

# Issues Affecting Small- and Medium-Scale Pineapple Processing Enterprises in Rwanda: A Cross-sectional Study

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## Abstract

Fruit processing small- and medium-scale enterprises (SMEs) play a vital role in the national economic development of Rwanda. Though they receive attention from the government, they still face numerous constraints that hinder their development. A cross-sectional study design was used to profile 16 small-scale and 11 medium-scale pineapple-processing enterprises in the country and assess the issues affecting them. From July to August in 2011, data was collected using a structured questionnaire and face-to-face interviews with enterprise managers. Results showed that most managers of these SMEs are male, married, within the age range of 36–40 years, have had formal education, and works 10 h per day. Most of these SMEs are located in the Eastern Province near pineapple production areas. The mean for the capital investment for small-scale processors was estimated at US\$11,066 and for medium enterprises at US\$805,000. Majority of small-scale enterprises had 10 employees or less while majority of the medium-scale enterprises had more than 10 employees, with both enterprises hiring mostly unskilled laborers working 8 h per day. Results reveal that the major constraints in pineapple-processing industry in Rwanda were the following: access to modern processing equipment and proper packaging material, access to raw materials, high cost of water and electricity, high transportation cost, and limited knowledge and skills of human resources. This article provides various recommendations on how SMEs can overcome these constraints and produce quality products that can penetrate the export market.

**Keywords:** pineapple processing; small and medium enterprises; Rwanda

**Abbreviations:**

BNR – Banque Nationale du Rwanda  
BPR – Banque Populaire du Rwanda  
BRALIRWA – Brasseries et Limonaderies du Rwanda  
BRD – Banque Rwandaise de Developement  
EWSA – Electricity, Water and Sanitation Authority  
GAP – good agricultural practices  
GMP – good manufacturing practices  
HACCP – Hazard Analysis and Critical Control Points  
ILO – International Labour Organisation  
MINECOFIN – Ministry of Finance and Economic Planning  
MINICOM – Ministry of Trade and Industry  
MSSD – Markets and Structural Studies Division  
RAB – Rwanda Agriculture Board  
RRA – Rwanda Revenue Authority  
RHODA – Rwanda Horticulture Development Authority  
SD – standard deviation  
SMEs – small and medium enterprises  
WBCSD – World Business Council for Sustainable Development

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**Introduction**

Globally, pineapple is the second most important harvested fruit after bananas, and it contributes over 20% of the total world production of tropical fruits. Most of the pineapples harvested are consumed as fresh fruits in the countries of production. The leading producers of pineapples worldwide are Brazil, Thailand, the Philippines, Costa Rica, and China. Ninety percent of the world demand of fresh pineapple fruits originates from twelve countries, namely, the United States, France, Japan, Belgium, Italy, Germany, Canada, Spain, England, Korea, the Netherlands, and Singapore.

Rwanda has a wide range of agro-climatic conditions suitable for production of horticultural crops. Hence, there is an opportunity to process high-value crops such as pineapple, which has the potential to grow on all soil types in the country. According to the Rwanda Horticulture Development Authority (RHODA, 2008), the Southern and Northern provinces accounted for 86% of the total pineapple production in 2008. Besides the increase in pineapple production, the government also considers the improvements in pineapple fruit processing technologies as a key intervention measure to develop small and medium enterprises (SMEs) in the country.

In the literature, SMEs play an important role in the economies of developing countries (WBCSD, 2004, Wignaraja, 2003; Randinelli and

Kasarda, 1992). Steel and Webster (1991) stated that SMEs have numerous advantages, such as stimulation of unskilled entrepreneurs, possibility of development on decentralized basis in rural and semi-urban areas to meet local demand, provision of linkages to agricultural and rural activities, use of simple technology, use of local human resource, and the creation of a middle class of self-employed entrepreneurs. Many have considered SMEs as a critical factor in the ongoing growth of market economies and in contributing to the creation of jobs throughout the world (Zorpas, 2010; Beck and Demirguc-Kunt, 2006; WBCS, 2004; ILO, 1998). SMEs have been acknowledged for their flexibility to quickly absorb technological innovations, and today, they occupy a significant position in industrial activities. SMEs provide most of the jobs in Africa, and they account for the majority of industrial units (Bhushan, 1998). In Sub-Saharan Africa, 60% of the labor force is found among food processing SMEs (Mhazo et al., 2005).

According to the Ministry of Trade and Industry (MINICOM, 2010), Rwanda's SMEs, which include formal and informal businesses, comprise 98% of businesses in the country and accounts for 41% of all private sector employment. But the number of SMEs has recently grown due to the encouragement of and assistance by the government. These enterprises are expected to contribute to the economy of the country, as has been the case in other developing and even some developed countries, by increasing value-added exports and revenue from such trade and thereby reducing the import-export gap, which is part of the government's strategy to make Rwanda a middle-income country by 2020 (MINICOM, 2010).

