Incentives and disincentives to investment in orange-fleshed sweetpotato – The case of a pro-poor public-private partnership in Rwanda

Technical assessment of orange-fleshed sweetpotato value chain in Rwanda

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SUSTAIN Scaling up Sweetpotato through Agriculture and Nutrition

Incentives and disincentives to investment in orange-fleshed sweetpotato – The case of a pro-poor public-private partnership in Rwanda

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Abstract

Purpose: Value chain development that involves smallholder farmers has become a key focus for donors, government and development agencies to reduce poverty. However, these value chains face various challenges, in part due to smallholders' inability to take risks required to invest. This calls for creation of incentives to propel the development of such value chains and attract private investors. The aim of this study was to document the incentives created along the implementation pathway of orange-fleshed sweetpotato (OFSP) value chain development in Rwanda.

Design/methodology/approach: The study used qualitative data collected through key informant interviews (KIIs) among purposely selected value chain actors and gender segregated focus group discussions (FGDs). Quantitative data collected as part of routine project monitoring has been used to corroborate and further explain trends reported in the qualitative data.

Findings: The results show that, through pro-poor public-private partnerships in rural Rwanda, an OFSP value chain that links smallholder farmers to formal markets has been established. Various incentives that were created during development of the chain are highlighted. Challenges and possible uncertainties as value chain actors expand their operations have been identified.

Research limitation/implications: The research was focused on the Rwanda case study, so the findings may not be applicable beyond that domain.

Originality/value: The Rwanda case study contributes to the on-going debate on value chain development and integration of smallholder farmers in the formal economy. It highlights key incentives that were pillars for the value chain to thrive, such as training, capacity building and 'handholding' business support for the private investor. A clear need for strong connectivity among chain actors is demonstrated.

1. Introduction

The renewed focus on poverty reduction as the principal goal of development has generated keen interest in the concept of pro-poor growth. Broadly, pro-poor growth can be defined as that which enables the poor to actively participate in and significantly benefit from an economic activity. It not only aims to create incomes and employment, it also seeks to empower micro and small-scale entrepreneurs to defend themselves against the forces of competition (Peppelenbos, 2008).

Pro-poor growth is thus a major departure from the trickle-down development concept that was the dominant development thinking in the 1950s and 1960s. The trickle-down approach implies a vertical flow from the rich to the poor that happens of its own accord. Economic growth goes to the rich first and then, in the second round, the poor begin to benefit when the rich start spending their gains (Kakwani and Pemia, 2000).

The agricultural sector is considered crucial in all of Rwanda's strategies on poverty reduction. One of the 'six pillars' in the Vision 2020 document was defined as the “transformation of agriculture into a productive, high-value, market-oriented sector with forward linkages to other sectors” (GoR, 2000). This is hardly surprising given that agriculture employs almost 90 % of Rwanda's active working population and represents about 45 % of its GDP. The Rwanda Poverty Reduction Strategy (2013) indicates that sustainable poverty reduction would be achieved through broad-based growth across sectors in rural areas by improving land use, increasing the productivity of agriculture, enabling graduation from extreme poverty, and connecting rural communities to economic opportunity through improved infrastructure. This approach is consistent with the analysis by Tom (2015) that reported a positive correlation between agricultural growth in Rwanda and poverty reduction.

Despite a clear desire to graduate rural communities from poverty, Rwandan government investment in agriculture remains lower than the commitment by African governments, made in the Maputo Declaration on Agriculture and Food Security, for 10% of national budgets to be invested in agriculture (African Union, 2003). The low investment from government has, however, been supplemented by investments from the private sector and civil society (Kathiresa, 2012).

The International Potato Center (CIP) used this public-private partnership approach to commercialize OFSP in Rwanda while focusing on integrating smallholder farmers into the formal economy through a value chain approach. The OFSP is a product of biofortification technology that has enhanced beta-carotene content thus improving the role of sweetpotato as a source of pro-vitamin A carotenoids.

In collaboration with its partners, CIP has developed OFSP puree that can be utilized in various commercial products including baked products. Production of bakery products by Urwibutso Enterprises, a Rwandan food and beverage company and the major buyer of OFSP puree in the country, has been a key pillar in sustaining the participation of OFSP value chain actors at various levels. Although the OFSP value chain in Rwanda has been in operation for over five years, the motivation of various actors to participate in the value chain has not been appraised. This study documents the incentives and disincentives that influence investment in the OFSP value chain in Rwanda.

1.1 The conceptual framework for pro-poor public-private partnerships

Figure 1, below, shows the pool of various actors that come together to make a pro-poor approach to functioning markets. A functioning market depends on both tangible and intangible factors. The tangible factors include infrastructure and the other services, while the intangible factors include the formal and informal rules.

In this report, key highlights on the steps taken by project implementers along the OFSP value chain and the implications of such interventions as perceived by various categories of actors in the value chain will be discussed.

