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Innovation Opportunities in Organic Pineapple Production in Uganda

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Abstract

Pineapple is an important horticultural crop grown in many tropical countries as a major source of income. It is also consumed as fresh and dried fruit and has been found to have high nutritional and medicinal value. In Uganda, organic pineapple production is practiced as part of organic agriculture (OA) systems that have been found to be particularly suitable for small-scale farmers. The purpose of this research was to conduct a rapid organic pineapple VCA toward identifying innovation opportunities to boost the organic pineapple production and marketing in Uganda. Uganda is leading in Africa with the largest organic area (240,197ha) and highest number of organic producers (190,552), courtesy of NOGAMU, which has been instrumental in organic farming certification in Uganda. Pineapples are produced exclusively as a small-holder crop, either as sole crop or intercropped with other crops such as bananas in a given Ugandan farming system. Organic pineapple production in Uganda is faced with many constraints including lack of national policy to support pineapple production, costly certification, and low soil fertility. Pineapple VCA conducted at the Ntungamo Organic Pineapple IP show that the chain starts with input supply of suckers to small-holder IP farmers as the main players in production and marketing to various actors in local and urban markets. Innovation opportunities exist in Uganda that can boost pineapple VC for enhanced socio-economic gains. The identified opportunities among others include increasing farm level production, provision of affordable certification for organic producers, acquisition of advanced solar driers, and introduction of small scale pineapple processing.

Key words: Organic pineapple, Innovation Platform, Uganda, VCA, Innovation opportunities

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Introduction

In Uganda, organic farming systems have been found to be particularly suitable for small scale farmers since they rely on local resources and build on indigenous knowledge (Walaga, 2011). The use of agrochemical inputs is not widespread. This is partly due to poverty (UBoS, 2009) with most Ugandan farmers being family based and are engaged in subsistence farming, and partly due to small land sizes while many do not own the land they cultivate (Tumushabe *et al*., 2006). Since late 1980s, Ugandan civil society organizations have therefore been working with poor small scale farmers to reverse declining farm productivity by developing sustainable farming systems, based on organic agriculture principles. This would allow for the development of highly productive farming systems that yield variety of products and services that sustain the livelihood of smallholders. It would also increase the food security of farmer families while the international market for organic agricultural produce offers good value for their products (Taylor, 2006; Walaga, 2011). However, in Uganda, although fruits are among the country's prioritized crops, organic production and access to markets continue to be constrained. The main pineapple growing areas in Uganda are shown in Figure 1.

