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SOCIAL ECONOMIC FACTORS AFFECTING SUGAR CANE PRODUCTION IN RWANDA

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Abstract*: Sugarcane is one of the key agricultural export commodities in the Rwandan economy. Despite the huge investments in sugarcane subsector, sugarcane yields in Rwanda have remained low thus affecting economic well-being of sugarcane farmers. This study aimed at determining socio-economic factors influencing sugar cane production along River Nyabarongo in Rwanda. A total of 202 farmers were randomly selected from the study area using multi-stage sampling techniques. Semi-structured questionnaire was used to collect data. Multiple linear regression technique was applied in data processing. The key findings revealed that cost of land preparation, cost of planting, cost of fertilizers, cost of transport and cooperative functioning fees were found to affect sugar cane production at 5% and 10% levels of significance respectively. The study recommends that policies and strategies should be formulated to encourage contract participation and expand the area under sugarcane. In order to make sugarcane production more competitive, there should be provision of better lending terms for farm inputs through credit system to farmers particularly, fertilizer to encourage optimum application.*

Keywords*: Adoption, Sugar cane, multiple regression, Smallholder, Nyabarongo, Rwanda*

Introduction

Sugarcane in Rwanda is produced by out growers and Kabuye Sugar Works which is a privately-owned company that makes its primary business in the processing of sugar cane into raw sugar. The Rwanda sugar production is based on both estate and out-grower production. The company's operations also contribute to the country's import substitution efforts and add some stability to the often-volatile price of sugar on the global market. However, because of low sugar cane production in Rwanda, Kabuye's positive impact has been limited as the majority of the country's demand is currently supplied through sugar imports from Uganda, Egypt, Zambia, and other COMESA countries (FAOSTAT, F. 2016) The production is projected to increase from 1,300MT to 2,000MT. The annual farmer revenues and agricultural laborer incomes are projected to increase by 38% and 69% over 5 years, (from 2011 to 2016) respectively. It is anticipated that an increment of 14 Million USD of imports will be substituted with local production of sugar over 5 years. Incremental tax receipts to Government of Rwanda are expected to exceed 4 Million USD over the same period. The foreign direct investment is estimated at USD 5 million. Direct and indirect employment will also increase from the current 545 directly employed personnel and over 5,000 agricultural workers. Efforts have been employed to achieve the production targets. The area under sugarcane cultivation and the crushing capacity of sugar mills need to

be expanded to 87,000 ha and 21,000 tonnes cane crushed per day (Kumar, 2016).Thus Rwanda remains to be dependent on imported sugar and the demand is increasing at alarming rate as national sugar supply is not able to meet the local demand. The country is sugar deficit with 30% of local production and 70% imported sugar which causes the sugar import bills being high. This necessitated conducting a study to assess social economic factors affecting sugarcane production in Rwanda and how to close the knowledge gap.

Social economic factors affecting Sugarcane production

Dindi (2013); Mahlangu & Lewis(2008) in their study revealed that fertilizer use was higher in major cash crops such as sugarcane, tea and coffee due to organized input credit schemes which allow farmers to acquire inputs on credit and repay through deductions made on deliveries of the produce.

According to the United States Department of Agriculture, nearly 50 per cent of the global sugar production comes from three major producing countries; Brazil, India and the European Union (Ricaud et al., 2012). Sugar is one of the most volatile commodities in the world trade in terms of price and production. There has been a decline in cane production per unit area of land and hence an increase in poverty for approximately 6 million people who depend on sugarcane farming either directly or indirectly (Jemaiyo, 2013).

In 2010, sugarcane was cultivated on about 23.8 million hectares in more than 90 countries with a worldwide harvest of 1.69 billion tonnes (FAO, 2011). This acreage under sugarcane is set to expand as sugarcane monoculture is being favored by most farmers at the expense of other food crops. This results to great impacts on food prices and availability of food commodities in the market (Oyugi, 2016).

Masuku et al., (2014), in his study on sugar-cane profitability in Swaziland reported that farmer's profitability was significantly affected by the yield per ha, farmers experience and the distance between the mill and the farm (transport cost). The study revealed that farmers closer to the mill made more profit compared to those further away and those farmers with more land under sugarcane production had gross profit increased.

Changes in commodity prices are important for the welfare of both developing and developed countries (Byrne et al., 2013). Commodity prices tend to exhibit particular characteristics that differentiate them from other traded goods. This is reflected in short-term volatility, occasional price spikes and the possibility of a relative decline in commodity prices in the long-run.

In Nigeria, while studying the impact of socio-economic factors on the performance of small-scale enterprises in Osun state, Aworemi et al., (2007) found that age, gender and education level of the respondents has significant contribution to the performance of small scale enterprises, measured in terms of profitability.