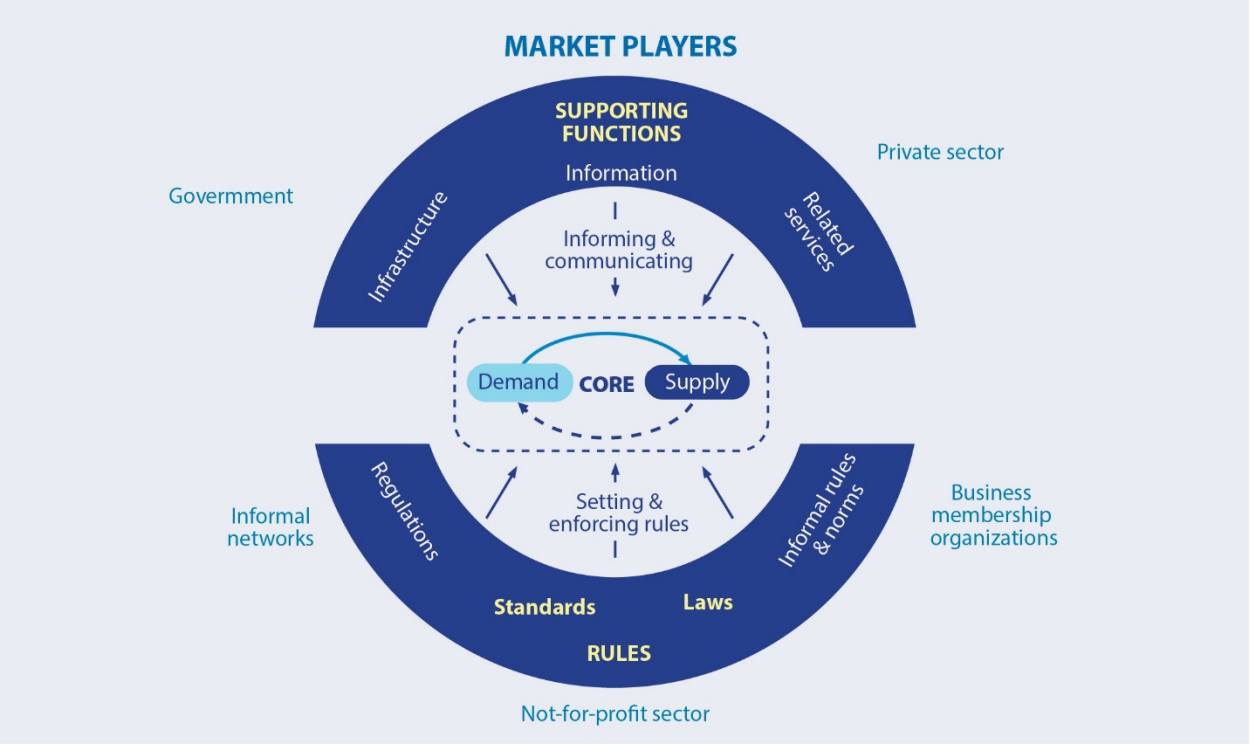

Figure 1: Illustration of market actors in a pro-poor approach *(Source: Marshall Bear, November 2005, ppt presentation)*

1.2 Research question

Main research question: What factors determine the early interest and adoption of OFSP processing by commercial partners and how can incentives be created for private sector co-investments at different stages of program implementation?

Sub-questions

1) What incentives were developed by CIP and its partners to get other value chain actors involved? What were the successes and challenges encountered?
2) Did Urwibutso Enterprises, the major buyer of OFSP, have to make major adjustments to initiate their OFSP line of products? If so, was it cost effective and did these adjustments pay off?
3) How did integration of smallholder farmers in the value chain development happen? What have been the successes and challenges of such approaches?

2. Methodology

A total of nine KIIs were held among purposely selected value chain actors. These included, the CIP project manager, program leader at the Rwanda Agriculture Board (RAB), chief executive officer of Urwibutso Enterprises, together with the head of bakery section and bakery staff, interns that supported farmer cooperatives in value addition, and finally shop attendants who sell OFSP bakery products.

In addition, information was gathered using FDGs with farmer groups that supplied OFSP to Urwibutso Enterprises and those that sold OFSP at a major roadside market. A total of eight FDGs were conducted; four of these consisted of female respondents while the other four consisted of male respondents. Each FDG was attended by eight participants.

Quantitative data collected as part of continuous monitoring of project activities is used to explain some of the information gathered through KIIs or FGDs.

3. Findings

3.1 Types of partnerships

Figure 2, below, illustrates the types of actors and their roles in driving commercialization of OFSP in Rwanda. Urwibutso Enterprises was the pivotal point for the value chain and had multiple functions as a buyer of OFSP from farmers, owner of a commercial bakery, distributor of baked products, and owner of a chain of retail shops in various parts of Rwanda. The business also had access to export markets such as to neighboring Uganda.

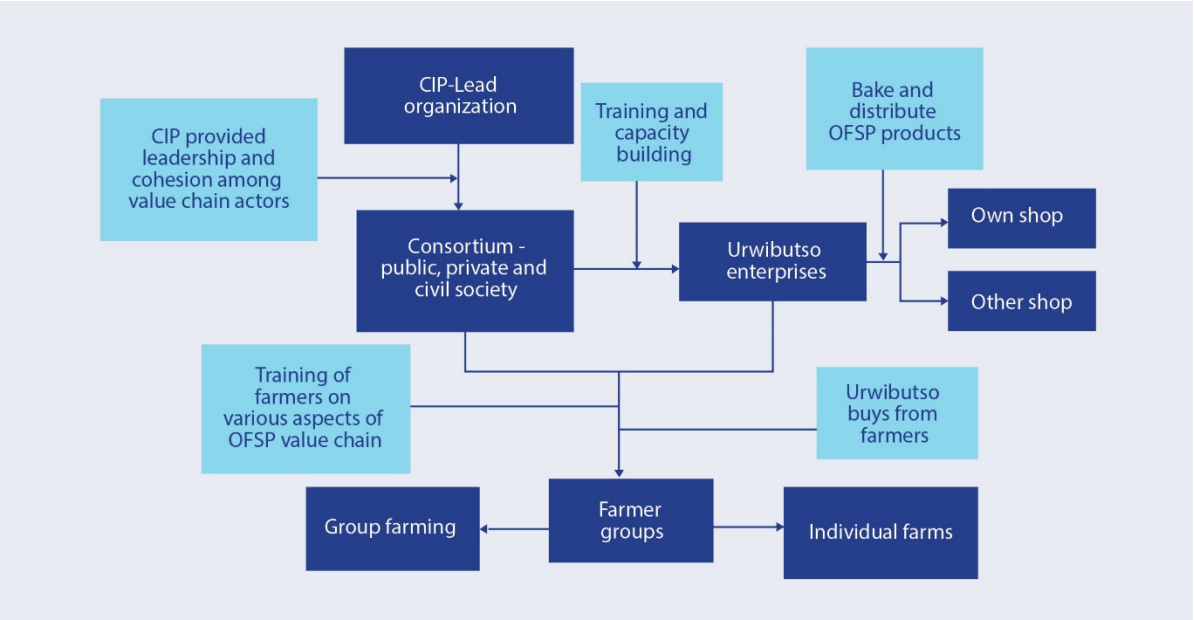

Figure 2 schematic illustration of OFSP value chain actors and their roles

The approach used in the case of commercializing OFSP fits well within the definition of a pro-poor public-private partnership in that poor people were included in the design and management of the operations of the value chain. In addition, the partnerships extended beyond an agreement between a private company and a government agency to include civil society organizations, community organizations and informal entrepreneurs. Letters of understanding were used as the main approach to guide the operations and clarify understanding of the roles of the various actors along the value chains. In the case of the farmers and service providers, such as bike riders that delivered the roots to Urwibutso Enterprises, mutual understanding and trust guided such operations.

A key strength of the project is that it has created convergence with other developmental programs in providing co-benefits to rural community. For example, creation of a credit and savings culture among members that enables them to lend and borrow funds among themselves. Moreover, some farmers had bank accounts. Urwibutso Enterprises also responds to real livelihood needs by encouraging parents of children attending schools run by the proprietor to supply at least one of the crops that the enterprise uses as raw material, which includes OFSP.

3.2 Integration of features of pro-poor approach to public-private partnerships

From the KIIs, FGDs and analysis of project monitoring data, deliberate efforts emerged from various value chain actors to include very small-scale farmers.

3.2.1 Time invested in building the value chain

Functional partnerships take time to develop; the Rwanda case study is a journey of about 20 years. The interview with Jean Ndirigwe, the head of RAB's sweetpotato program, provides clues on how time has been invested in creating partnerships towards sweetpotato commercialization.