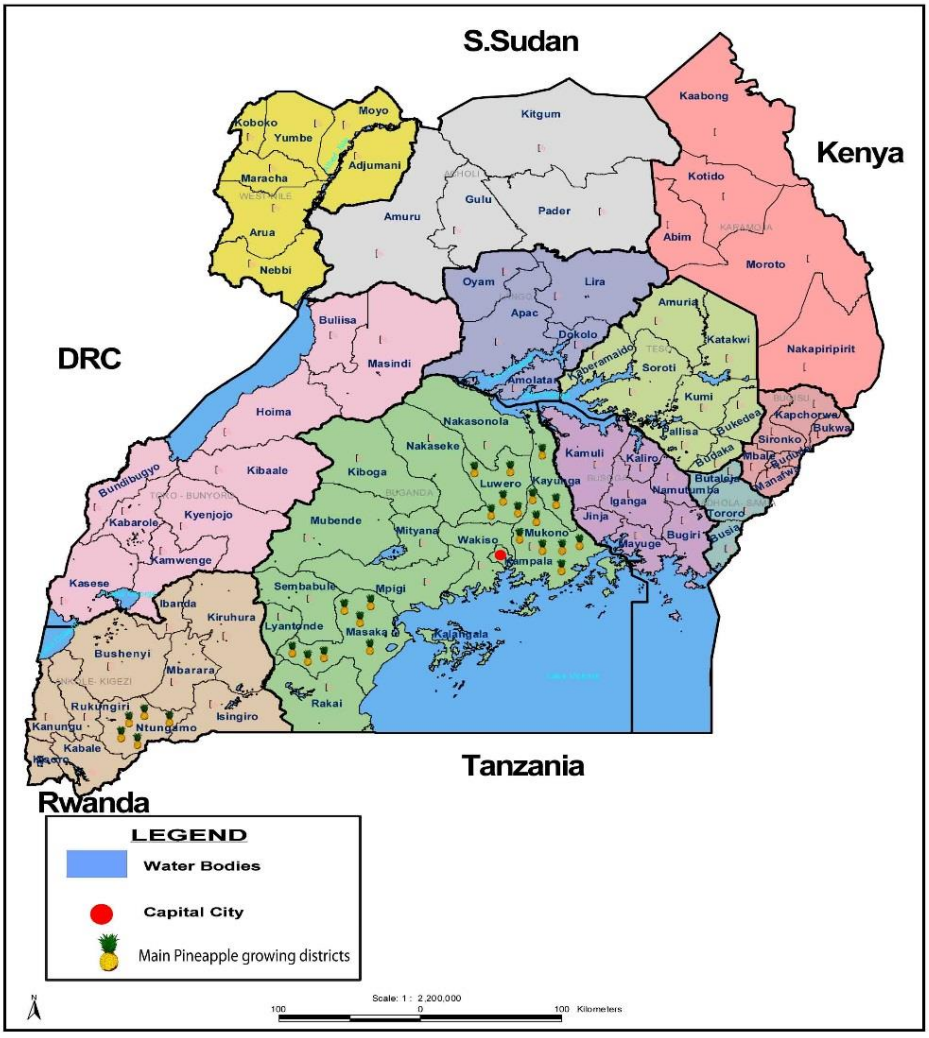

Figure 1. Map of Uganda showing main pineapple growing areas

Growth of organic agricultural land in Uganda and access of organic agricultural products to markets is closely associated with the National Organic Agriculture Movement in Uganda (NOGAMU), which was established in 2001. There has been a steady increase in certified land and number of organic farmers respectively from 2002/2003, reaching a peak in 2007/2008. More export companies have been acquiring the organic status each year and hence more farmers and certified land (Namuwoza and Tushemereirwe, 2010). By mid-2005, NOGAMU had attracted over 300 individual members and 80 corporate members. Many of the NOGAMU corporate members have membership in the thousands, which means that NOGAMU is linked to 25,000 stakeholders in the organic sector (Taylor, 2006). In Africa as well as in the East African Community (EAC), Uganda has the largest organic area (240,197ha), and the highest number of organic producers (190,552) (FiBL and IFOAM, 2016) (Table 1 and Fig. 4). Organic agriculture requires less financial input and relies more on the available natural and human resources, which can be afforded by the small-holder farmers (Kwikiriza, 2016).

Table 1: Total area of organic agricultural land (ha) and number of producers among countries of the EAC (2014)

	Burundi	Kenya	Tanzania	Uganda	Rwanda
Area (ha)	148	4,894	186,537	240,197	2, 248
Producers (No.)	34	12,647	148,610	190,552	3,952

Notes: ha= hectare, No.=number
Source: FiBL and IFOAM (2016)

