and oven fried. Therefore, sensory profile of one product in terms of texture, appearance and taste could be used to predict the others.

4 SECTION II: GENDER AND SOCIO-CULTURAL CONTEXT

4.1 Agronomic norms and practices of potato in different regions of Uganda

Potato production in the East African region has doubled in the past ten years. This growth is mostly attributed to increased acreage (Sebatta et al., 2014), growing urban populations and consumer demand for convenience foods. Potato is increasingly popular because it is deemed to provide better food and income generating options when compared to other staple crops (CIP, 2008). Potato (or Irish potato as it is commonly known in Uganda) is an important strategic commodity recognized by the government as a potential driver of improved rural livelihoods (Mbowa and Mwesigye, 2016). In Uganda, potato is grown in high altitude areas such as Zombo, Isingiro, Bushenyi, Kyenjojo, Kibaale, Kabarole, Kamwenge Rakai, Mubende and Mityana districts (Okoboi, 2011). Nationally, potato yields in Uganda have remained low at an average of 7.5t/ha compared to other countries and despite on-station yields of 25t/ha and an achievable yield of 40-60t/ha (FAO, 2013; FAO, 2018; Okoboi *et al.*, 2014). Majority (93%) of farmers still rely on informal sources of seed potato, such as own saved seed, markets or neighbors; despite the fact that the quality of seed from such sources is not guaranteed (Kinyua et al., 2011). The crop is mostly cultivated by smallholder farmers with plot sizes ranging from 0.25 to 5 ha and characterized by low productivity. Low productivity is attributed to low use of improved inputs, limited access to improved seed and pests and diseases (Okwadi, 2013).

South-western Uganda, the leading potato production area (contributing 60% of national production), has the smallest per capita cropland area in Uganda (van Soesbergen et al., 2017). In this region, potatoes are usually planted as a monocrop. Farmers use Good Agriculture Practices (GAPs) such planting in straight lines, keeping gardens weed free, controlling pests and diseases and dehaulming, among others. Potatoes are usually grown in two seasons per year, except for areas with access to swamps (such as Mwizi in Kabale) or irrigation (Kapchorwa) where the crop can be grown all year round.

Potato growing households usually have a clear gender demarcated division of labor for production and marketing activities. Tatwangire and Nabukeera (2017) found that women are responsible for planting, weeding and harvesting. Men undertake seed selection, crop management (e.g. spraying and dehaulming) and marketing related activities (e.g. bagging, transporting and selling). However, Mudege et al. (2016) noted that seed selection and preservation is the domain of women.

4.2 Access to technology

The seed plot, negative selection, and positive selection are low-cost techniques which can, if done well, improve significantly the quality of home-saved seed potato used by smallholder farmers every season. Though these techniques could significantly improve seed quality, few farmers use them (less than 35%). Aheisibwe et al. (2015) noted that male headed households (MHH) were more aware of seed plot techniques (47.6% vs 29.4%) and positive selection (45.8% vs 35.3%) than female headed households (FHH). Overall, main reported seed-related challenges include: limited access to quality seed, distance to source (bulkiness), high cost and low awareness of quality seed.

Mugisha et al. (2017) reported that over 70% of male and female farmers respondents in a study conducted in south western Uganda had ample knowledge of recommended practices e.g. proper use of agrochemicals and dehaulming; however, few practiced them.

Due to limited fertilizer use and scarcity of labor in major potato growing areas, soil and water conservation practices are of great importance. Muzira et al. (2018) found that over 80% of

potato fields belonging to both MHHs and FHHs in south--western Uganda had no soil conservation measures and exhibited high levels of soil degradation. However, this was more prevalent in FHHs and was linked to limited access to land which forced the households to farm on the edge of slopes thus destroying soil conservation structures. Further, FHHs were forced to rent out land to other farmers who in a bid to expand area under cultivation would inadvertently destroy conservation structures.

FHHs had more land under fallow and woodlots as compared to MHHs. This was attributed to limited resources to till land but enabled greater periods of fertility restoration; but only for households where land was not a constraining factor.

Diffused light storage (DLS) is a low-cost method to store seed potatoes and it uses indirect natural light and good ventilation to control excessive sprouting and related product loss. However, it is reported that less than 30% of farmers can afford to use them.

4.3 Farmer access to and adoption of new potato varieties

In the last 40 years, over 20 varieties have been introduced by NARO, CIP and the Regional Potato and Sweetpotato Improvement Program for Eastern and Central Africa (PRAPACE). Most of these varieties were resistant to late blight; a major cause of potato production losses in the country (NARO, 2017). The most popular varieties grown in the three major production regions are Rwangume (Naropot 4), Victoria and Kinigi (Namugga et al., 2015; Kyomugisha et al., 2018); and are preferred because of their disease resistance and high yields. In eastern Uganda, the variety Shangi from Kenya is becoming popular because of its suitability for boiling, reduced cooking time, early maturing, with big tubers and high yields (Sinelle, 2018).