However, a survey revealed that less than 10% of horticultural products from Rwanda are processed. These statistics imply that 8182 out of the 9611 tonnes of pineapples produced remain unprocessed (Kilcher and Ringo, 2009). Similar observations have been reported in most African countries, whereby postharvest losses of fruits and vegetables are estimated at 40%–80% due to inadequate postharvest handling and processing (Fellows, 2004). Hence, processing offers a viable solution to the problems of postharvest losses.

A number of studies showed that in Rwanda, the fruit processing industry is still at its infancy and faces numerous constraints. These constraints include lack of proper processing equipment (including basic laboratory facilities), skilled technicians in food processing, and limited information on good agricultural practices (GAP), good manufacturing practices (GMP), and Hazard Analysis and Critical Control Points (HACCP) at farm and enterprise levels. Other constraints include limited information on the quality requirements of international markets and quality standards of food products, as well as the lack of attention to product presentation and packaging materials (Nankani et al., 2005). Reardon and Barrett (2000) went on to add that developing economies undeniably need improved technologies throughout the agri-food production, processing, and distribution chain; skills transfer;

foreign capital; and increased export earnings. Therefore, adopting improved and validated food processing technologies, enforcing good standards of quality and hygiene, and having regulatory instruments may assist local small- and medium-scale agro-industries to compete favorably in the market.

Since 2006, when the pineapple industry was promoted in Rwanda, there was no existing detailed information on the socio-economic characteristics of the small- and medium-scale pineapple-processing enterprises that had started their businesses at that time. Thus, the purpose of the study is to present a profile of these SMEs and analyze the constraints that hinder their development. The article concludes by providing recommendations for improving the pineapple-processing SMEs in the country.

## Materials and Methods

This study used a cross-sectional research design that examined the current status of pineapple-processing SMEs in Rwanda from July to August 2011. The survey involved 16 small-scale and 11 medium-scale pineapple-processing enterprises across the country using a guideline booklet containing a list of these enterprises (RHODA, 2008). For the purpose of this study, small enterprises are defined as those enterprises having a capital investment of less than US\$25,000 while medium enterprises are those having a capital investment above US\$25,000 (MINICOM, 2010).

Data was collected from the enterprises' managers through face-to-face interviews using a structured questionnaire with closed and open-ended questions as well as structured observations. The questionnaire was pretested for its validity and was amended appropriately prior to the actual research. It comprised of two main sections: the first contained questions related to the socio-economic life of the enterprises and the second contained questions related to the good manufacturing practices of the enterprises. The computation of percentages, means, cross-tabulations, and chi-square were performed using SPSS version 16.0.

## Results and Discussion

### Socio-demographic Profile of Pineapple-Processing SME Managers

In general, more men (55.6%) managed pineapple-processing activities compared to women (44.4%) (Table 1). But unlike medium enterprises, which were managed by more men (63.6%), small enterprises were managed equally by both men and women. This seems to be the trend in SMEs in various African

**Table 1.** Socio-demographic profile of pineapple processing enterprise managers

Profile	Small Enterprises (%)	Medium Enterprises (%)	All enterprises (%)
Sex			
Male	50.0	63.6	55.6
Female	50.0	36.4	44.4
Civil status			
Single	18.8	36.4	25.9
Married	56.2	63.6	59.3
Widowed	25.0	0.0	14.8
Age (years)			
Less than 30	6.2	18.2	11.1
31–35	6.2	18.2	11.1
36–40	31.3	18.2	25.9
41–45	12.5	0.0	7.4
46–55	25.0	36.4	25.9
56–65	18.8	9.0	18.6
Educational level			
Completed primary school	18.8	36.4	25.9
Completed post-primary school	25.0	9.1	18.5
Completed secondary school	31.2	27.3	29.6
Completed bachelor's degree	25.0	27.3	25.9

and Latin American countries (Liedholm, 2002; Mead and Liedholm, 1998; Steel and Webster, 1991) although there is evidence that women might have a slight tendency to manage smaller enterprises than men (Daniels, 1999; McPherson, 1991).

Both enterprises categories were managed by married entrepreneurs (59.3%) and only few were managed by single (25.9%) and widowed (14.8%) entrepreneurs, which suggests that the married entrepreneurs were more capable of balancing family responsibilities, such as caring for children and other family members, and doing business. Managing a pineapple-processing enterprise requires a mean working hours of 10 h per day (SD 4). The median

was 8 h, with minimum working hours of 6 h and maximum of 20 h, which is significant at 5%.