Ndirigwe started partnering with CIP in 1995. He indicated that gains made by various CIP projects have been consolidated over time. He has worked with three sweetpotato projects: first Dissemination of New Agricultural Technology in Africa (DONATA), then Sweetpotato Action for Security and Health in Africa (SASHA), and most recently the Scaling up Sweetpotato through Agriculture and Nutrition (SUSTAIN) project. The SASHA project was a proof of concept that explored whether OFSP product development could be profitable. SUSTAIN built on the work of SASHA to scale up, reaching more people with vitamin A. Ndiringwe, who was a principal investigator in both the SASHA and SUSTAIN projects, highlighted that the role of RAB was to identify sweetpotato varieties that were suitable for various districts and make clean planting material available using *in vitro* multiplication.

In addition to working with RAB, SUSTAIN brought on board former SASHA partners, such as Urwibutso Enterprises, the Rwandan farmers' federation (IMBARAGA) and the Young Women's Christian Association, and others such as World Vision and Catholic Relief Services. As a consortium, according to Ndirigwe, the commitment of each partner was critical and they all signed a letter of understanding to guide their operations. For continuous monitoring and updates, these partners held monthly meetings hosted by each partner in rotation.

3.2.2 Identification of the private sector

Identification of a private sector partner aligned well with the principles of pro-poor public-private partnerships. Urwibutso Enterprise was chosen for its track record in buying raw materials from farmers that it transformed into various products which were sold principally to low-income earners. When the head of bakery was asked how easy or difficult it was to introduce OFSP products, he responded that it was easy because "we *were already baking bread and doughnuts. It was also easy to introduce the products to the market because we had other products in the market. We followed the same marketing process, using the same distribution channels. We also had acceptable packaging for doughnuts*."

At farmer level, the bakery manager observes that ease of introducing the products was due to the company's previous experience working with farmers who were also their suppliers of other raw materials, such as strawberry and chilis. He added that provision of field follow-up and the establishment of demonstration plots also got more farmers interested in OFSP. However, all was not

smooth sailing; CIP, as the lead organization, had to help create an enabling environment for the private sector to initiate processing. Below are some of the interventions put in place.

3.2.3 Creation of an enabling environment for the private sector

The participatory market chain approach was used in partnership development. In an interview with the project manager, the observation was made that after three years CIP had transitioned from leading in planning, coordination and facilitation to a backstopping role. The slow process that planting material/vines for sweetpotato undergo before large quantities become available for root production was cited as part of the challenge for rapid value chain development. In particular, the project worked with small-scale farmers through the decentralized vine multipliers (DVMs) approach that seeks to have vine multiplication taking place within short distances of root producers to minimize transport costs. Furthermore, there was an intentional effort to work with women, who often lacked resources and the ability to take risks.

CIP had to actively promote business opportunities to the private sector through the illustration of the business model and the support thereof to deliver the proposed business plan. As part of this process, CIP and partners provided training to farmers on a range of production-related aspects: production and provision of clean planting material, demonstrations on good agronomic practices for sweetpotato, and quality assurance at harvest and post-harvest, amongst others.

Additional activities included the training of bakery staff on production of the new products, guidance on the procurement of key equipment, use and maintenance of equipment and support to purchase some of the equipment, e.g. pastry cutter. Furthermore, the private sector was provided with ‘handholding’ business support by a team of experts from CIP and RAB, including in the packaging and branding of biscuits.

A key strength of OFSP bakery products is that the profit margin was higher than that of the 100% wheat flour (the closest competitor) due to higher output per baking batch. In addition, OFSP products used less of ingredients such as margarine and sugar. Above all, the OFSP products were perceived as being softer, an attribute that was liked by consumers. CIP and its partners were, therefore, able to present a clear and compelling business case to Urwibutso Enterprises.

Despite already having a functional bakery, Urwibutso Enterprises had to make changes to accommodate the new products. This included the expansion of the kitchen area and purchase of additional equipment, such as the puree machine, gas burners and other baking appliances. The business also had to discuss quality assurance procedures with OFSP farmers, agree on contracting modalities, and provide support for farmers to encourage them to become interested in the innovation.

When asked about the experience of working with Urwibutso Enterprises, the farmers recalled that they had to deliver undamaged medium-to-large OFSP, washed and in a clean gunny bag**.** Deliveries had to be made on the assigned date and payment was expected within seven days. The price per kg was RWF 200–220 (USD 0.22–0.25). The practice was for Urwibutso to pay at least RWF 20 above

the prevailing sweetpotato market prices. The farmers observed that selling to Urwibutso was well organized and that they made money from OFSP.

Table 1 shows the sales made by farmers between the year 2014 and 2017. A generally increasing trend is depicted confirming that farmers benefited from sale of roots to Urwibutso Enterprises. By 2015, through the consortium engagement, higher price per kilogram of roots had been negotiated that explains the high value of roots sold as compared to sales made in 2014.

Table 1: Quantity of roots sold in 2014-2017

Year	Quantity sold (tons)	Value of root sales (USD)
2014	16.7	2,912
2015	33.5	33,475
2016	56.5	56,451
2017	46.7	61,202

The startup interventions by CIP and its partners were fruitful. When the bakery manager was asked what the trends were on consumer demand for OFSP products, he responded: ***"It*** is increasing". With a smile he added: *"The bakery is able to meet its costs and make profits. The bakery section has been able to employ more people while other staff members have received rewards through pay rise. Urwibutso Enterprise staff have received new skills through the partnership and new products emerged. Jobs have also been created for farmers that sell OFSP to us*."

Figure 3 correlates well with the observation of the bakery manager and the shop attendants that demand for OFSP products is increasing. The 2017 data depicts a spike in consumption of doughnuts (known locally as mandazi) during the month of July. This agrees well with the information provided by the shop attendants that more mandazi were purchased during the cold season as people eat mandazi as an accompaniment to hot tea to keep warm.