Mudege et al. (in press) found that poverty levels are associated with the variety that farmers chose to grow. Farmers in the bottom levels of the wealth ladder tend to grow local landraces such as 'Byumba' as it doesn't require spraying. The reverse is true for wealthier farmers, as they are able to purchase and grow certified seed of released/improved varieties.

Factors hindering adoption of released varieties have been associated to low adoption of innovative crop management practices such as use of fertilizers, crop protection products, and seed selection methods, amongst others (Priegnitz et al., 2019). Farmers with limited access to land, labor and knowledge usually have the least ability to adopt innovative practices, and this translates into low adoption of new and improved varieties (ibid). Freeman and Qin (2020) also found that households with access to information have greater likelihood to use improved inputs.

Ebrahim (2019) found that amongst other factors, farmers that live near an adopter of an improved variety and have access to extension services are more likely to take up new/improved varieties. For women farmers who usually have limited access to extension services, living close to an adopter may be an important pathway for accessing new varieties.

A recent study by Thiele et al. (2020) notes that breeding programs rarely prioritize consumer preferred traits, a fact that can be associated with low uptake of improved crop varieties, including of potato. Some varieties like Cruza for example have been rejected because of poor cooking qualities (Namugga et al., 2015).

4.4 Uses and products of potato

In Uganda, potato is mostly consumed in the boiled form, especially in the production areas. A study conducted in eastern Uganda found that potato producing households consume 7.4% of their total production, allocate 14.8% to seed and sell 81.0% (Tatwangire and Nabukeera, 2016). Women and children are the ones who engage in preparation of boiled potatoes at home.

Increasingly consumers prefer to eat chips and crisps, a trend driven by rapid urbanization and change in urban food eating habits (Kyomugisha et al., 2018). There is a growing presence of street food vendors in urban and peri-urban areas, and potato chips are a major component of street foods. Street food vendors prepare and process the chips using simple equipment – and these businesses are mostly operated by women, but the clients are mostly single men, or men who live without their spouses (Mackay, 2019)

Fast food chains, restaurants and hotels process potatoes into chips and sell to their customers with better value-added presentation compared to street food vendors. According to Tatwangire and Nabukeera (2017), such enterprises commanded 70% of the processed potato trade in eastern Uganda.

Potato crisps and potato sticks are other snacks prepared from potato. Magala et al. (2006) noted that the processing into potato crisps is mostly done at cottage industry level. Small scale entrepreneurs (mostly women) process between half a bag to three bags of potato on a daily basis and trade their products informally through kiosks, shops and school canteens among others. Medium-scale entrepreneurs sell to more modern outlets such supermarkets.

4.5 Gender dimensions of the boiled potato value chain

This section attempts to review the gender dimensions of the boiled potato value chain using the Gender Dimensions Framework (Rubin et al., 2009). The framework enables us to assess if and how women and men chain actors have access to resources such as knowledge, productive input, income and benefits thereof; beliefs and perceptions which shape gender identity and behavior; practice and participation in the chain; and laws, legal rights and institutions that govern the potato value chain.

The boiled potato value chain in the south-western and eastern regions of Uganda consists of four major actors: input suppliers, producers, traders and consumers. The roles and functions of each node of the chain is discussed in the following sections.

4.5.1 Input supply

Seed is one of the most important inputs in potato production, and potato farmers mostly use farm saved seed, or source it from neighbors. According to Mudege et al. (2016), women are responsible for seed selection and preservation and play a major role in ensuring maintenance of varieties from season to season. Formal seed producers are typically farmers who grow both ware and seed potato (Kyomugisha et al., 2018), and most of them are members of the Uganda National Seed Potato Producers Association (Mbowa and Mwesigye, 2016). Besides land, labor, tools and equipment, seed producers need to have access to extension services. Seed entrepreneurs also need access to market intelligence and storage space (such as DLS).

According to Sebatta *et al.* (2014), the seed value chain is profitable providing a return of 40%, and seed producers exhibit a higher level of commercialization compared to ware producers. Only 23% of farmers add value to their seed potato, the majority (78%) being men. From the study, seed producers were noted to use more specialized inputs and thus achieving higher yields i.e. 6.9 t/ha as compared to 5.5 t/ha reported for ware producers. Limited engagement of women in the seed business could be attributed to a lack of resources; and further highlights the issue of women being invisible actors in this activity. This also implies that women do not benefit as much as men from the lucrative seed potato business.