Majority of enterprise managers of small enterprises (43.8%) were within the age range of 36–40 years while 30% of enterprise managers of medium enterprises were within the age range of 46–55 years. These age ranges are within the active age of a typical Rwandese, which is set between 15 and 65 years (MINECOFIN, 2002). Results are similar to ages of small and micro enterprise proprietors in Swaziland and Lesotho, which were set at 43 and 46 years old (McPherson, 1996), while in Zimbabwe, the mean age of small enterprise managers was estimated at 38 years (McPherson, 1991).

In both small and medium enterprises, managers of the pineapple-processing enterprises have had formal education. In business, education is crucial. Several studies have shown that a high level of education of the entrepreneurs is the key to the success of any business (Steel and Webster, 2001; McPherson, 1996; Cabal, 1995; Parker, 1994). The current study shows therefore that since the majority of enterprise managers are well educated, these SMEs are expected to grow and contribute to the economy of the country once other factors affecting their growth are dealt with.

### **Characteristics of Processing Enterprises SMEs in Rwanda**

The Eastern Province of the country hosted the highest number of processors (38.4%), and Kigali Province, the least (7.7%) (Table 2). Most of the enterprises were newly created, with only 29.5% in operation for more than 6 years. Most of the processors started their business between 2005 and 2009. However, some medium enterprises started operations in 2006, which coincided with the creation of RHODA, the institution that started the promotion in the country of pineapple production by distributing healthy pineapple planting materials and other agricultural inputs to farmers and processing by subsidizing the potential entrepreneurs' acquisition of fruit processing equipment.

Processors reported that they preferred to process pineapple because the fruit is abundant in their areas and needed value addition in order to reduce spoilage of the raw pineapple fruit and find a market for the new products and increase their income. In Rwanda, processed pineapple products, especially juices and wines, are in high demand during the dry season (June–August) because this coincides with weddings and other church festivities. However, demand is low during the rainy season (February–May).

*Human resources in the enterprises.* For pineapple processors in Rwanda, majority of small-scale enterprises (81.2%) had 10 employees or less while majority of the medium-scale enterprises (90.9%) had more than 10 employees.

**Table 2.** Business profile of pineapple processing enterprises in Rwanda

Profile	Small enterprises (%)	Medium enterprises (%)	All enterprises (%)
Geographic distribution			
Northern Province	0.0	20.0	7.7
Southern Province	37.5	0.0	23.1
Eastern Province	37.5	40.0	38.4
Western Province	25.0	20.0	23.1
Kigali Province	0.0	20.0	7.7
Number of years in operation			
1–3 years	31.3	9.0	20.1
4–6 years	18.7	81.8	50.2
More than 6 years	50.0	9.0	29.5
Number of employees			
Less than 6	43.8	9.1	29.6
6–10	37.4	18.2	29.6
11–15	18.8	27.3	22.2
16–20	0.0	27.3	11.2
21–25	0.0	18.1	7.4
Capital investment (US\$)			
Less than 10,001	53.3	0.0	26.6
10,001–15,000	26.7	0.0	13.3
15,001–25,000	20.0	0.0	10.0
25,001–35,000	0.0	50.0	25.0
35,001–50,000	0.0	10.0	5.0
50,001–65,000	0.0	30.0	15.0
More than 65,000	0.0	10.0	5.0
Processed products			
Jam	17.6	8.3	13.8
Syrup	5.9	8.3	6.9
Ready-to-drink juice	11.8	41.7	24.1
Wine	64.7	41.7	55.2

The mean number of employees for small-scale enterprises was 7 (SD 4), and for medium-scale enterprises, 15 (SD 7) employees. The number of people employed by the enterprises in this study mirrors the numbers previously published in a government report (MINICOM, 2010).

The working hours of the technical staff were at 8 h per day and working 6 days a week. The weekly total of 48 h is slightly more than the 40–45 h per week set by the government. In general, both enterprises employed more permanent than temporary staff. For medium-scale enterprises, the mean for permanent employees was 11 (SD 5) and for temporary employees 4 (SD 5). This is significantly higher compared to those of small enterprise, whose mean for permanent employees was 6 (SD 4) and for temporary employees 1 (SD 3) ( $p \leq 0.05$ ). This implies that the growth of SMEs in Rwanda would create significant private sector non-agricultural employment opportunities for the population (MINICOM, 2010).

But these enterprises usually hire unskilled workers with low levels of education for its technical staff whose majority has only completed primary school education in small (82.3%) and medium (62.8%) enterprises. None of these technical staff had received on-the-job training.

Both enterprises have no plans for vocational training for technical staff, which is not surprising in a developing country like Rwanda. Mhazo et al. (2005) reported similar findings in Zimbabwe, where few of the personnel in small and medium agro-processing industries received formal training in food-processing techniques. This is something that needs to be looked into considering that a business with formally trained workers showed statistically significant higher growth than those businesses with untrained workers (Wignaraja, 2003; Parker, 1994).