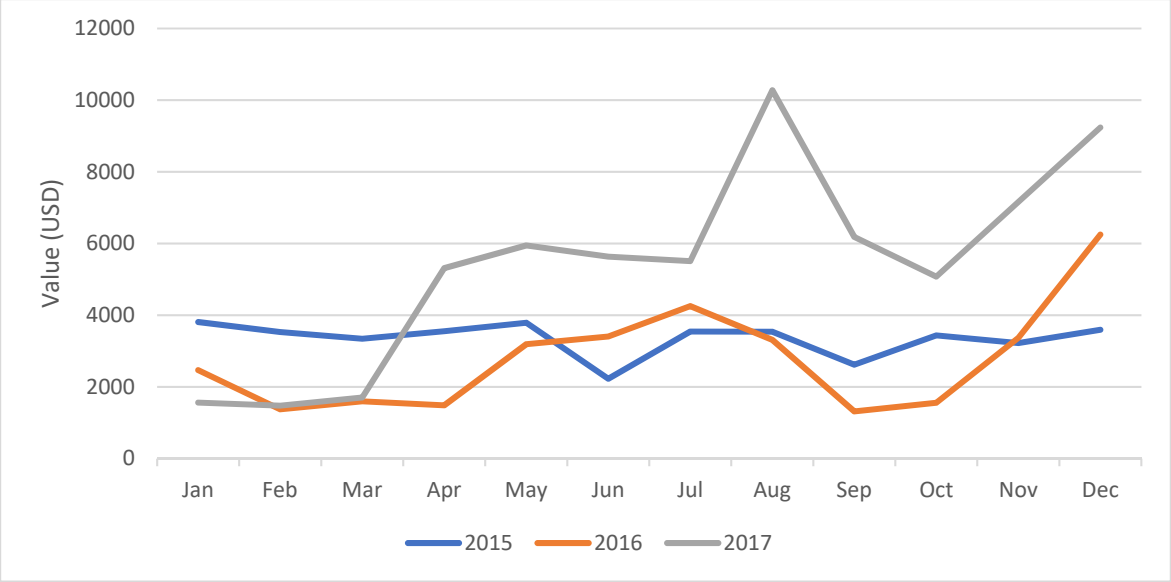

Figure 3: Trends in sales (USD) of OFSP-based mandazi (doughnut)

3.3.4 Social responsibility

Despite increasing trends in the number of roots received by Urwubutso Enterprises for processing, at the time of this interview farmers reported that the quantity demanded by the enterprise was lower than the current supply. This necessitated creation of additional avenues to offload excess roots from farmers. When farmers approached the district government to create additional markets for OFSP, the government built a roadside market where farmer groups or individuals could sell their roots. CIP assisted with painting and the branding of the market and erected signs providing information to consumers about the nutritional benefits of OFSP.

At the time of the interviews with farmers, the roadside market had been in operation for about two years. Farmers unanimously agreed that the construction of the roadside market was a step forward in expanding market opportunities for OFSP. However, positive and negative feedback, almost in equal measure, was received regarding utilization of the market. Farmers close to the location where the roadside market was constructed appreciated that it made selling of sweetpotato easier. This group observed that they sold the roots at the same price as to the major buyer, Urwibutso Enterprises, although this was on a retail as opposed to wholesale basis, so there were lots of small transactions. One woman observed: "*Selling at the road side market is tiresome and not many women can keep up the pace needed.*"

The roadside market also came with additional government support as farmers could sell their wares without paying any cess taxes that would usually be due to the government. Use of the roadside market was also expanded to sell other varieties of sweetpotato, both white- and yellow-fleshed, with the objective of increasing the flow of customers to the market. The waiver on the payment of tariffs to the government was also extended to those selling the white varieties of sweetpotato.

Some farmers highlighted concerns about the roadside market. They reported that it took them up to two hours to walk to the market, which was a challenge, especially while carrying sweetpotato roots

on their heads or backs. If they hired transport, there was significant possibility that they would make a loss. These farmers were coping by selling their roots at local markets that were closer to them. At these markets, prices are negotiable and often lower than paid by Urwibutso Enterprises or at the roadside market. When asked the way forward, farmers favored selling their roots in bulk to a trader who would then retail them independently.

Another subsidy that affected the OFSP value chain was large-scale (estimated 2 Million cuttings) procurement of vines by the government to be distributed for free to farmers in 2017 as a disaster management strategy following a prolonged drought experienced in 2016. These vines were purchased from vine multipliers who had been trained and provided with technical support by the project. This subsidy by the government significantly benefited the vine multipliers, as shown in Table 2.

Table 2: Value (USD) obtained by multipliers from sales of vines

Year	Total value USD (including vine sales from farmer groups)
2015	27,881
2016	40,024
2017	293,896

This large-scale distribution of vines, which is planting material for about 145 acres of sweetpotato, led to an increase in root supply in 2018, exceeding the needs of Urwibutso Enterprises. The enterprise had a systematic database that showed the estimated production of roots per farmer/farmer group and a schedule for delivery. Following the government-led mass distribution of vines, these estimates were no longer valid. This points to the need for an organized market system to minimize the number of farmers who stop growing OFSP, for example if they are unable to sell their produce.

Furthermore, areas in which farmers were allowed by the government to plant sweetpotato, including OFSP, were limited at the onset of the project. However, due to farmer demand and a clear illustration of the benefit of the value chain approach adopted by the project, the government in 2017 opened more areas to farmers for sweetpotato production. This may also help explain the influx of OFSP on the market in 2018, when this study was done.

3.3.5 Role of communities and NGOs

The most effective way to ensure agricultural activities benefit the poor is to involve them in the design and step-wise implementation, including provision for periodic feedback. However, community organizations will typically have very little capacity to deal with the procedures involved in even simple public-private partnerships (Perez-Ludena, 2009). To overcome this challenge, CIP and its partners established a rapport with the community by working with NGOs, such as IMBARAGA whose staff not only understand the legal and technical aspects of the schemes, they also get close enough to the community to break down barriers and bring the partners together. The cost of the interventions by the NGOs was met through a sub-grant from the CIP-led project.

Community participation in this value chain facilitated effective monitoring and enforcement of mechanisms. For instance, when asked about the services that the farmer groups provided to the community, a trail of self-regulating functions were listed. These include the farmer groups facilitating collective marketing to ensure Urwibutso Enterprises received sweetpotato that met their specification. The farmer groups also trained farmers not in the group on issues related to quality assurance, consistent with the demands of Urwibutso Enterprises. In addition, trained farmers participated in training other farmers on agronomic practices, such as spacing, ridging and preparation of vines. The community, therefore, played a key role in informal reinforcement of set procedures, including maintaining the smooth flow of information from the buyer to the farmer. As observed by Fischer and Qaim (2012), the role of collective action in assisting small-scale farmers through economies of scale, bargaining power, and information sharing/learning cannot be overemphasized. These attributes enhanced market participation and increased income of participants, especially women who are the majority in the farmer groups supplying to Urwibutso Enterprises. Similar trends are depicted by monitoring data that showed most of the roots were supplied by groups of farmers, not by individual farmers.

3.3.6 Effect of OFSP marketing and processing on well-being of farmers

The study by Mathenge et al. (2010) found a positive correlation between participation in the market and exiting poverty. In the current study, when asked what the benefits of selling OFSP to Urwibutso Enterprises have been, both men and women highlighted increased ability to pay for goods and services that improved their well-being. Top of the list was the ability to pay regular premiums for family healthcare insurance. The Rwanda government runs a mutual health insurance that aims to provide universal health coverage (Saskena et al. 2010). The costs per person is about USD 30 per year. Focus groups of both men and women mentioned this as a key need that sales of OFSP met. Health bills have the potential to plunge households into extreme poverty, so the contribution of SUSTAIN work to poverty reduction cannot be overemphasized.