4.5.2 Producers

Potato production is traditionally a family engagement, especially at subsistence level. Women and children provide family labor for planting, weeding, dehauling and harvesting. At commercial level, women still play this role, but as invisible actors since men dominate this

sub-sector. Mugisha et al. (2017) found that most of commercial potato production in Western Uganda was under men management. As production progresses from subsistence to commercial, the crop becomes more of a male crop contributing 22% of annual income for men compared to 17% for women (*ibid*). At commercial level, male farmers hire laborers to assist with labor intensive chores such as weeding and harvesting. Pest and disease control is mostly done by men (Mudege et al., 2016). Value addition activities such as sorting, grading and washing are done mostly by laborers when farmers envisage a higher price for value added potato. These activities are done under the supervision of men commercial farmers (Sebatta et al., 2014). At the marketing level, Kyomugisha et al., (2017) found that farmers need resources to transport potato from home to market, as well as for communication (telephone calls and messages), storage and packaging. From a gender perspective, in addition to limited access to these resources, women farmers may not be able to participate in marketing due to limited mobility and domestic responsibilities. Finally, it was reported that farmers who sell directly to traders incur higher transaction costs compared to those who sell to brokers, but also attain better prices and establish stronger trade networks (*ibid*).

4.5.3 Traders

Produce assembly is mostly done by rural traders and their agents, who aggregate ware potato bought directly from smallholders. This function is mostly done by men as it requires mobility and flexible working terms. According to Sebatta *et al.* (2014), women are less likely to participate in potato trade especially with regards to price setting and bargaining. Urban wholesale traders handle large volumes of potato procured directly from farmers or brokers and later sell their produce to rural retailers and other big buyers (Mugisha et al., 2017). This function is also done primarily by men (Kyomugisha, 2012; Mudege *et al.*, 2016). Retail traders sell directly to consumers in small quantities and are mostly women (*ibid*).

4.5.4 Processors

4.5.4.1 Boiled potato:

Boiled potato is prepared by women with support of the female children for consumption at household level (Mudege et al., *in press*). In south-western Uganda, varieties with limited market demand such as Rwashaki are the ones mostly used for home consumption (Kyomugisha et al., 2018). Restaurants serve boiled/lightly fried potato for breakfast as well (*ibid*).

4.5.4.2 Potato chips and crisps:

Potato crisps are still mostly produced at cottage level by sole entrepreneurs, while chips are prepared and sold by street vendors in urban and peri urban centers, and also by fast food outlets. Mbowa and Mwesigye (2016) found that women are the dominant actors in the potato processing business, but also own the highest proportion of informal enterprises. For women entrepreneurs, this is primarily due to several challenges they face: limited access to business development services such as credit, networks and weak trade linkages.

Production of crisps requires more advanced equipment (e.g. for packaging and branding) and skills as compared to chips – which forms an entry barrier for aspiring entrepreneurs. Inadequate storage of tubers is a limiting factor that curtails profits from potato processing. This is further exacerbated by inconsistent supplies, especially in months of low production.

According to Kyomugisha et al. (2018), processors prefer Rwangume, Victoria and Kinigi varieties for making chips. Processor prefer varieties with high dry matter, few eyes and red skin (Mbowa and Mwesigye, 2016). However, processors face difficulties in accessing the desired varieties due to a host of reasons but mostly related to inadequate seed supply, low yields, long maturity time and susceptibility to pests and diseases (*ibid*). Another challenge which processors in urban markets face is the mixing of varieties at source. This implies that

processors have to sort the potatoes in the market before purchase, for avoiding ending up with tubers that are not fit for processing (Magala et al., 2006).

4.6 Trade-offs between different uses of potato and policy issues

For women, the primary purpose for growing potato is food security given their responsibility of ensuring food availability in the household. As such, their plots and related cultivation practices are geared towards subsistence farming. Men, on the other hand, are more likely to grow for commercial purposes – as reflected by the level and quality of inputs they use. However, while commercial farmers endeavor to purchase seed, many still depend on farm saved seed; and hence select quality large tubers for this purpose (Mbowa and Mwesigye, 2016).

In times of food scarcity, there are conflicting priorities for the household: the desire to put food on the table; and the foresight to ensure seed availability for the next planting season. This may create tensions within the households and at times lead to domestic violence; with women bearing the brunt of this trade off (Mudege et al., 2016).