*Enterprise capital investment.* The mean for the capital investment (i.e., fixed assets and working capital) of small-scale processors was estimated at US\$11,066 and of medium enterprises at US\$805,000, with a significant statistical difference between the two ( $p = 0.03$ ). The running capacity of both small and medium enterprises was estimated at US\$37,683 (SD 8,216), with a minimum of US\$833 and a maximum of US\$416,666. The majority of small enterprises had a running fund of less than or equal to US\$8,333 while medium enterprises had more than US\$25,000. A strong association was observed between small and medium enterprises and the fixed capital investment ( $p = 0.00$ ).

According to most managers of both enterprise categories (89.0%), enterprises were able to manage their cash flow all year round. However, about 66.7% of them accessed credit to increase their investments; more medium-scale processors (81.8%) availed of credit from banks compared to small processors (56.2%). The main sources of loans were the Banque Populaire du Rwanda (BPR) and the Banque Rwandaise de Developement (BRD).



Small-scale enterprises (75.0%) had a tendency to avail of credit less than US\$8,333 while medium-scale enterprises (42.9%) had a tendency to avail more than US\$35,000. The mean for the percent interest rate was estimated at 13.65% (SD 4.18). This showed that small-scale processors are less likely to avail of credit (Wignaraja, 2003). Therefore, there is a need for development banks to approach SMEs and assess their capacity to take the loan and use it efficiently. Otherwise, medium enterprises will continue to only benefit from such available development funds if small ones are not assisted.

With this finding, it is clear that the enterprises with minor capital investment can hardly compete and grow. Mather (2005) argued that for SME food processors to be competitive in South Africa, they needed more capital investment in modern fruit-processing equipment and layout so that they can meet the standard requirements of the market. The limited access to credit for SMEs is also known as a key constraint in Rwanda. Hence, the government has set strategies to overcome this by assigning two financial institutions, the Banque Nationale du Rwanda (BNR) through the BPR and the BRD, the task of making credit available to SMEs. However, only a few SMEs benefit from this service due to limited information on how to access the fund (MINICOM, 2010). Steel and Webster (1991) had similar findings in Ghana, where SMEs had to look for additional capital investment from relatives and acquaintances due to limited access to credit. The lack of finances was also found to be a serious constraint to the growth of SMEs in some developed countries, such as Russia and Bulgaria (Pissarides et al., 2003). Despite the challenges SMEs face in Rwanda, it may be expected that the government interventions for SMEs to access credit will improve their condition. In Nigeria, where its agriculture guarantee scheme met success, the livelihoods of farmers and entrepreneurs were greatly improved (Olaitan, 2006).

*Processed products and their marketing.* Both types of enterprises processed different types of products from pineapple, namely, syrups, ready-to-drink juice, jam, and wine. Small enterprises had the capacity of producing about 231.4 L of juices per week compared to 312.5 L for medium enterprises. For jam, small enterprises had the capacity to produce 52.5 kg per week while medium enterprises could produce 200 kg per week. Only one medium enterprise had tried to process dried pineapple slices, but it did not succeed in producing a good product. Small-scale processing industries are more inclined to produce wine products. This is hardly surprising since juice spoilage is common, and throughout history, fermentation to alcoholic beverage has been the only preservation alternative for these small businesses (Bates et al., 2001).

For small- and medium-scale processors, pineapple wine and ready-to-drink juices were the most in-demand products, garnering 59.0% and 22.0%

market shares, respectively. Pineapple jam and syrup have lesser demand, garnering 11.0% and 8.0% market shares, respectively. The affordability of a 500-mL bottle of fruit juice or wine, which costs US\$0.5 and US\$0.8, respectively, was the driver of demand. In comparison, 1 L of pineapple syrup costs US\$4.1.

Majority of processors (46.0%) sold their products in the nearest market located in their respective districts while other enterprises sold their products in Kigali City (25.0%) and neighboring districts (29.0%). Generally, small-scale enterprises preferred markets within their district due to limited financial and transport means to move goods across distances. Medium enterprises, on the other hand, preferred markets in Kigali City and neighboring districts because they can afford to sell their products there with considerable markup in pricing due to higher demand. Most of the time, processors sold their products to intermediaries such as restaurants and supermarkets. Retailers of their products, located in the cities, are ideal since they require bulk quantities of products and need to replenish their stocks regularly. Also, trading with these intermediaries is less risky since agreements are formalized by contracts.

The case in Rwanda is different from that in Latin America and other parts of Africa where majority of the small and micro-enterprises sold their products directly to consumers rather than to other firms. These enterprises though are less likely to grow than those that sold their products to traders (Liedholm, 2002). Just like the processors in this study, micro- and small firms in Cote d'Ivoire found their niche in the local market (Sleuwaegen and Goedhuys, 2002).