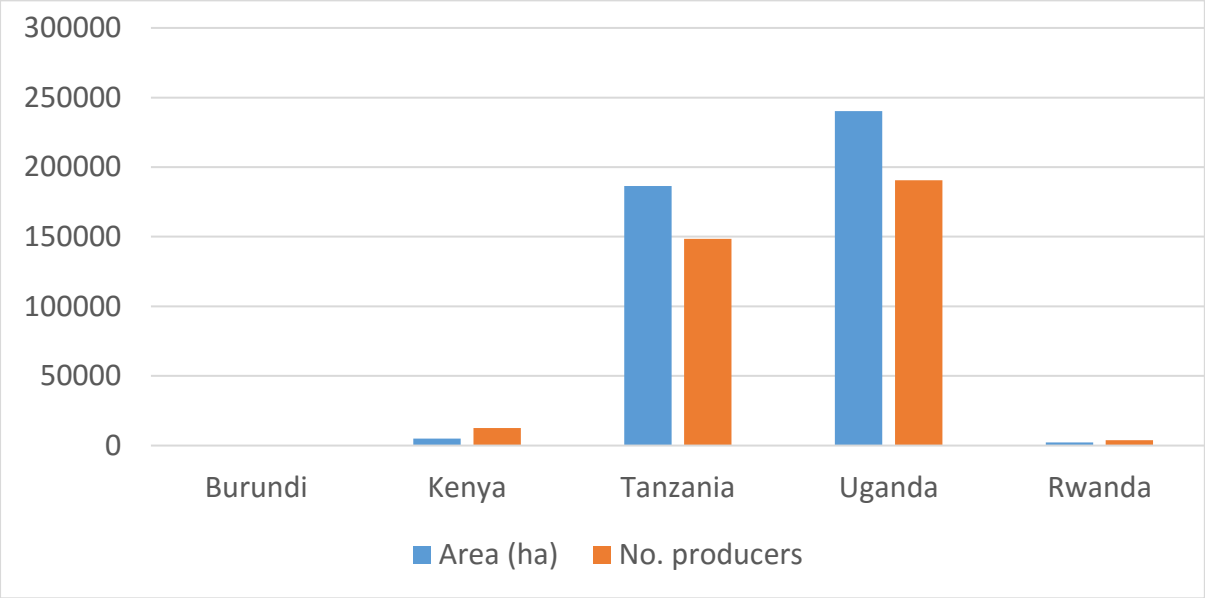

Figure 2. Total organic agricultural land and number of producers in EAC countries (2014)

It is however important to recognize that certification has increasingly gained increasing global acceptance as the critical decision point for organic agricultural products to enter into the global organic agricultural production and marketing system. The global organic agricultural production and marketing system requires that certain elements of the system such as the land, the farmers or the products be certified as organic before they are marketed as such (Tumushabe *et al*. 2006). Up till the late 1990's, certification was done by foreign companies and was not easily accessible to small scale farmers. But with support from NOGAMU, Ugocert, a local certifying company was established to reduce on the high costs incurred when using the foreign companies. Farmers are certified in groups, as production per household is so low that individual certification would be economically infeasible. Other than Ugocert, other international certification agencies offer the service in the country. However, the process is still expensive for the certifying agencies to cover large numbers of farmers. Therefore many farmers who would be willing to be certified remain un-certified and cannot join organic markets.

Agronomy and production trends

The most important types of pineapple grown throughout the tropics are the *Smooth Cayenne*, whose leaves are spineless except at the apices, and *Queen*, whose leaves are spiny and more difficult to work with, although with smaller and sweeter fruits than the *smooth cayenne*. (NAADS, 2005). In the EU markets, smaller sizes of pineapple are preferred. The larger sized *Smooth Cayenne* that is mostly grown in Ntungamo district, is less competitive in such markets and also has a high acid content (FIT and Ssemwanga, 2006). Pineapple can be intercropped with other food crops in a given farming system. For example in Ntungamo, pineapples are commonly intercropped with bananas (Fig. 3) and coffee.

Figure 3. Pineapples intercropped with bananas in Ntungamo

Pineapples are generally planted in double rows spaced at 2ft (60cm) between the rows, 1ft (30cm) between plants and 4ft (120cm) between adjacent double rows. This gives an approximate plant population of 36, 250 plants per ha. Holes are dug shallowly (7-10cm deep) using a small hoe or by simply inserting a large stick in the ground so that only the pedal part is firmly planted. The propagules are planted on a level ground and later ridged. Ridge planting helps provide a deep bed for good root growth and also retains water between the double spaces or even drains away excess water in water logged areas. Figure 4 shows an established organic pineapple garden in Ntungamo.

Pineapples are vegetatively propagated using either the crown, slip or sucker, shown in Figure 5. However seed can also be used in breeding. Vegetative propagation materials are commonly used by small-holder farmers in Ntungamo.