Potato products primarily under women's control:

Women are responsible for seed acquisition and preservation for subsistence and in some cases, for commercial purposes. They are also in charge of food availability in the home and thus determine when and how to prepare and consume boiled potato. Preparation and sale of chips as a street food is also done primarily by women (Tatwangire and Nabukeera 2017).

Potato products primarily under men's control:

Men dominate multiplication and sale of seed through formal seed channels. They also control commercial sales of ware potato (Mudege et al., 2016). However, as noted above, women play an important role in seed selection and conservation but their role is not recognized. This might be linked to the fact that potato is largely considered a man's crop, especially when grown for income (Walukano et al., 2016). Efforts to achieve increased productivity are supported by policy instruments such as the National Seed Policy and the National Fertilizer Policy to address the yield gap; and the National Extension Policy to address the knowledge gap. Given the proven productivity increment that quality seed ensures, high yielding varieties are likely to be increasingly adopted (*ibid*). However, women farmers are likely to be barred from participating in sustainable intensification programs due to limited access to natural and productive resources. This implies that women may not be able to adopt new varieties to the same extent as men, more so if they do not meet their preferred characteristics or traits.

According to Ortiz et al. (2016), farmer institutions and private seed companies are pivotal players in the quest for availing quality seed. However, most of the farmer institutions such as Uganda National Seed Potato Producers Association (UNSPPA) and Wanale Seed and Ware Potato Producers Association (WASWAPPA) are led by and dominated by men; with the few women members holding 'token' positions (Mudege et al.; 2016). This disparity further alienates women's participation in quality seed production and, ultimately, the whole performance of the sector.

Similarly, potato marketing associations such as Mbale Potato Dealers Association (MPODA) are dominated by men wholesalers with limited participation of women – who are mostly retailers with limited bargaining power and ability to voice the needs of the last mile in the chain, the consumers (*ibid*).

5 SECTION III: DEMAND ASSESSMENT

5.1 Market demand for potatoes in Uganda

The market demand for potato in Uganda is expanding and this is attributed to the rapid urban population growth and changing food eating habits of urban dwellers. To a great extent, potato is demanded by the urban population in various forms including chips, crisps and French fries (J.G. Wang'ombe, 2008; Jansky et al., 2009). This brings small scale processors into the value chain. The most common marketing channel is characterized by farmers selling on cash basis to wholesalers who in turn transport the potatoes to urban centers (L. Aliguma et al., 2007; Tatwangirwe and Nabukeera, 2017)]. Marketing channels in urban centres include wholesale markets and small shops in Kampala (Kaganzi *et al.*, 2008). Traders also sell potatoes to higher value outlets such as supermarkets, restaurants and fast-food chains (Bonabana-Wabbi et al., 2013).

5.2 Value chain actors and demand trends

Growing urbanization and demand from urban consumers have provided emerging market potentials for potato and potato products (Bonabana-Wabbi et al., 2013). Although potato production is largely localized in few areas of Uganda, its supply chain commonly ends in almost all the urban markets and restaurants in the country, hence bringing many market chain actors into play. The level of potato marketing and domestic demand of ware potato products is on the increase. Key players along the ware potato value chains include farmers, agents (or brokers), local traders, urban wholesalers, urban retailers, processors, and consumers. It is noted that most wholesalers sell directly to markets and hotels in big towns such as Kampala. Products from the processing of potato tubers include boiled potato, chips, and crisps (Tatwangire and Nabukeera, 2017). Some industries, such as those owned by Uganda Industries Research Institute (UIRI), process potatoes into quality crisps (Mbowe and Mwesigye, 2016). Various institutions such as schools, hotels, and hospitals also procure and consume ware potatoes in large quantities. (Tatwangire and Nabukeera, 2017). Travelling traders who either own trucks or hire them for buying potatoes from farmers or village traders and then transport and sell to wholesalers and urban retailers in other district markets are key players in the value chain. These traders supply most of the potatoes to wholesalers and retailers through brokers (Ferris et al., 2001).

From the key informant interviews, value chain actors associated with potato include the following.

- Bulk buyers/ transporters/ dealers who buy directly from farmers; transport and sell in major markets to wholesalers and retailers.
- Brokers who buy from farmers on behalf of the wholesalers who in turn transport to urban areas and sell to other wholesalers, retailers within major markets, retailers at other locations, hotels, restaurants and institutions.
- Small scale retailers who buy potatoes ranging from half to many sacs and sell the tubers to individual buyers, hoteliers, restaurants, kiosks and roadside dealers.
- Individual buyers who buy for home consumption.
- Hotels and restaurants who buy fresh potatoes and sell it boiled, fried or fried chips.
- Kiosk and fast food restaurant dealers who buy fresh potato from retailers and sell in form of fried chips.
- Roadside dealers/ small scale processors who also buy potato in fresh form from retailers and sell it in form of fried chips.
- Farmers and farmer organizations.
- People living in and around production areas.