Use of productivity enhancing inputs, such as fertilizer and manure, is inadequate among smallholder farmers, which limits their ability to produce sufficient marketable surplus (Mathenge et al. 2010). Purchase of sheep, pigs and cattle for manure was mentioned as other benefits farmers have enjoyed from the sale of OFSP. Furthermore, livestock ownership is an indicator of wealth, so this is a clue that SUSTAIN has assisted farmers and reduced poverty levels. The lowest recorded sales were about 12 kg per day per farmer, so on a trading day farmer earned significantly more than a dollar per day, surpassing the poverty line.

A key objective of the SUSTAIN project was to impact on household nutrition through diversified diets. During the FGDs, this topic was raised by women but not men. One woman said: "*Eating in the family has improved due to the kinds of foods we purchase from the money we got from vines."*

Another respondent said*:* "*We got money that helped us to buy various foods."*

Proceeds from OFSP also improved gender relations in various ways, particularly among the women who cited benefits such as:

"*Women have gotten money from vines and roots. Before it was not easy for a woman to get money for her personal needs or even be able to contribute to household needs such as food and clothing."*

One woman said: "*Women have gotten money that they can spend without asking men."*

In their FDG, men indicated that their participation in OFSP value chain was minimal at the start of the project. However, gradually they became interested when women started making money from OFSP. One of the men stated: "When *a woman comes home with RWF 100,000 (over USD 110) from OFSP, will you stay at home or you will follow her?"*

Women's participation in vine multiplication is shown by monitoring data in Figure 4. The sharp decline in the number of farmers that supplied vines in 2017 has been attributed to occurrence of a prolonged drought in 2016 that led to drying up of the streams of water that are often used to irrigate the vines. Despite a decrease in the number of vine multipliers, the total quantity of vines supplied in 2017 was the highest (Table 2). A possible explanation could be that vine multipliers that supplied high quantities of vines in 2017 had the required infrastructure of a non-seasonal water supply and irrigation facilities. Continuous monitoring data shows male vine multipliers supplied 95% of the total vines supplied in 2017. This is a possible pointer to gender inequality in access to resources such as irrigation facilities, as well as weaker ability to adapt to climatic shocks among women. A decrease in number of groups is also shown Figure 4. Thus, male vine multipliers increased the quantities each supplied.

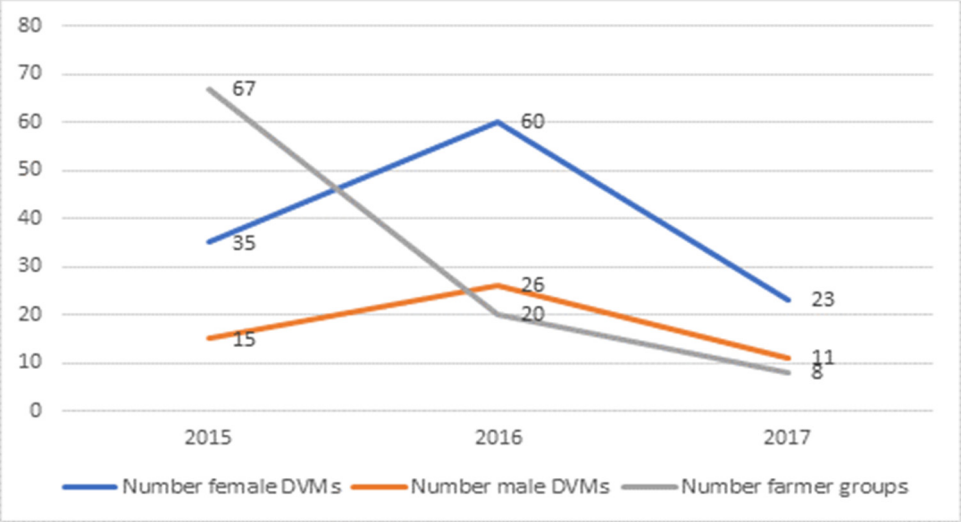

Figure 4: Gender desegregated trends in supply of vines

Purchase of land was cited as a key achievement by both men and women during the FDGs. Rehabilitation of a permanent house or construction of a new one was also cited by both men and women. It appears that, through adopting OFSP, participating farmers have been able to escape poverty and are now able to meet the essential needs of food, shelter and clothing. They are also able to pay for secondary needs, such as healthcare and education.

The ability to create on-farm employment for various farm activities, such as weeding, harvesting, planting and cleaning of roots, was also cited as a benefit from participating in the project. Additional employment off the farm has been for bicycle riders who deliver the roots to Urwibutso Enterprises.

It was interesting to learn that the approach used by the project had elevated the image of the OFSP above the community's previous perception of sweetpotato. Farmers are now motivated to cultivate sweetpotato, which now has a new image as a raw material for processing.

3.3.7 Capacity building and learning

3.3.7.1 Training of farmers on production, post-harvest handling and value addition

The project had targeted training content around agronomy of sweetpotato, nutrition education using OFSP as the entry crop, value addition of OFSP, and market access including quality assurance. These aspects were raised during the FGDs as the benefits that have been gained by project participants. Some of the skills participants reported that they had gained included:

"We [now] know the value of OFSP- how to prepare it and its nutrition."

"We have received new varieties that are rich in vitamin A. We only knew white varieties [before]."

"We have learned how to plant in ridges." "We used to plant two cuttings in a hole, now we plant one cutting."

These skills were gained through a purposeful effort by the project that aimed to assure OFSP competes favorably as a cash crop, in part to sustain farmers' adoption amidst other competing crops for the small parcels of land held by farmers.

3.3.7.2 Training of cooperative on bakery business

On a pilot basis, the project opened two bakeries in rural areas (Muhanga and Gakenge), located 25-45 km from Kigali, the capital city of Rwanda. These cooperatives were run by farmer groups that had been trained on various aspects related to the bakery business. However, despite such training and other material support, such as provision of small pieces of equipment, the farmers were not able to run the cooperatives profitably. Learning from this failure, the project then recruited interns trained in agribusiness to run each bakery as a private entity, while contracting members of the farmers group as workers.

The interns were provided with start-up capital and operated the businesses for 15 months (April 2016-July 2017). Both interns were excited to learn about the OFSP puree innovation from CIP. They wrongly thought, however, that promoting their newly invented vitamin A-rich products would be easy.

One of the interns noted: "The *market was a challenge. Our principle was to produce medium-size mandazi that were nutritious. However, the market was looking for a big mandazi, like what was well established in the market prepared from 100% wheat flour. The low-income consumers we targeted were hungry; they were interested in quantity not quality as was the case for our marketing philosophy."*

The interns attempted to respond to market forces by increasing the size of the mandazi, but the cost per unit escalated and they could not compete favorably. The opportunity to compete was further complicated by steep changes in cost of sourcing OFSP roots, especially when the crop was not in season. It was observed that the price of roots could increase three to four-fold. Despite this instability, the OFSP-wheat flour mandazi prices were expected to be stable and compete with the

100% wheat mandazi, the raw material cost of which remained relatively stable. While there were reductions in utilization of ingredients such as sugar and margarine when OFSP was included, the cost reduction could not match the cost of production increases occasioned by oscillations in prices of OFSP roots.