Figure 4. An established organic pineapple garden in Ntungamo, South-Western Uganda

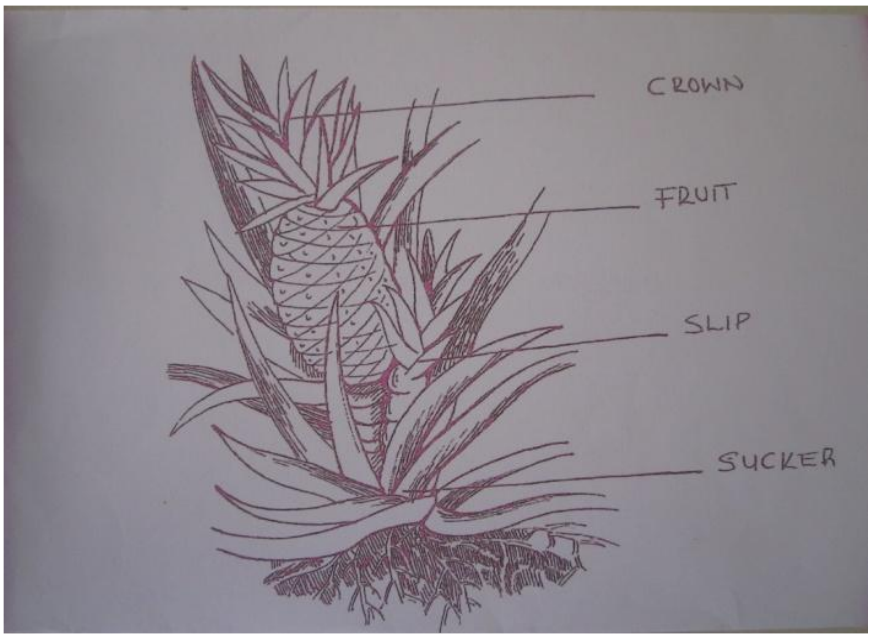

Figure 5: Pineapple fruit and propagation materials
Source: NAADS (2005)

Harvest is done 5 to 51 or 52 months after induction based on the external maturity of the fruit for the market. The harvest operation is done using special devices to draw the fruit from the field by breaking the fruit that shows proper maturity.

Role of the pineapples in the food chain

Pineapple (*Ananas comosus*) is an important horticultural crop in many tropical countries. In Uganda, pineapple is widely grown in the central region in the districts of Mukono, Kayunga, Luwero and Masaka. Ntungamo is one of the pineapple growing districts of south-western Uganda (Bua *et al*., 2013). Pineapple is produced exclusively as a small-holder crop, either as a sole crop or an intercrop with bananas (FIT and Ssemwanga, 2006). In these areas, farmers grow pineapple as a major of source of cash income, and a variety of other purposes including home consumption and processing into juices as well as solar drying for exports (Bua, *et al*., 2013). Fig 6 shows the different forms of pineapple consumption.

Figure 6. Different forms of pineapple consumption; fresh (left) and dried (right)

There are other uses of the pineapple. For example, pineapple is a good source of fibre that is used by some countries in Asia, in the paper and clothing industries. Pineapple contains bromelin, a protease that can be obtained from the juice of pineapple stems by methanolic precipitation. Applications of Bromelin in the food industry are in meat tenderization, chill proofing of beer, in protein solubilization, fish waste treatment, leather coloring and as latex paints stabilizer among many other uses (De la Cruz and Garcia, 2005). Tropical and sub-tropical countries with abundant pineapple production would find the process of Bromelin preparation feasible where production may be intended for export markets (TTPC, 2004 in De la Cruz and Garcia, 2005)

Pineapples have also been said to have different medicinal and healing properties. The fruit is anti-parasitic, detoxifier, improves digestion, regulates stomach acidity, aids in detoxification processes, and the neutralization of free radicals and blood clots, as aid in the treatment of rheumatoid arthritis, reduction of sciatica symptoms, collagen production, and weight control and in the treatment of albuminuria. Evidence of these claims was generated from studies made in the US and Europe (Coveca, 2002 in De la Cruz and Garcia, 2005). One of the best known properties of pineapple is being a diuretic. This helps to eliminate toxins through the urine, helping patients with ailments of kidneys, bladder and prostate. Due to the fiber content of the pulp, pineapple prevents constipation and regularizes the intestinal flora. Further, there is evidence of appetite reducer, heart protection and aid for fever, sore throat and mouth aches and inflammation. Lightly boiled ground pineapple can be used to clean infected wounds because it eliminates dead tissues, not affecting live tissue, acts as disinfectant and accelerates cicatrization (Mundogar, 2004). The by-products from pineapple are encouraged for feed production. Leaves can be used in three forms: fresh, dried and in silage (Geo coppens, 2001).