### **Major Constraints in the SMEs**

Pineapple-processing SMEs faced numerous constraints that hindered their productivity. They reported the top 10 major constraints to their business, with limited access to equipment and proper packaging materials topping the list (Table 3). These constraints were common to small-scale food processing enterprises in developing countries and considered as the primary cause of the enterprises' weakness in terms of price, quality, and delivery performance (Markelova et al., 2009; Minten et al., 2009; Mhazo et al., 2005; Nankani et al., 2005; Wignaraja, 2003; Sleuwaegen and Goedhuys, 2002; Zapharullah et al., 1998).

*Equipment and packaging material.* Access to equipment and packaging materials is a pervasive problem for the enterprises (Table 3). Rwanda's largest processor, Inyange Industries, for example, has invested US\$30 million for a state-of-the-art juicing plant for pineapple and passion fruit, which will force other industry leaders to follow suit (Booth and Golooba-Mutebi, 2012). SMEs, however, can hardly afford modern equipment.

**Table 3.** Top 10 constraints cited by small and medium pineapple processing enterprises in Rwanda

Constraints	Small enterprises (%)	Medium enterprises (%)	All enterprises (%)
Limited access to equipment and proper packaging material	100.0	100.0	100.0
High transportation cost	93.8	90.9	92.6
Lack of capital to acquire modern equipment	93.8	90.9	92.6
Limited entrepreneurial skills	87.5	100.0	92.3
Limited knowledge on how to process quality product	100.0	60.0	84.6
Limited access to information on export market requirements	93.8	70.0	84.6
High cost of water and electricity	81.2	81.8	81.5
High cost of raw materials	31.2	70.0	58.3
Poor quality of raw materials	18.8	45.5	29.6
Lack of raw materials	18.8	36.4	25.9

The common processing equipment used in the pineapple-processing enterprises were boilers, electrical juice extractors, mechanical juice pulpers, juice mixers, and knives. The majority of respondents (67.0%) did not know the manufacturer of most of the equipment they were using. Some processors (44.0%) bought their equipment in a Kigali supermarket, and others (56.0%) looked for modern processing equipment in Uganda, Kenya, Tanzania, and South Africa. Some of the equipment, such as boilers and juice extractors, were supplied to the processing enterprises through donor-funded projects operating under RHODA and BRD.

The packaging material used for processed pineapple products include glass bottles for wine, plastic bottles for juices, and plastic pots for jams; and these are mostly supplied by BRALIRWA (Brasseries et Limonaderies du Rwanda), the largest brewer and soft beverage company in Rwanda. A very small number of processors sourced their packaging materials, which are quite expensive, from other East African countries such as Uganda, Tanzania, and Kenya.

Due to high cost of these materials, some enterprises resort to using recycled packaging materials, but this raises food safety and hygiene concerns (Mhazo et al., 2005). Studies have shown that there is potential for post-consumer contaminants to be absorbed in recycled materials and for these to migrate to food that use recycled packaging (Arvanitoyannis and Bosnea,

2010; Franz, 2002; Lao and Wong, 2000). With lack of regulation, this is quite problematic. While it is necessary to look at environmental issues and promote recycling of consumer waste, food safety for consumers must also be a primary concern.

Many studies suggest that a strong export support to small-scale enterprises in the form of duty free access to imported raw materials and equipment would assist SMEs in penetrating the export market (Jina and Deninger, 2009; Wignaraja, 2003; Berry et al., 2001).

*Raw materials.* When it comes to raw materials, more enterprises generally have problems with the high cost of raw materials (58.3%), which are sometimes sourced from the neighboring districts. Since medium-scale processors produce a higher volume of processed products than small enterprises, it is no wonder that they have more problems with raw materials compared to small-scale counterparts. In addition, a few of the small and medium enterprises have reported poor quality of raw pineapples and lack of raw materials as their constraints (Table 3).

In Rwanda, the Smooth Cayenne is the most common cultivar. The price of a piece of pineapple weighing 1 to 2 kg ranged from US\$0.13 to US\$0.58 (mean: US\$0.30; SD 0.13). However, prices tended to be much lower, ranging from US\$0.08 to US\$0.16, for a 2-kg pineapple in the Eastern Province, which is a major pineapple-growing province in the country. In fact, there has been a recorded excess of supply in the province in 2008 (RHODA, 2008). The price of a piece of pineapple during the peak production season ranged from US\$0.06 to US\$0.50 (mean: US\$0.22; SD 0.10). During the lean season, the cost of a piece of pineapple range from US\$0.13 to US\$0.83 (mean: US\$0.33; SD 0.18).