Efforts to secure a market in Kigali, where consumers would be expected to have greater purchasing power, yielded little reward due to high transport costs. Moreover, even in Kigali, consumers expected that that the mandazi should be sold at the same price as the 100% wheat flour versions. The interns do, however, consider that the Kigali market was better than the rural market. One observed: "*It was exciting to explain to consumers about vitamin A and the products. People view you in a different way when you provide such information."* Another intern observed that: "*The OFSP cakes do not look special in the shop. All a consumer wants is a cake", which* points to the same need of promotional activity, consumer education and branding.

After 15 months of dedication, the interns filed their last report recommending closure of the businesses, mainly citing challenges in attaining a break-even or profit within the business environment that existed. When asked what could be done to avoid the closure, issues mentioned included: the funds invested in the business needed to be increased to include cost of transporting products to Kigali, as well as to promote the products for their nutritional qualities. An observation was made by one of the interns that they made products that were eaten at breakfast by most households in Kigali and therefore a market for a healthier version of commonly eaten products exists. The other intern proposed a split in roles along the value chain to increase efficiency; for example, one company could concentrate on the baking and marketing of products, while sweetpotato production would be taken up by another company. The two interns, however, believe OFSP puree products do have a place in the Rwandan market. An interesting observation which warrants further consideration was made by one of the interns who suggested that "*CIP's presence created a fake business environment. CIP should give the business to independent entrepreneur."* She added*: "Sometimes farmers could sell roots at high price because they knew it was an NGO buying."* Figure 4 is an indication of the performance of the two businesses. This shows low sales and thus inevitable closure.

Table 3: Quantity and value of roots sold in Muhanga and Gakenke, - former cooperatives

Year	Muhanga		Gakenke	
	Quantity sold (kg)	Value of root sales (USD)	Quantity sold (kg)	Value of root sales (USD)
2016	3180	640	2215	471
2017	9186	2592	457	106

4. Discussion

Value chain development, which facilitates the participation of smallholder farmers and small and medium-sized rural enterprises in higher value markets for agricultural products, has become a key component in the strategies of many development agencies, donors and governments (Humphrey and Navas-Aleman, 2010; Staritz, 2012).

In this case study of sweetpotato in Rwanda, the skills of farmers were built to a level where they were perceived as doing farming as a business and therefore could engage with Urwibutso Enterprises on a business-to business basis. The value chain actors' interventions seem to have been oriented to improve the performance of the value chain by:

- identifying and working with weak links within the value chain;
- improving flows of knowledge and resources along the chain;
- improving the efficacy of linkages between chain actors; and
- developing new or alternative linkages in the value chains.

In a review by Humphrey and Navas-Aleman (2010), these four interventions were also identified as working pathways for value chain actors, either in isolation or collectively. In the Rwanda case, the four scenarios worked together.

Consistent with the review by Devaux et al. (2018), work along a value chain approach was initiated after a series of activities that attempted to address segments of the value chain in isolation whereby OFSP production/varietal testing was the focus. Production work was followed by proof of concept on whether inclusion of OFSP in a commercial product was possible, and finally a scale up to embrace a full value chain development approach, further compounded by deliberate effort to be pro-poor. This step-wise expansion was accompanied by pro-active learning and innovation that resulted in OFSP puree and bakery products. The current journey, started in the 1990s, is not unusual; high quality cassava flour (HQCF) is yet to be commercialized more than 30 years since similar attempts were initiated (Lamboll et al, 2018).

Various authors have illustrated the time-consuming nature of value chain development, especially when this has been triggered by an agricultural innovation, such as biofortified sweetpotato in this study. Such studies include the work by Thiele et al. (2012) and Ayele et al. (2012) who worked on innovations for livestock fodder and market access, respectively. These authors show how single innovations had to be linked up with other approaches for intended market access to be achieved, all of which were time consuming.

Collective marketing is central in pro-poor approaches to market access. Collective action refers to voluntary action taken by group to pursue common interests or achieve common objectives. In collective action, members often act through a group or organization; in doing so they may act independently or with encouragement of external agents such as developmental organizations (Thiele et al. 2012).

A similar approach was used in this study. Urwibutso Enterprises would only deal with farmer groups for ease of transaction, access to training and sharing market information. Similar to the approaches described by Devaux et al. (2009) and Theile et al. (2012), farmers, market players and agricultural service providers were brought together to discuss the OFSP value chain. OFSP was perceived as a new crop in 2014 and OFSP bakery products are still a surprise to many consumers today.

These meeting connected up the value chain and enabled each of the actors to understand their roles. This may explain the endurance of these chain actors for close to five years at the time of the study. Theile et al. (2012) observed that platforms that bring stakeholders together around value chains can result in new products, processes, norms and behaviors that could not have been achieved otherwise and that benefit poor farmers. Furthermore, similar attributes of new products, practices among farmers and norms governing the groups emerged because of the interconnectivity of the OFSP chain actors.

Both men and women farmers mentioned effective motivation for their participation in the value chain as being the ability to use money from sale of either vines or OFSP roots to meet essential and secondary needs, such as food, shelter, clothing, housing, purchase of land and livestock, and payment of health insurance. Women mentioned improved self-esteem from having money that they could spend without asking permission from their husbands. Similar findings are reported by Mudege et al. (2017) in a study among Malawian farmers. While myths exist around women participating in agriculture only as subsistence farmers (Mahra and Rojas, 2008), the case of Rwanda shows how pro-poor approaches can link vulnerable groups into the formal market.

At the outset of value chain development, the majority of farmers were women. Men started participating in OFSP production after realizing that women were reaping benefits from sales of OFSP. Furthermore, the OFSP value chain enhanced women's ability to contribute to household and personal income. Most of the women farmers came from male-headed households, which is a departure from the myth that only female-headed households need interventions (Mahra and Rojas, 2008).

This OFSP value chain is not without challenges. The discussion with farmers that highlighted supply of roots outstripping demand of the major buyer represents uncertainty on the part of farmers that may affect adoption of OFSP. Lamboll et al. (2018) defines uncertainty as a situation where outcomes are indeterminate, and the odds of a given outcome cannot be known in advance. In this situation, value chain actors are less willing to invest. The increasing consumer demand for OFSP products, however, may overcome such uncertainties, assuming increased consumer demand for OFSP products translates into increased demand for roots from Urwibutso Enterprises. Furthermore, one of the unexpected outcomes of this study was the sighting of OFSP products in one of the shops that was not supported by CIP or its partners. Such independent start-up companies may also ease uncertainties in market demand for OFSP.