Nutritional value of pineapples

Pineapple fruit is a rich source of vitamin C and is usually consumed fully ripened as juice, dessert or at breakfast. Pineapples contain 81.2 - 86.2% moisture, and 13-19% total solids, of which sucrose, glucose and fructose are the main components. Carbohydrates represent up to 85% of total solids whereas fiber makes up for 2-3%. Of the organic acids, citric acid is the most abundant. The pulp has very low ash content, nitrogenous compounds and lipids (0.1%). From 25-30% of nitrogenous compounds are true protein. Out of this proportion, 80% has proteolytic activity due to a protease known as Bromelin (De la Cruz and Garcia, 2005).

Production constraints and identified hindrances to productivity and profitability

In Uganda, the National Development Plans (NDP) recognize agriculture as the primary source of growth and a priority area with the objective to increase sustainable production, productivity and value addition in key growth opportunities. However, the government does not have an explicit policy focusing on the development of the organic agriculture sub-sector. Government position on organic agriculture can only be deciphered from the general agriculture policy framework (Tumushabe *et al*., 2007). In the absence of a national organic policy, the full potential of organic agriculture for the rural smallholders cannot be realized. This is because the allocation of government resources is directed towards the realisation of policy objectives and goals, and without such a policy government resources cannot be invested in education, research and extension in support of organic agriculture development. Further, the country cannot actively contribute to multilateral trade negotiations around organic agriculture (Walaga, *et al*. 2011). As certification has increasingly gained global acceptance for organic agricultural products to enter global organic markets, it is a constraint in Uganda given that it is an expensive venture to undertake by the poor Ugandan small-holder farmers.

In addition, expansion of pineapple value chains is confronted with various challenges or constraints including environmental, technical (productivity, markets and policy), economic and institutional that need fixing. In particular, environmental constraints impact pineapple expansion from various perspectives including deforestation and soil erosion to agrochemical contamination of local rivers and wetlands (Kellon and Arvai, 2011). From technical point of view, the constraints that face the pineapple subsector include limited cost-efficient farming and poor processing techniques, high cost of transport, poor quality products and not meeting volumes required (Hotegni *et al.,* 2014). The institutional challenges include issues of adherence to regulatory standards and business arrangements.

Innovation Opportunities

Innovation opportunities that exist for the organic pineapple include drying the fresh pineapple, packaging, labelling and selling both at the local market, especially in supermarkets in the city, as well as in the export market. At the Ntungamo IP, farmers were trained to prepare fresh pineapple, and to use a Solar-drier for drying it. (Figures 7 and 8).

Fig 7. Farmers at the Ntungamo IP using a Solar-drier to dry organic pineapple

Figure 8. Drying the Organic pineapple in a Solar-drier

The packed product (Fig. 9) is already being tested in Kampala markets and other regional markets. The farmers would benefit from having more solar-driers since they have received training and have gained the capacity to dry the fruit. There are other products that can be made from organic pineapple and have not been explored. These include juices and jams. Farmers could be trained to produce these products to be sold locally and in major towns. It then becomes necessary to develop the packaging industry so as to provide packaging materials for the new products if they are to enter affluent and profitable markets.

Figure 9. Dried and packed Organic pineapple

Value Chain Analysis

This Value Chain Analysis (VCA) is based on the organic pineapple production at the Ntungamo IP in south-western Uganda. The value chain processes, actors and services are laid out in Figure 10. The organic pineapple value chain at the Ntungamo IP begins with the production and supply of organic suckers. There are selected IP members who produce and share the suckers with fellow members. Pineapple being a perennial crop, suckers are always in sufficient supply for any new farmers or those wishing to expand their gardens. The IP establishment enables the farmers to access the suckers from the producers.