Since majority of the processors started the processing activity because pineapple fruits were abundant in their areas, only a few of them have problems with supply. Most of them reported sourcing raw materials from farmers near their processing plants (89.0%) or from their own farms (44.0%). Hence, it takes only 1 to 3 h for the raw materials to reach the processing plants for 85.0% of the enterprises. However, SMEs have observed a decrease of the raw material over time, which necessitated the sourcing of pineapples from other districts or nearby provinces, especially during periods of low production.

Most of them (74.0%) confirmed having regular supply of pineapples. This regular supply of raw fruits must be sustained by putting more effort in encouraging pineapple producers to increase annual production. However, since pineapples propagate by suckers and slips, the number of planting materials cannot supply the farmers' demand for planting materials. Use of biotechnology, such as tissue cultures, offers a feasible solution to production of large number of plants (Gahakwa et al., 2012). Aside from providing

healthy pineapple planting materials, providing additional agricultural inputs and introduction of best practices to pineapple growers can also help increase fruit production. A steady supply of raw materials is key to avoiding closure of the enterprises. Lack of raw materials was reported to be the main cause of closure of micro- and small enterprises in Zimbabwe (McPherson, 1991).

It was noted that only 30.0% enterprises had a contract with the suppliers specifying volume and quality requirements. Processors do the sorting when they receive the pineapples using the ripeness and damages to the fruit as criteria for selection. They select enough ripe pineapples, which are yellowish in color (Bates et al., 2001), and reject the damaged ones, which are, in general, very small in number (i.e., one or two pineapple fruits per truck). For most of the processors (85.0%), the number of days they could store pineapples before the processing ranged from 1 to 3 days. The remaining processors can store pineapples up to a week.

*Electricity and water.* Results revealed that 81.5% of all small and medium enterprises have encountered problems with regards to high cost of electricity and water, which are supplied by the Rwanda Electricity, Water and Sanitation Authority (EWSA) (Table 3). These costs are considered fixed costs in a processing enterprise, and as such, they can seriously affect the profitability of an enterprise.

For electricity, the industry rate in Rwanda for 1 kW at midpeak hours (i.e., 7:00 AM to 5:00 PM) is fixed at US\$0.21 while at on-peak hours (5:00 PM to 11:00 PM) rate is fixed at US\$0.28 (EWSA, 2010). This is quite high compared to cost in other East African countries such as Uganda where small-scale businesses pay only US\$0.14 per kW (Mwenda, 2012). Despite the high costs, the majority of medium enterprises (82.0%) reported having easy access to electricity compared to a relatively smaller percentage of the small enterprises (44.0%) ( $p < 0.05$ ). This seems to suggest that with higher cost of electricity comes more efficient services for its transmission and distribution.

Majority (70.4%) of both small- and medium-scale enterprises had access to clean water, but for 81.5% of the enterprises, the cost of water was considered very high, ranging between US\$0.30/m<sup>3</sup> and US\$1.75/m<sup>3</sup> (EWSA, 2010). The cost for water in Rwanda is near water cost in other Sub-Saharan African countries such as Burkina-Faso, Zambia, and Senegal while it is much higher compared to that of Ethiopia and South Africa, which are at less than US\$0.25/m<sup>3</sup> (AICD, 2009).

Majority (70.4%) of pineapple-processing SMEs had access to clean water. Few of them (29.6%) got water from boreholes because the source of potable water was placed very far from their processing sites. Lack of access to clean water for these few processing enterprises is a very big challenge to them since the availability of potable water in any food processing industry is a requirement for hygienic purposes as per the Codex Alimentarius Commission (2003).

Only 44.4% had regular supply of water for both small and medium enterprises. Majority of the enterprises (93.0%) did not have supply of hot water, but the use of boiled water for processing and cleaning activities was a common practice. Most of the enterprises were treating water for cleaning by adding cleaning products such as sodium hypochlorite, liquid soap, and sodium sorbate. Some of these treatment practices have been advised by Carderon (2010) and Bates et al. (2001), and processors have been trained on the treatment of the fruit and utensils before any processing activity. Water used in the processing plant was not assessed in terms of quality by any enterprise though potable water is important to food-processing industries (Bates et al., 2001).

*Transportation.* Most of the enterprises are located near the pineapple supply, where it usually takes about 1–3 h to transport the fruits. Hence, processors do not have a problem in sourcing their raw materials. However, there is a problem in terms of transportation cost for marketing of the products (Table 3).

The mean distance between the processing units and the nearest market was estimated at 12.25 km (SD 11.91) for small processors and 8.91 km (SD 13.88) for medium processors. On the other hand, the mean distance to Kigali market was estimated at 113.75 km (SD 53.74) for small processors and 90.45 km (SD 61.41) for medium processors. Though these distances do not differ statistically, it was observed that small-scale pineapple processors were at a disadvantage.