5.2.1 Size of the different value chains and trends

Within the major production areas, wholesale buyers provide the biggest market outlet for fresh potatoes, as they buy the fresh product in large quantities from farmers either directly or through agents (brokers); and transport it to distant urban and peri-urban markets. In urban areas, over 50% of potatoes are likely to be consumed as chips (Ferris et al., 2001). Hotels, restaurants and take-aways (fast-food outlets) are the main business enterprises that process potatoes into chips. These processors provide a big market for the traders of fresh potatoes. On the contrary, processors within the major production areas provide the smallest market outlet for potatoes. These process potatoes into chips and crisps on a very small scale. Chips are mainly sold to fast food customers, while crisps are sold to supermarkets. In low production areas, end consumers are the number one buyers of potatoes because farmers are more likely to sell small quantities to neighbors (and in local towns) for final consumption than to other market segments (Mbowa and Mwesigye, 2016).

From **Table 6**, information obtained from the key informants shows wholesalers, processors, and retailers in urban and peri-urban markets as the biggest value chain actors, followed by retailers within the major urban markets. Individual consumers, hotels, restaurants and institutions were noted to be at the lower end of the value chain.

Table 6 Size of value chains in urban and peri-urban markets according to the KIIs

Demand segment	Size
Wholesalers	40%
Traders/ retailers within major urban markets	10 - 20%
Retailers in peri-urban markets	40 - 50%
Household / individual consumers	5%
Processors/ roadside kiosk dealers	40%
Hotels and restaurants	5%
Institutions	5%

5.2.2 Geographical and demographic characteristics of the value chain actors

Urban wholesalers mainly come from towns near the production areas and Kampala districts. Mbale town is the current potato hub in eastern Uganda where traders from different places meet to re-weigh, sort, and package potatoes before shipping them to different destination markets such as Kampala city and Lira, and including export markets in South Sudan and other neighboring countries (Tatwangirwe and Nabukeera, 2017).

Information obtained from the KIIs reveals that wholesale buyers and transporters usually travel from urban areas to production areas to purchase fresh potato. These are mainly adult men and business people because potato is a high value crop (communication by female research officer, NARO). Men are also physically stronger and resilient, and have the ability to stay away from home for a long time while handling the process of purchasing, loading and transport of fresh potatoes from production areas to market places while women have to stay home and deal with housekeeping duties (communication by male researcher, NARO). Brokers who are usually men and a few women in production areas connect wholesale buyers

to farmers. The potato value chain comprises of people across regions, ethnic groups and religions.

Retailers who sell the fresh product in smaller quantities are mostly women. According to a male key informant, women have the patience to sell a few sacs of potato over a number of days to obtain a little profit while men have less patience; and under pressure to earn large profits over a short period of time to take care of their households. A trader at Wekembe market recounted that female retailers are 30 years and above, with mixed marital status though most of them are married with families under their care. On the other hand, individual buyers include both men and women, whether single or married, youths and children who buy the fresh product for home consumption. These mostly consume the product in boiled and fried forms.

Key informants revealed that hotels and restaurants buy fresh potatoes and sell it boiled in addition to other foods, fried or fried chips. Hotel chefs and restaurant owners are majorly male and a few women. Small scale processors buy fresh potato from retailers and sell in form of fried chips. These include men and women across ages and ethnic groups. Roadside dealers/ small scale processors are usually male and female youths between 20 and 30 years old, mostly singles.

Furthermore, people living in and around production areas mainly consume potato in boiled form as a staple food. However, according to a male researcher at NARO, demand for potatoes among people in production areas is low. He attributed this to the fact that potatoes are expensive, yet people in those areas have low incomes. He added that although potatoes may appear cheaper in production areas, they are not affordable. However, other respondents indicated that at times farmers in production areas, get tired of eating potatoes to an extent that they may receive a kilogram of sugar in exchange for the potatoes.

Most of the demand segments stated are found in urban and peri-urban areas where the population is high and demand is geared mostly towards fast foods, and easy to cook foods including potatoes.

5.2.3 Profitability

Potatoes flow through a multi-staged marketing channel i.e. through a few different value chain actors before reaching the final consumer. This implies that profits are shared by many players along the chain. Potato prices are mainly set by traders depending on tuber availability and distance to target markets. Profits earned by traders are higher when no brokers are involved in the value chain than when they are present (Tatwangirwe and Nabukeera, 2017). For the producers, potato enterprise is a profitable one, returning more than the original investment in purchased inputs and labor (Bonabana-Wabbi et al., 2013).