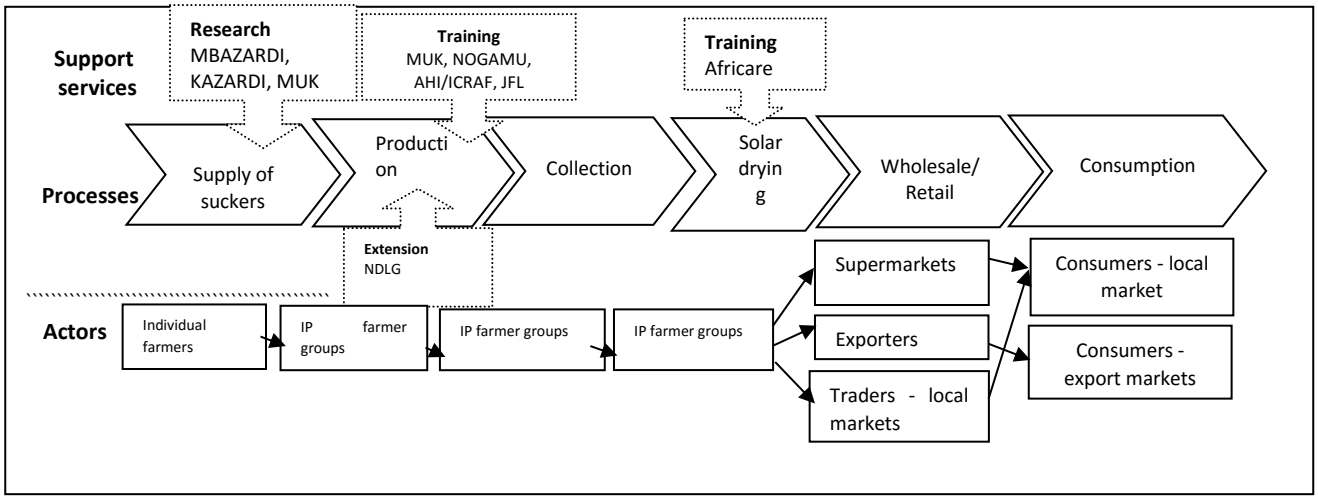

Figure 10: Map of the organic pineapple value chain at the Ntungamo IP

Production is done by the IP farmers with support of extension services by Ntungamo District Local Government (NDLG). Other institutions that are involved at this stage include NOGAMU offering trainings on organic farming practices, ICRAF on agro-forestry issues, and Makerere University on soil and water conservation practices. Jakana Foods Ltd (JFL), an organic products exporter based in Kampala was identified by NOGAMU as a potential market outlet for the IP products. Mediated by NOGAMU, JFL signed a contract with the IP at the beginning of 2015 in which the farmers are expected to supply a minimum of 200kg of dried pineapple to JFL. Jakana therefore has to get involved in training the farmers to achieve and maintain the required standard of production.

The pineapple outputs, production costs, revenues and gross margins obtained by the farmers in the study period are described in Table 2. There were no significant differences in the outputs, revenues from the pineapple sales, and gross margins per acre, between the two farmer categories (IP and non-IP farmers). However the mean total cost of production was significantly higher (at the 10% level) for the IP farmers at Uganda Shilling (UgX)831, 320/= than the non-IP farmers at UgX526,590/=. Although both IP and non-IP farmers were found not to use any inorganic fertilizer, the IP farmers mostly purchased farm yard manure and compost from other farmers who kept livestock. The cost of these purchases, and the cost of hiring labour for their application as well as the application of mulch contributed to the high cost of production for the IP farmers. This is as a result of the training they had received to achieve and maintain the standards of organic farming.

Table 2: Production costs and gross margins

Parameters		IP		non-IP	t-value
Production (heads/ha)	(n=49)	10,676	(n=57)	11,792	0.31
Mean value of harvest (UgX)	(n=37)	3,841,000	(n=48)	2,673,500	1.441
Mean value of harvest per acre (UgX)	(n=37)	3,880,700	(n=43)	2,737,600	0.954
Revenue from sales (UgX)	(n=37)	3,085,800	(n=42)	2,587,000	0.753
Average total cost of production (UgX)	(n=32)	831,320	(n=34)	526,590	1.725*
GM (UgX)	(n=29)	2,499,900	(n=26)	2,910,300	0.462
GM per acre (UgX)	(n=29)	1,515,900	(n=26)	2,518,100	0.992

Notes: heads=pineapple heads (fruits), ha=hectare, UgX=Uganda Shillings, n=number, GM=Gross margin, *significant at the 10% level
Source: Survey data (2015)