Different modes of transport are used by processors selling their processed products, such as manually carrying the products by head or riding a bicycle, lorry, taxi, bus and pickup. About 26.0% of the respondents walk more than 150 km to reach the city. Medium-scale enterprises use less manual carrying of products and riding the bicycle as means of transport for their products. However, being far from the Kigali market negatively affected them due to high transportation costs. According to one Rwanda transportation company, cost for a hired truck per day can reach up to US\$208.30. Not only this, but for small and medium enterprises that transport their products through bicycle or public transport, the distances clearly affect the quality of their products.

In Rwanda, transport facilities have been indicated as a limiting factor to SMEs (MINICOM, 2010), but it is expected that with the new SMEs development policy of 2010, such as access to credit and development infrastructures, the challenges in transportation would be resolved.

According to 85.0% of the respondents, the roads linking them to the nearest markets are good roads because the government has prioritized the maintenance of the roads in the last two years (MINICOM, 2010). Good rural roads are essential for rural agro-enterprises to successfully access the market and benefit from other development services (Hazell et al., 2007).

*Lack of entrepreneurial skills.* Beside formal education, all enterprise managers had received training related to management or processing. Through the years, the government has intensified its commitment in designing enterprise training programs, which were administered by Rwanda's National Agricultural Export Development Board (NAEB) and RHODA. However, managers felt that the one-time training was not enough for them, and they suggested study tours in other countries where SMEs have shown a strong impact on their economic development in order to learn from the experience of those successful enterprises. Managers have also shown their interest in continued learning through vocational training. It has been observed that vocational training for entrepreneurs have a significant impact on enterprise growth and success (Liedholm, 2002; Zapharullah et al., 1997; McPherson, 1996).

Based on the available information, one may argue that education, both formal and vocational, for enterprise managers is one of the key determinants of a business enterprise's success. The active learning process of human capital formation of managers was pointed out as an important success factor for SMEs (Sleuwaegen and Goedhuys, 2002).

*Knowledge on processing quality product.* According to the results, all the small-scale processors and 60% of the medium-scale processors admitted having limited knowledge on processing of quality product, probably due to limited training received (Table 3). Limited technical knowledge is probably the reason majority of small (59.3%) and medium (72.7%) enterprises experienced losses during the first year of enterprise initiation.

Some of the problems encountered by pineapple processors are the following: fermentation of processed juice a day after its production, too short shelf-life for jam at two weeks, and high acidity levels of the wines. Enterprise managers pointed at the lack of proper capping machine and packaging materials (35.7%); lack of technical skills on processing pineapple juice, wine, and other products (28.5%); and lack of proper and reliable raw materials (7.3%) as the root cause of the spoilage. Interestingly, 28.5% of the managers did not know the cause of spoilage for their products. These answers show that there is a need for intensive training for the pineapple-processing enterprises to address these problems.

Small enterprises used only sensory evaluation to gauge the quality of their products while medium enterprises used more laboratory tools to assess the quality of their processed products. Furthermore, the majority of the small enterprises (62.5%) did not have a product testing plan at the time of the interview while the majority of the medium enterprises (90.0%) had that plan ( $p < 0.05$ ). Mather (2005) argued that small and medium food processing enterprises find it difficult to meet private and international grade standards because they do not have food testing laboratories. In addition, the Ministry of Trade and Industry (2010) recognized that one of the major challenges for

SMEs in Rwanda is the use of rudimentary production facilities, and this leads to processed products that are only fit for local distribution (Nankani et al., 2005).

From these results, it can be stressed that processors have to be trained on the quality parameters of the pineapple fruits acceptable for processing in order to process quality products in compliance with international standards as set by the Food and Agriculture Organisation (Bates et al., 2001) and the Codex Alimentarius Commission (1993).

*Access to information on export market requirement.* More small-scale processors (93.8%) had problems accessing information on the requirements of the export market than medium-scale processors (70.0%) (Table 3). Processors received information on where they can sell their products mainly through government institutions in charge of agricultural extension and export, such as the NAEB and the Rwanda Bureau of Standards (RBS). Informally, they can also get the information from acquaintances located either inside or outside the country.

There is limited information about the existence of export markets for pineapple products available to processors, and these are the following: there is a market for products in East Africa, Europe, and United States; products have to be certified by the RBS before going outside the country; the export market is interested in organic products; and an import permit is needed from the importing countries if the products are to be sold in those countries.