Travelling traders with high quality fresh potatoes typically increase their prices relative to those prevailing in the market. Conversely, they reduce the price when sales are slower than they had anticipated, and quality starts to degenerate. They then sell at clearance prices to avoid additional costs such as accommodation costs, overnight parking fees, product loss and transport surcharge from truck owners. Travelling traders sometimes also sell at a loss especially when there is excess potato supply on the market coupled with gluts in other alternative foodstuffs like cooking bananas, sweetpotato and cassava (Ferris et al., 2001).

5.3 Preferred characteristics of potato by the different value chain actors

The different potato varieties available in markets include Rwashaki, Kinigi, Sutama, Victoria, and Kachpot 1. The first four provide the highest marketing margins in Kabale and Kisoro districts (Bonabana- Wabbi et al., 2013). It is noteworthy that most traders and consumers in

urban areas refer to potato varieties as Kabale, Kisoro, Fort (Fort Portal), and Mbale relating potato variety to production area (communication from Wekembe market traders).

The high demand for Kachpot 1 is explained by its high dry matter content and smooth red skin, which is suitable for processing. Low dry matter content and “deep eyes” that lead to wastage when peeling are undesirable characteristics of Victoria variety, while “blemish rings” coloring characteristic of Kinigi variety also lower its quality (Mbowa and Mwesigye, 2016). Uganda’s Rutuku which has the same characteristics as Victoria is highly sought after by traders, for its chip making quality. Its characteristics are large tuber size, red/light red skin color and yellow/cream flesh.

As summarized in **Table 7**, information obtained from the KILs presents little variation in the preferred characteristics among the different value chain actors. Most people prefer yellow fleshed potatoes that are hard when raw and firm when cooked. However, the key informants noted that variation in skin color of raw potato may not necessarily indicate potato quality. Potato processors prefer hard potatoes due to their ability to retain the shape after frying i.e. they do not become soggy or crushed.

Preference of retailers, individual consumers, and processors (such as roadside dealers, and fast food restaurants) is geared towards potato variety, maturity and big size; potato processability characteristics such as low oil absorption, and final product characteristics such as taste and shape retention after cooking. Processors prefer big sized potatoes because they give more chips, increasing profitability. Wholesalers usually focus on low price of potatoes, availability of large quantities, potato variety and potato maturity.

Table 7 Preferred characteristics for potato per value chain actor according to the KILs

Demand segment	Characteristics
Producers	High yield Resilience
Bulk buyers/ transporters/ dealers	Maturity
Wholesalers	Maturity
Traders/ retailers with in major urban markets	Firm tuber Medium/ big tuber size
Retailers at other locations	Firm tuber Medium/ big tuber size
Household / individual consumers	Firm tuber Low oil absorption Yellow flesh Shape retention after cooking
Processors/ roadside / kiosk dealers	Low oil absorption Firm potato when cooked Red skin color Good taste of cooked potato Medium/ big tuber size Maturity Yellow flesh High dry matter content Smooth skin Shape retention after cooking
Hotels and restaurants	Firm potato

According to the traders at Wekembe market, varieties preferred by the market were Kisoro, and Kabale. These are hard when raw, firm when cooked, take up little oil, do not dry quickly and have a good yellow appearance. Kisoro has medium and large tubers, white skin and cream flesh, while Kabale is characterized by large tubers, purple/ white skin and white flesh.

An overview table summarizing the value chain actors and preferred characteristics for potato has been included in the appendix section.

5.4 Transportation, storage and sale of the potato product

On farm, potato is packed in gunny bags and stored in specialized structures or in a farmer's house. Transportation to the market is done either using bicycles, head loads or motor vehicles (trucks, pickups) (Mbowa and Mwesigye, 2016). Bulk buyers, wholesalers and transporters use trucks i.e. Fusos, Kantas and lorries to transport large quantities of fresh potatoes from production areas to urban and peri-urban areas where they sell the product to other wholesalers, retailers and institutions. These trucks carry a minimum of 100 bags of fresh potato each bag weighing 120kg. Within the production areas, peri-urban and urban areas; bicycles, head carriage, pickups, taxis and personal vehicles are used to transport the fresh product along short distances from both major and minor markets (communication by Wekembe market traders). In urban and peri-urban markets, storage facilities for the fresh product include bulk stores and market sheds with regards to wholesalers. These keep the potatoes in bags. Retailers store the product in mini stores, shops and verandas (communication by female research officer, NARO). Additionally, traders report that although some retailers store the fresh product in open spaces in the market, these expose the fresh product to water (from rain) and humid conditions that induce rotting, hence spoilage and low profitability of the product. For these reason, retailers and wholesalers in the market either store the fresh product in bags under sheds or cover the potatoes with tarpaulins (communication by Wekembe market traders).