Although not significantly different from the non-IP farmers, the mean total production (number of fruits harvested) among the sampled farmers was 10,676heads/ha, which is much lower than the recommended output of 20,000heads/ha (NAADS, 2005). The yield of pineapple at the IP farms has to double to catch up with the recommended yield, and this has to be the first intervention point. The value of harvest and revenue from the sales are not significantly different between the two categories of farmers. This is because they mostly sell in the same village markets, at about the same prices; both organically produced and conventional pineapples. The contract between the IP and JFL had not been effected during most of the study period and so both organic and non-organic pineapples were mostly sold in the nearby markets. This makes the gross margins of the IP farmers lower than the non-IP farmers given the formers' elevated cost of production. For the farmers that were able to sell fresh pineapples to JFL, they were able to get the price offered by JFL of UgX800/= per head, which was higher than the average price they would get from the local markets at UgX 650/= per head. However only 10 of the IP respondents were able to sell to JFL during that period.

The process of farmer certification at the IP is being handled by both NOGAMU and JFL, subject to availability of funds. The lack of financial resources has greatly limited the number of farmers that can be certified to be able to sell products to the organic market through JFL. By the end of 2015, only a total of 80 farmers from Itojo and the new sub-county of Ihunga had been certified, out of a total of 510 potential IP members. This is the second intervention point for the value chain. Although the district is among the high pineapple producers in south-western Uganda and the country (Bua *et al*., 2013), and farmers are showing interest in joining the organic farming at the IP, the rate at which farms can be certified and continually monitored for compliance to the organic standards is hampered by the lack of funds among the certifying bodies.

When the pineapples are harvested, they are collected at central points within the community where JFL picks them for transportation to the city and further for export. Other products mainly include dried pineapple. The technique of solar-drying was introduced by Africare through NOGAMU. Selected farmers were able to learn how to dry the pineapples, and package them for sale to supermarkets in the city and also for export. However there were challenges with the acidity and moisture content of the product when it was delivered to the export market in the United States. This challenge could on one hand be resolved by the acquisition and use of better quality solar-driers which at present are not available at the IP. On the other hand the acidity could be as a result of soil properties. This is still being investigated by the research institutions; MBAZARDI and Makerere University, Departments of Soil Science; and Food Science and Technology, to enable farmers produce dried products of an acceptable quality for the existing and emerging markets through JFL. The third intervention point for this value chain would therefore be the acquisition of advanced solar-driers. At the same time with the increase in numbers of the IP members, given the stringent quality standards of the export market, it would also be useful to introduce small scale processing enterprises within the community for farmers to produce other products for the local market as intervention point four. Other products that could suitably find local market include pineapple jams, juices and wines. However entrepreneurs for these products need to be supported; either the farmers themselves or other members of private sector who can utilize the fresh pineapples produced by the farmers.

SWOT Analysis

Table 3. A strengths, weaknesses, opportunities and threats (SWOT) analysis of the Organic Pineapple Value Chain

Strengths	**Weaknesses**
• Pineapple VC is an enterprise where farmers can produce their own planting materials, • Farmers already have some knowledge of pineapple agronomy, • The enterprise utilizes the available household labour since organic farming is labour intensive, • Organic agriculture improves the entire farm; in terms of soil and water conservation, productivity, and enhances synergies between crops and animals on the farm, • Other organic products can be produced from the same farm e.g. apple banana.	• Lack of a national policy constrains government budget allocation to key areas such as certification, • Farmer who do not keep livestock do not have sufficient manure to sustain the organic system, • Poor transportation (and hence high costs) from the rural areas to the city where the market is, • Yield estimates and record keeping by the farmers, are still poor, • The IP does not have solar-driers, • There are no local processors in Ntungamo to purchase the produce from the farmers in bulk.

Opportunities	Threats
• Niche organic market exists; both local and export and demand for organic products is increasing, • Organic pineapple has the potential to improve rural household livelihood, in terms of nutrition and general welfare, • Many private organic exporters exist in the country, • Other institutions also exist; NOGAMU, UEPB, MTTI, private organic certifiers that can support market access.	• When the farmers wait for a long time without accessing the market e.g. because of certification or not achieving the required quality, they might abandon the enterprise, • Weed and pest management, • The problem of pineapple acidity might reduce the chances of accessing the export market.