Most of the processors would like to sell their products outside Rwanda, such as East Africa, the United States, and Europe; but they do not see how they can penetrate those markets because they perceive their products to be of low quality and they have difficulty complying with the requirements of the export market (Kilcher and Ringo, 2009; RHODA, 2008). Most of the respondents indicated that they experienced competition from two large pineapple-processing enterprises, Inyange and Urwibutso. Small- and medium-sized processors in South Africa are often taken over by larger processors in order to limit competition and increase capacity (Mather, 2005). Also, they face competition from banana wine processors located throughout the country. In Rwanda, bananas are usually grown on hillside plots by smallholders to prevent erosion, and production of banana wine is a major smallscale agroindustrial activity of the poor (Reardon et al., 2001).

Markelova et al. (2009) and Berry-Ameyagaw (1997) recommended the formation of cooperatives that will market their products because it has been demonstrated that this strategy enables small enterprises to enter bigger markets in developing countries. As an example, they pointed out a case in Thailand where a women's group involved in processing tropical fruits was able to purchase processing equipment, which allowed them to transform



their products, achieve a better price, and access new market opportunities. But Akwabi-Ameyaw (1997), in his analysis of cooperatives in Zimbabwe, cautioned that changes to the prevailing organizational culture must be instituted in order to cooperation and working for the common good among members and curb the leading members from seeking individual self-interest and private gain.

*Others.* According to 59.2% of enterprises from both categories, Rwanda Revenue Authority (RRA) taxes were high as they were required to pay 18% of their return on investment. Also, 74.0% of the enterprises thought the Rwanda Bureau of Standards regulations were restrictive to food processors because the required standards of basic processing equipment and hygiene seemed to be very high. However, SMEs need to abide by these standards if they hope to produce high-quality products for export.

The findings of the present study corroborate many other studies conducted in developing countries. McPherson (1991) reported that in Zimbabwe, government rules and regulations, such as tax payments, were indicated by enterprise proprietors as very serious constraint to their business. Similarly, in Cote d'Ivoire, Sleuwaegen and Goedhuys (2002) reported that rules and regulations such as various taxes, price regimes and difficult licensing policy hindered the growth of small- and medium-sized firms.

## Conclusions and Recommendations

Fruit-processing SMEs play a vital role in the national economic development of Rwanda. This subsector has the potential to supply local needs and meet export requirements, which can create employment opportunities and contribute to the overall economic development of the country, with proper nurturance. Though these SMEs receive attention from the government, they still face numerous constraints that hinder their development and their access to foreign markets, such as access to modern processing equipment and proper packaging material, access to raw materials, high cost of water and electricity, high transportation cost, and limited knowledge and skills of human resources. To overcome these constraints, the following critical areas need to be addressed:

1. Fruit processing SMEs need to be strengthened. This will help reduce heavy losses experienced by fruit producers and ensure product availability in the market. To encourage uptake of this new enterprise, entrepreneurs need to be exposed to available technologies on fruit processing and preservation and have an idea regarding the range of

products that can be manufactured and this would be done through intensive and continuing training.

2. For the short term, the government and non-government organizations can subsidize the importing of processing and packaging equipment, removing value-added tax on imported materials, and introducing low-cost financing to help SMEs. Small and medium enterprises can also operate under an umbrella cooperative to purchase valuable processing equipment, which individual enterprises could not possibly afford on their own.

However, a long-term solution is to invest on collaborative research between the public and private sectors that will aim to assist equipment manufacturers to produce quality and affordable fruit processing machines for processors, making it unnecessary to source expensive equipment from outside the country. Research could also contribute by investigating how equipment production cost can be reduced. Testing services can be offered to the informal sector, which does not have the capacity to conduct research on its own.

3. The strict enforcement of food safety and hygiene standards should be practiced to protect the welfare of consumers.
4. Trainings offered to small and medium fruit processors needs to include business management skills. Thus, training in agricultural institutions and universities should also encompass the same to ensure competence of graduating extension officers in the subject.
5. Private organizations and non-government organizations should help the government to establish training programs for small enterprise owners and government extension staff involved in assisting entrepreneurs.
6. These enterprises did not have easy access to infrastructure despite the fact that accessibility to efficient and cost-effective infrastructure was key to SME's development. Therefore, access to potable water and to food quality testing laboratories would improve the quality of pineapple products produced by small and medium pineapple-processing enterprises.
7. The viability of any business is enhanced through proper training, growing financial packages, and strategic equipment ownership arrangements. For this reason, agricultural training institutions and extension services should develop a business model to assist fruit processors in terms of planning, management, and finances for

them to increase business profits. Since access to information is key to business success, enterprises must have access to information on technologies and the requirements of the export market.

8. Women entrepreneurs should be a key focus area for interventions. Since more women are engaged in small-scale processing, they need to be trained on managerial skills for them to increase the profit levels of their enterprises. They also need to be encouraged to think about starting bigger businesses by making it easier to access capital from microcredit development institutions available in the country.

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