High transport costs, which are attributed to mechanical breakdowns and bad roads are one of the major challenges faced by potato traders, hence greatly contribute to the high market prices of the product (Mbowa and Mwesigye, 2016). Besides, lack of organized storage translates into high postharvest losses among farmers, traders, and processors (Mbowa and Mwesigye, 2015). These challenges in addition to poor communication facilities, high costs of electricity, lack of pre-cooling and pack houses, limited access to cold and dry storage facilities make it difficult for value chain actors to successfully market their produce (MAAIF, 2010). Improving transport, storage, and market infrastructure can therefore reduce marketing costs so that households in more remote areas can benefit more from commercialization.

With regard to sales, it is noteworthy that the product is sold fresh by both men and women of various ethnicities and religious backgrounds at various stages of the potato value chain. However, wholesalers (buying directly from producers) are mostly men who, according to the key informants, are physically strong and resilient. At the market, wholesalers sell the product in bags, large scale retailers sell the fresh product in bags, basins, heaps and tins while small-scale retailers, mostly women, sell in small polythene bags and tins. Processors who sell the potatoes in form of chips include majorly male and female youths. Fried potato chips are sold in paper bags, polythene bags and containers, while boiled potato in hotels and restaurants is usually served in addition to other dishes (communication by Wekembe market trader).

6 CONCLUSIONS

While efforts have been made to introduce new improved potato varieties in Uganda, adoption rates are low; especially by women farmers. Nonetheless, the most preferred varieties are released varieties such as Rwangume (Naropot 4), Victoria and Kinigi. There are gender specific roles in the seed and ware potato chains, with seed production being dominated by men, though women play an important role in seed management. In the ware potato chain, the wholesale function is dominated by men while women are more prevalent in retail and processing boiled potato. Preferences for raw, processed and boiled potato were similar amongst various end-users in the value chain. Producers, traders and consumers all preferred red skin, yellow flesh, smooth skin and big tubers among raw potato characteristics. Processor preferences were similar, however, in addition, shallow eye depth, high dry matter and low sugar content were a requirement. A good boiled potato was defined by consumers as being mealy, having a bright yellow color, good potato taste and smell. The information obtained in this study with regards to food science requires translation into objective physicochemical measurements and sensory evaluation that can be used by breeders to improve the potato varieties to meet specific end-user requirements. Additionally, a vast amount of literature has been generated on potato production, potato value chain, and performance of potato markets in Uganda. However, limited literature is available regarding potato demand size, trends and profitability in Uganda's urban and peri-urban areas which calls for additional research in this area.