Summary and Conclusion

Pineapple is an important horticultural crop in many tropical countries, and a major source of cash income. It is also used for consumption as fresh and dried fruit, as well as juice. Other products that can be obtained from pineapple include concentrate, jam, and wine. Pineapple has been found to have high nutritional and medicinal value and other important uses. In particular, organic pineapple is even more appealing in export markets where demand for organic products continues to increase because of the associated health benefits. Organic products attract higher prices, enhance the quality of the soil, which ensures stable yield of crops. Organic pineapple is a relevant crop for the farmers in Uganda, considering that they rarely use inorganic fertilizer and therefore establishing organic agriculture would entail lower financial costs. Further organic pineapple has a range of products that the farmers could explore to enhance their incomes and household nutrition. However, there is need to speed up the certification processes, support for the purchase of appropriate technologies to process especially solar-driers, and support towards the development and wide dissemination of appropriate packaging materials for the new products.

References

Bua, B., Karungi, J. and Kawube, G. (2013). Occurrence and effects of Pineapple Mealybug Wilt disease in Central Uganda. *Journal of Agricultural Science and Technology* A 3 (2013) 410-416.

Coveca (2002). Comision veracruzana de comercializacion agropecuaria. Gobierno del Estado de Veracruz, México.

De la Cruz and Garcia, H.S. (2005). Pineapple: Post-harvest operations. Food and Agriculture Organisation of the United Nations (FAO). Rome, Italy.

FiBL and IFOAM (2016). The World of Organic Agriculture: Statistics and Emerging Trends, 2016, West Germany, Bonn.

Hotegni, V.N.F., Lommen, W.J.M., van der Vorst, J.G.A.J., Agbossou, E.K. and Struik, P.C. (2014). Bottlenecks and opportunities for quality improvement in fresh pineapple supply

chains in Benin. *International Food and Agribusiness Management Review*, 17 (3): 139-170. https://www.researchgate.net/publication/265554739_Bottlenecks_and_Opportunities_for_Quality_Improvement_in_Fresh_Pineapple_Supply_Chains_in_Benin [Accessed: April 31 5, 2017].

Hui-Shung, C., Griffith, G. and Zepeda, L. (2003). An overview of the organic food products market in Australia. Working paper series in Agriculture and Resource Economics. UNE, Australia, Armidale.

Kellon, D.S. and Arvai, J. (2011). Five propositions for improving decision making about the environment in developing communities: Insights from the decision sciences. *Journal of Environmental Management*, 92: 363-371.

Kwikiriza, N., Mugisha, J., Kledal, R., Karantininis, K. and Namuwoza, C. (2016). Tracing Uganda's Global Primary Organic Pineapple Value Chain, *African Crop Science Journal*, vol 24, no 1, pp 15-33.

Namuwoza, C. and Tushemerirwe, H. (2011). Uganda: Country Report. Willer and Kilcher (Eds.). The World of Organic Agriculture: Statistics and Emerging Trends, 2011, IFOAM, Bonn.

Republic of Uganda (RoU) (2015). Second National Development Plan 2015/2016-2019/2020 (NDP II)(Draft).

Taylor, A. (2006). Overview of the current state of organic agriculture in Kenya, Uganda and the United Republic of Tanzania, and opportunities for regional harmonization, New York and Geneva: United Nations.

Tumushabe, G., Naluwayiro, R. and Mugyenyi, O. (2006). The status of organic agriculture production and trade in Uganda. Background Study to an Integrated Assessment of the Sub-sector, ACODE.

Uganda Bureau of Statistics (UBoS) (2009) Uganda Census of Agriculture 2008/09. Uganda, Kampala.

Walaga, C et al. (2011). Promoting organic agriculture in Uganda. Uganda, Kampala.

Weir, S. (1999). The effects of education on farmer productivity in rural Ethiopia, Oxford: Centre for the study of African economies. UK, Oxford.

World Bank (2011). Uganda: Agriculture for Inclusive Growth. Draft Final Report, June, 2011. USA, Washington D.C.

World Bank (2012). Uganda: Promoting Inclusive Growth, Synthesis Report, USA, Washington D.C.

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