METHODOLOGY

The study was conducted in the Kigali city and Eastern province along river Nyabarongo. The latter is the longest in the country. The two provinces were chosen because the two provinces touch on Nyabarongo River where more sugarcane plantation is grown. It is the upstream area of the river where big portion of sugar cane is produced.

The study adopted a cross sectional survey design. The study employed both quantitative and qualitative methods. A qualitative approach enabled the collection of data in actual context, while quantitative approach enabled to get responses on the same questions from a large pool of respondents and quantified in order to make appropriate conclusions. Multiple regression analysis was used to determine social economic factors that affect sugarcane production.

The target population in this study comprised of the small holder sugarcane farmers working with Kabuye sugarcane factory. The target population comprised of 800 sugarcane farmers. The population was stratified according to the various agro-ecological zones and further into sugar co-operative societies and factories. At the factory level, random selection of individual farm households was done to avoid bias. The target population for this study was the farmers working with Kabuye Sugar factory.

Farm level data was collected by adopting the stratified random sampling design. The goal of this design was to achieve the desired representation from various subgroups in the population. According to Kothari et al., (2005), if a population from which a sample is to be drawn does not constitute a homogenous group, stratified sampling is generally used in order to obtain a representative sample. Under this method, the total population was divided into several sub-populations that are more homogenous .These sub-populations are referred to as strata (Kothari et al., 2005). In this case, the two ecological zones that are suitable for sugar growing in Nyabarongo represented the strata. To achieve this, three cooperative societies cutting across the two provinces were randomly selected. The list of total household heads in the selected sectors was obtained from Kabuye sugar factory.

Using Slovens' formula, the sample size was given by equation (1)

$$n = \frac{N}{1+N(\alpha)^2} \quad \text{..... (1)}$$

$$n = \frac{1200}{1+1200(\alpha)^2} = 202 \quad \text{..... (2)}$$

Where **N=** is the sample frame, **n** is the sample size and α is the margin of error, α: precision level chosen (for confidence interval of 95%).

A structured questionnaire was used to collect data from the respondents. Although it is costly, this method was selected because of it could give fairly reliable results (Kothari et al., 2005). Both open and closed ended questions were used. Open ended questions helped in collection of more in-depth responses from the respondents while closed ended ones were quicker to administer and analyze. The questionnaire contained three sections; first section included financial factors and second section contained the information related to moderating factors and final section was on costs and revenues.

Regression analysis using the ordinary least square estimation was employed to determine social economic factors affecting sugarcane yields in the study area. Data were analysed by both qualitative and quantitative methods. The data were then exported to STATA version 13, for analysis independent variables that have p-values of less than 0.05 had significant contribution in bivariate analysis. In this study, the following specification of the linear model is presented as:

$$Y = \beta 0 +_{B1} X_1 +_{B2} X_{2+u} \quad \text{..... (1)}$$

Where:

$\beta_{0 =}$ Constant, β_1-β_3=Parameters to be estimated, Y= Sugarcane production, $X_{1 \text{ to } X20}$ were social economic factors and U= error term

Results and Discussions

Results from the OLS model presented in table 1 showed that cost of land preparation was statistically significant the financial cost factor that influenced the sugarcane production in Rwanda at 10% level of significance. Expectedly, there is a negative relationship between cost of land preparation and total expected sugarcane production, this implies that one unity increases in cost of land preparation, the expected sugarcane decreased by 6.2% of the total yield. This is reasonable because the increase in such cost, reduce the farmer's ability to afford other additional farm inputs for sugarcane production. The regression coefficient of the variable of cost of land preparation was positive (-0.6216) at 5% level of significance, which is somehow significant indicating that the cost of land preparation should be reduced as it has positive impact on sugarcane revenue and returns.

To reduce the cost accrued in land preparation caused by the immense number of man days needed at this stage; which in turns increased the farmers' revenues, further intense mechanization involving traffic of heavy machinery from planting to harvesting and transporting to the sugar factory can lead to deterioration of soil physical conditions. The effect will be soil compaction, reduced rainwater infiltration into the soil profile, poor soil aeration root growth and difficulty in absorption of nutrients from the soil itself and from the fertilizer. Through land preparation prior to planting new crop is essential to bring the soil to fine tilth for proper germination of the sets and suitable soil condition for root development. The findings in this study are agrees with the results of Reza et al., (2016) in their study of productivity and profitability of sugarcane production in Northern Bangladesh.

The results from the OLS model is presented in table 1. The cost of planting influenced the sugarcane production in Rwanda at 5% level of significance. There is a positive relationship between the cost of planting and the expected sugarcane yield, as one unit increase in cost of planting materials, the expected sugarcane increases by 5.1 percent. This is an implication that the farmers are adopting the improved new cultivars to boost sugarcane production with high yield as in Ong'ala et al., (2013). This was in their study of an economic selection index that combines cane yield and sugar content in identifying superior sugarcane clones in Kenya.