The price of OFSP in the 20 markets from which data was available shows a stable price offer to farmers that could further reduce uncertainty. However, learning from the pathway of 30 years in

getting to commercialize high-quality cassava flour, a more collective adaptation to uncertainty may be more effective than individual adaptive strategies (Lamboll et al. 2018).

Various subsidies appear to support the functioning of the value chain. Soon, farmers will need to be weaned off from such subsidies. Government subsidies have been shown to be substantially political and therefore depend on the leadership of the day in various administrative levels. In the case of sorghum in Kenya, where the buyer, East Africa Breweries, depended on a tax break from the government, it struggled to maintain a stable market for farmers when the subsidy was discontinued with a change in leadership (Orr, 2018). While the changes to the fiscal and regulatory policy environment by the government of Rwanda may seem small—the waiver of tariffs at the roadside market and lifting of the ban on planting sweetpotato in wetlands/valleys—any changes in this status quo would present a shock to the smallholder farmers and could displace them from the value chain. Furthermore, the case of sorghum in Kenya and OFSP in Rwanda both reveal the risk farmers face when value chains are strongly anchored on a single buyer. However, diversification of market outlets through the roadside market and sales in other local markets will provide a critical cushioning mechanism to sustain markets in Rwanda. Similar case scenario exists for high-quality cassava flour in Nigeria. When the integration of the cassava flour in bakery products struggled in the market, farmers survived through alternative markets, especially informal markets that emerged (Lamboll et al. 2018).

5. Conclusion

This study used key informants' interviews, focus group discussion and project quantitative monitoring data to explore the operations of OFSP value chain development in Rwanda. The incentives that have been created at various levels of the value chain have been highlighted. Possible weak points within the young value chain have also been pointed out.

A deliberate effort to integrate smallholder farmers and especially women emerges. These farmers are linked to a formal market with Urwibutso Enterprises through a coordinated effort of value chain actors whose roles are well identified. The role of the initiator of the value chain, CIP, has evolved to the level of technical support, an indication that most chain actors have attained enough interest in the value chain and can self-regulate.

Favorable conditions for the OFSP value chain to grow appear to be emerging but still needs guidance from research and development agencies for innovations to uptake increasing production from farmers. While small avenues to dispose of excess amounts of sweetpotato are evolving, a collective value chain approach needs to be considered to reduce uncertainty among farmers that could otherwise easily result in them dropping OFSP.

Incentives to participate in the value chain are economic and nutritional leading to improved livelihoods and well-being. Both men and women farmers cited ability to meet essential and secondary needs as a major motivator for engaging in OFSP. The OFSP value chain suits both men and women farmers and enables greater gender equity and integration of women in agribusiness.

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Annex 1: Key informant and focus group guide questions

Urwibutso Enterprises: Bakery manager

1) When did you join Urwibutso Enterprises, and in what role?
    a. How long have you been in this bakery department? How long have you been managing the bakery?
2) Why did Urwibutso Enterprises decide to invest in OFSP line of products-
    a. Which OFSP products does Urwibutso Enterprises sell?
    b. What is the substitution level of wheat flour for the OFSP puree? List per product.
    c. How easy or difficult was it starting to make products that incorporated OFSP in them?
    d. Did you have to adjust anything to start using OFSP as a raw material? If yes, what? ____
    e. Did you have to change/acquire any machinery or equipment to ensure that you can utilize OFSP?
    f. Did you change any process or methods of products processing to enable you to utilize OFSP? If so which ones?
    g. Did you have to do any additional staff training? If yes who did the training? How was it?
    h. Did you employ any new staff to handle OFSP processing or was retraining enough? [*Probe about gender (women/men) employed and why*]
    i. What about how you procure raw material, did you have to change anything? If yes, what? How was it?
    j. Did you have to organize any new supply chain and distribution arrangements?
    k. Did you have to overcome any major challenges to introduce the OFSP based products? If yes, please explain.
    l. How did you go through the process of OFSP products development? What role did CIP and Euro Ingredients Ltd (EIL)- ANTONIO play? How would things have been done different without these collaborations?
    m. Did you/partner conduct any *product testing* before the OFSP products were launched? Please explain.
    n. Did you have to conduct any special media or communication campaign to introduce the products into the market?
3) Please point out to us any disappointment you have gone through in working with OFSP as a raw material so far? If any, how did you manage the problem?
4) I understand that Puree that is used for bakery products is prepared within the enterprise. Please describe this process
    a. What quality control/assurance procedures, if any, have you had to put in place due to this processing arrangements? *(probe using puree handling e.g., receiving, storage, utilization, etc.).*
    b. How has this affected the baking process and costs (*personnel, time, material)* for your department?

5) In general, what quality control/assurance procedures have you had to put in place that are specific to OFSP products? How has this affected the baking process and costs (*personnel, time, material)* for your department, in general?

6) Have you adjusted the **weight and prices** of the OFSP products you are selling from the time you launched them? If so, why?
[*Looking to hear- Low demand for the OFSP products, feedback from customers, reduction in costs of procuring/preparing puree, it was a marketing move to get more volumes sold etc.*). *For any mention ask:*]
What has been the lessons learned in general about pursuing this line of business?
[*Probe about using OFSP, working with a Organi, collaboration with research org, etc.*]

7) If you were to start all over again how would you have organized the introduction of OFSP as a raw material?

8) Do you think it makes economic sense working with OFSP as a raw material?

9) Will you continue utilizing OFSP as a raw material in your production system? How do you project the future of OFSP products to look like at Urwibutso Enterprises?

10) In general, are time and skill /human resource requirement for baking OFSP products different from all-wheat products? Please explain

[*Looking to hear whether special skills are needed, some staff decline to bake the OFSP products, is it easy to slice the OFSP bread as compared to the white bread (special attention needed*?]

11) What would you say is the consumer demand for the OFSP products you produce? It its increasing, decreasing or stagnant? What would you say is the reason why consumers buy these products?

12) Lastly, what do you consider as the main advantages of incorporating OFSP in the line of baked products such as dough nuts and biscuits?

Urwibutso Enterprises top management—Sina Gerard

1) When did Urwibutso Enterprises start this bakery business?
2) What was the focus of the business at the beginning? How has that evolved over time?
3) Why did you decide to join this (bakery/baked products/confectionery) industry?
4) How is the industry in general? How has it changed over time?
5) Why did Urwibutso Enterprises decide to invest in OFSP line of products (i.e., OFSP doughnuts (big and small), and biscuits.
6) How would you describe Urwibutso Enterprises' partnership regarding introducing and running OFSP line of products? Please mention challenges, opportunities, risks entailed.
    a. International Potato Center (CIP)
    b. EIL-(Antonio)
7) If we were to introduce the OFSP products all over again, what would you like to change, what would you like to retain? [*Probe using raw material sourcing, use of puree, % of puree used, investment in process, quality control/assurance and equipment, …*]
8) What would you say is the consumer demand for the OFSP products you produce? Is it increasing, decreasing or stagnant? What would you say is the reason why consumers buy these products?
9) What would you say is the future of OFSP products at Urwibutso Enterprises…?