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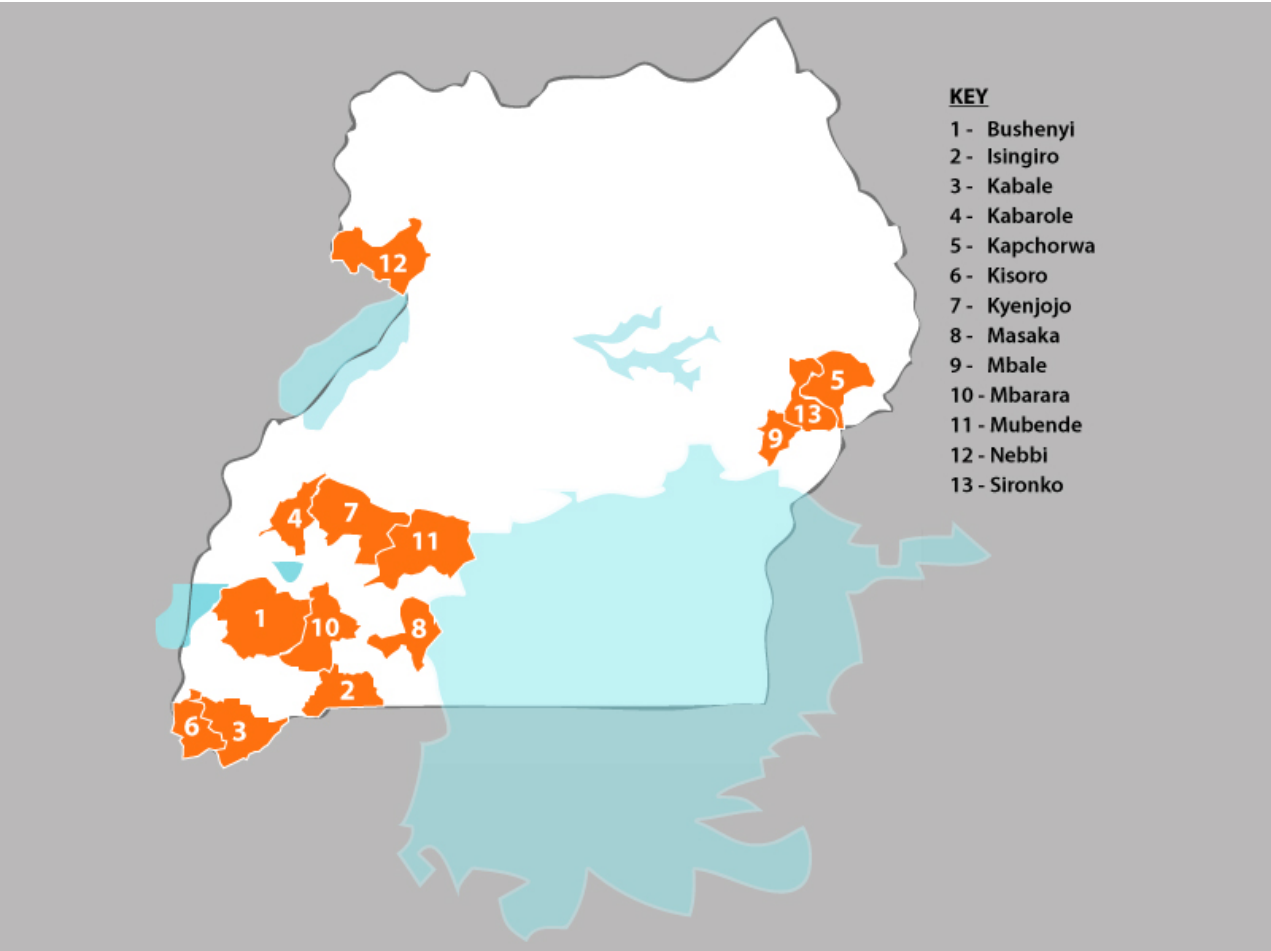
8 APPENDICES

8.1 APPENDIX A: OVERVIEW TABLE OF THE POTATO VALUE CHAIN AND PREFERRED CHARACTERISTICS

Value chain actors	Characteristics preferred	Size of demand segment	Profitability /value of the product by value chain actor	Geographic location	Socio-economic characteristics of value chain actor (income, gender, age, etc.)	Main sources of information
Producers	High yield Resilience		Highly profitable across seasons	Production areas (Kabale, Kisoro, Kapchorwa, Mbale, Masaka) Urban areas	Majorly men because it's a high value crop Business people Adults All races	Visits to major market outlets such as Kalerwe, Owino, Nakasero
Bulk buyers/ transporters/ dealers	Maturity		Highly profitable across seasons	Major urban markets such as Nakasero, Kalerwe	Men of High-income status All races	Visits to major market outlets such as Kalerwe, Owino, Nakasero
Wholesalers	Maturity	40%	Highly profitable during peak season, Less profitable during off peak	Major urban markets		Kachwekano ZARDI (KaZARDI) – NARO
Traders/ retailers with in major urban markets	Firm roots Medium/ big root size	10 - 20%	Profitable during peak seasons			

Retailers at other locations	Firm root Medium/ big root size	40 - 50%		Urban areas and peri urban areas Production areas where potato is a staple food		UBOS report
Household / individual consumers	Firm root Low oil absorption Yellow flesh	5%	Highly profitable during peak season, but less profitable during off peak season	Urban and peri-urban areas	Youths across gender Middle aged men and women All races	
Processors/ roadside kiosk dealers	Low oil absorption Firm potato when cooked Red skin color Good taste of cooked potato Medium/ big root size Maturity Yellow flesh High dry matter content Smooth skin	40%		Urban areas	Majorly men All races	
Hotels and restaurants	Firm potato	5%		Peri - urban areas		
Institutions						

8.2 APPENDIX B: MAJOR POTATO GROWING DISTRICTS IN UGANDA



Source: Okwadi J., 2013



RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas

The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is a partnership collaboration led by the International Potato Center implemented jointly with the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT), the International Institute of Tropical Agriculture (IITA), and the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), that includes a growing number of research and development partners. RTB brings together research on its mandate crops: bananas and plantains, cassava, potato, sweetpotato, yams, and minor roots and tubers, to improve nutrition and food security and foster greater gender equity especially among some of the world's poorest and most vulnerable populations.

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