Results from the OLS model presented in table 1 shows that the cost of fertilizers influenced the sugarcane production in Rwanda at 10% level of significance. There is a positive relationship between cost of fertilizers and expected yield of sugarcane from small holder growers. Normally, fertilizer application is important for obtaining optimum yield of sugarcane. As mentioned earlier, the use of chemical fertilizer is unbalanced and inadequate. Most of the growers use only nitrogenous fertilizers while others use an unbalanced combination of N and P. The use of K is almost negligible in cane crop. It is very important to use proper doses of balanced fertilizers to obtain the maximum yield of cane crop. The results are in agreement with the research findings conducted by Hussain and Khattak (2008) where they found that there is a significance difference in crop yield when chemical fertilizer is applied at appropriate time and using the correct application rate.

Results on transportation (table 1) shows that the cost of transportation was statistically significant. There is negative relationship between cost of transport and sugarcane production. For one unit increase in the cost of transport, the expected sugarcane yield decreased by 1.5percent of the total yield. This indicated negative impact in planning for the next farming season. It is an implication that as long as the transportation cost increases, there would be an increase in transactional cost and reduces the farmer's revenue at the end of the season. This will have an impact to the farmer in planning for the next farming season economically. This finding is similar to the findings of Morris et al., (2017) in their study of impact of falling sugar prices on crop

growth and rural livelihoods. They found that the impact on farmers' livelihoods of falling sugar export prices will depend on their ability to either increase productivity or reduce costs, or both.

Results on cost of operations (table 1) showed that cooperative functioning fees was statistically significant. The financial cost factor influenced the sugarcane production in Rwanda at 5% level of significance. There is negative relationship between cost of transport and sugarcane production. For one unit increase in the cooperative functioning fees paid, the expected sugarcane yield decreased by 1.7percent of the total yield. A cooperative is an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise. It is the cooperation of farmers that can be used to bargain power of farmers in which government use to channel the inputs at low cost and subsidized credits. At the cooperative level, farmers can access credits from financial institutions as they are assured that they can pay back loans. This would result in poverty reduction, access to finance and use of better quality inputs increased production. ad It will also lead to major improvement in post-harvest handling of produce such as drying and storage. The study results agree with findings by Mohammadi et al., (2012). In their study of the role of agricultural cooperatives in improving farmers' technical knowledge: a case study on sugar beet growers in Fars Province, Iran. Thus the study findings reject the null hypothesis and accept the alternate research hypothesis that economic factors affect sugarcane production significantly differently

Table 1: Social Economic Factors affecting sugar cane production along river Nyabarongo

Sugar cane production	Coef.	Std. Err.	T	P>|t|
Economic factors				
Land preparation	-0.6216	0.3990	-1.56	0.123*
Drainage	0.0173	0.0797	0.22	0.828
Seed and seed bed preparation	-0.0611	0.0995	-0.61	0.541
Planting	0.5095	0.1738	2.93	0.004**
Fertilizers	0.0981	0.1208	0.81	0.119*
Intercropping activities	0.0863	0.2355	0.37	0.715
Pesticides	0.0204	0.0994	0.21	0.838
Weeding	0.3917	0.5403	0.72	0.471
Harvesting	-0.0184	0.0409	-0.45	0.654
Transport	-0.1516	0.1289	-1.18	0.143*
Cooperative normal share	-0.0604	0.1520	-0.4	0.692
Cooperative functioning fees	-0.1765	0.0692	-2.55	0.012**
Land size	0.0072	0.0110	0.65	0.514
On farm income	0.0120	0.0301	0.4	0.691
Off farm income	0.0157	0.0132	1.19	0.234
_cons	0.9782	0.4084	2.4	0.019

Sample Size = 202; Wald Test= 16.8453 | P-Value > Chi2(12) = 0.1555; F-Test = 1.4038 | P-Value > F(12 , 85) = 0.1802; (Buse 1973) R^2 = 0.1654 | Raw Moments R^2 = 0.8978; (Buse 1973) R^2 Adj = 0.0476 | Raw Moments R^2 Adj = 0.8834; Root MSE (Sigma) = 0.3216 | Log Likelihood Function = -20.8932

- R2h= 0.1654 R2h Adj= 0.0476 F-Test = 1.40 P-Value > F(12 , 85) 0.1802

- R2v= 0.1654 R2v Adj= 0.0476 F-Test = 1.40 P-Value > F(12 , 85) 0.1802

Note: *** @ 1%; ** @ 5% and * @ 10% level of significant

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