Bakery staff that frequently bakes OFSP products at Urwibutso Enterprises

1) What excites you/like about baking the OFSP doughnuts (big and small and biscuits? [*Mentions ease of handling the dough, baking time, quality of the products motivates etc.*]
2) What do you perceive as the MAJOR challenges in producing OFSP these products? Please explain.
3) What skill / trick have you had to learn while handling OFSP products that does not apply for other types of bread? How did you learn the new skill/trick, if any?
4) How would you compare time requirements of OFSP bread as compared to baking in terms of the following: [more, the same, less: please explain if different]?
    a. Handling the dough
    b. Baking a batch
    c. Cooling
    d. Slicing
    e. ….

5) Do these vary between women and men bakery staff?

6) What are new procedures, if any, do you now have to adhere to since you started baking OFSP products: Do some of these procedures favor women/men? Explain.

    a. What would you say is the consumer demand for the OFSP products you produce? It its increasing, decreasing of stagnant? What would you say is the reason why consumers buy these products?

7) In your view, what are advantages of incorporating OFSP in baked products such as dough nuts and Biscuits.

Shops that sell products from Urwibutso Enterprises

a. When did you start operating this shop, and in what role?
b. How long have you stocked the OFSP products from Urwibutso?
c. What motivated you to start stocking the OFSP products?
d. Are there any changes you have had to make to adequately stock these products (changes with the supply distribution chain)?
e. Are you a retail or a whole sale trader?
f. Do you stock the same products which contain only wheat flour? If No why
g. How do the prices of these products compare- Those containing OFSP and those containing only wheat flour?
h. What factors have informed the way you set the price for the OFSP products?
i. Did do any promotional activities when you started stocking these products? Which type of promotion? For how long?
j. What do you think is the advantage of stocking the OFSP products?
k. Have you been receiving consistent and sufficient supply as per your order from Urwibutso Enterprises? If no, which months have been most affected, how do you cope with this shortage of supply?
l. What would you say is the consumer demand for the OFSP products you produce? It its increasing, decreasing or stagnant? What would you say is the reason why consumers buy these products?
m. In your view, what are advantages of incorporating OFSP in baked products such as Dough nuts and biscuits

Interns Yvette and Dembe (Separately)

1) When did you work as an intern to support OFSP COOPERATIVE?
2) What were your roles?
3) What excites you about OFSP puree processing? – *Mentions job creating, income creation, simple applied technology etc.*
4) While supporting the cooperatives, what comments do you have regarding How to deal with farmers- *Contracting? Aggregation, collection of roots, delivery of roots, provides any type of training to farmers? Quality issues? How deal with rejects? How deal with refuse- peels and water etc.*
5) What would you say: i) are the MAJOR challenges in puree processing for a cooperative? ii) is the most challenging **stage** of puree processing as a business for a startup cooperative? Why?
6) What would you say: i) are the MAJOR challenges in preparing bakery products ii) is the most challenging **stage** of producing bakery products for a as a business for a startup cooperative? Why?
7) I have learned that the cooperatives are no longer functional. In your own opinion why is this the case? How could these challenges have been better handled?
8) Lastly, what, in your view, what are the advantages of incorporating OFSP in baked products such as doughnuts and biscuits?

Key informant—Farmer group that supply Urwibutso—two groups consisting of men and two groups consisting of female farmers.

1) Tell me about your cooperative: when it started, how many members (by gender), what are the main activities.
2) What would you say has been the benefit of working with CIP?
3) Now tell me about your experience: i)) supplying supermarket (Urwibutso Enterprises). [*Ask about root quality requirements, crop managements requirements, volume requirements, root handling practices, price of roots, contracting process*]. Do these differ by gender? Please explain.
4) How does the farmer group facilitate participation of smallholder farmers to supply roots to Urwibutso/ Fresh root market (As applicable)? [*Probe with aspects such as requirements for: membership; crop managements including harvesting time, root handling, technical advice by group designated official/staff, if any; transport, etc.*]
5) What would you say is the major limitation in getting farmers to meet demands of your buyers? Do these reasons apply for men and women equally?
6) In your opinion, what are advantages and disadvantages of having the buyer - (Urwibutso in your locality?
7) What is the kind of risks that the farmer organization faces in supplying OFSP roots to Urwibutso Enterprises?
8) Lastly, what, in your view, what are the advantages of incorporating OFSP in baked products such as bread?

Informant- Farmer group that supply to the road side market—two groups.

9) Tell me about your cooperative: when it started, how many members (by gender), what are the main activities.
10) What would you say has been the benefit of working with CIP?
11) Now tell me about your experience: your current market [*Ask about root quality requirements, crop managements requirements, volume requirements, root handling practices, price of roots, contracting process*]. Do these differ by gender? Please explain.
12) How does the farmer group facilitate participation of smallholder farmers to supply roots to road side Fresh root market (As applicable)? [*Probe with aspects such as requirements for: membership; crop managements including harvesting time, root handling, technical advice by group designated official/staff, if any; transport, etc.*]
13) What would you say is the major limitation in getting farmers to meet demands of your buyers? Do these reasons apply for men and women equally?
14) In your opinion, what are advantages and disadvantages of having the buyer - (road side fresh root market as applicable)- in your locality?

15) What is the kind of risks that the farmer organization faces in supplying OFSP roots to roadside market?

16) Lastly, what, in your view, what are the advantages of incorporating OFSP in baked products such as dough nuts or biscuits?

Partner—*Imbaranga*

1) For how long have you worked with CIP? What has been your role?
2) What would you say are incentives for OFSP commercialization by the various actors in the value chain?
3) In your own opinion what place does Urwibutso enterprises have. For rural development? Does it set precedence? Do you believe the partnership that has been working to support Urwibutso is on track? What should they consider doing differently to enhance the commercialization process?
4) Now tell me about your experience with farmers that supply to: i (Urwibutso Enterprises/Road). *[Ask about root quality requirements, crop managements requirements, volume requirements, root handling practices, price of roots, contracting process]. What role does Imbaranga have in supporting farmers in this endeavor*?
5) How does organizing farmers into farmer groups facilitate participation of smallholder farmers to supply roots to Urwibutso Enterprises/roadside market. What is your role in supporting the farmers?
6) What would you see as the major limitation in getting farmers to meet demand from their buyers and future ones)? Do these reasons apply for men and women equally?
7) Lastly, what, in your view, what are the advantages of incorporating OFSP in baked products such as doughnuts and biscuits.

The International Potato Center (known by its Spanish acronym CIP) is a research-for-development organization with a focus on potato, sweetpotato, and Andean roots and tubers. CIP is dedicated to delivering sustainable science-based solutions to the pressing world issues of hunger, poverty, gender equity, climate change and the preservation of our Earth's fragile biodiversity and natural resources.
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