Effect of social-economic factors on profitability of soya bean in Rwanda

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Abstract - The economic benefits from the soya bean production help scaling up the livelihood standard status of the common people. However, the economic benefits derived from soya bean production remains low. This study intends to identify the effect of socio-economic factors that influence the profitability among small hold soya bean producers/farmers. The data was carried out in Kayonza district in the eastern part of Rwanda, it was collected through intensive survey of randomly selected 137 sample respondents using pre-tested interview schedule. To examine the profitability of soya bean production, the gross margin and cost benefit analysis was carried out. Multiple regressions were used to find out the effect of social-economic factors on profitability of soya bean production. The OLS (ordinary least square/multiple linear regressions) estimation results revealed that proportions of area cultivated in 2017A&B for soybean production, education levels, farming experience and marital status were statistically significant to influence the profitability of soybean production in the study area. Cost-Benefit Analysis estimates and totals up the equivalent money value of the benefits and costs to the community of projects to establish whether they are worthwhile, the mean average total cost investment was 40,995 Frws, average mean for gross farm revenues was 103,831Frws and the average mean of net farm income was 62,836Frws and cost benefits ratio was varied from 1.93 to 3.23 which indicated that soybean is profitable for small holder farmers. Therefore, study recommends that policy makers and implementers in Rwanda in order to increase profitability of soya bean should first base on existing strengths of farmers such as their experience, farm size, promote current polices of adult education and land tenure systems that would link farmers to financial institutions.

Key words: Profitability, small scale producers, cost benefit analysis, multiple regression, Kayonza district, Rwanda

1. INNTRODUCTION

Soybean was first introduced in Rwanda in the 1920s by INEAC (Institute National pour l'Etude Agronomique du Congo Belge). Variety adaptation trials followed in the subsequent years and farmers started showing reasonable interest in the 1960s. By 1969 there were 550 hectares under production, rising to 1,640 ha in 1973. By 1977 Rwanda's soybean acreages had jumped to 6,000 hectares, largely stimulated by the installation of a new soybean oil mill.

Rwanda imports 30,000MT of cooking oil annually- one of the main soya products, at a cost of USD 42 million. Mount Meru SOYCO Ltd alone requires a supply of 45,000 MT of soybean annually for edible oil and soy cake production, which is more than the annual production, estimated at 35,000 MT. African Improved Foods (AIF), which is a new investor company that mainly produces infant fortified foodstuffs, is expecting to consume about 17,000 MT per year. This puts soybean grains demand for the two companies at 62,000 MT/year, almost doubling the total national annual production. There is a limited number of studies done on soybean in Rwanda, the most important being studies by Mugabo et al., 2014; and Mujawamariya et al., 2014. Scanty literature is also obtained from several project reports. Currently the main constraints to soybean production in Rwanda include poor germ plasm leading to lack of improved varieties suitable for the country, poor soil fertility, climatic variability, pests and diseases, poor farmers' accessibility to quality seeds, and limited skills of best agronomic practices. Investment into soybean value chain can transform and enhance profitability and incomes of smallholders due to the existing competitive and insatiable local as well as regional market demand for soybeans. Soybean is mostly grown for home consumption and income. However, production objectives differ depending on farmer and location. For example, Bugesera district mainly produced soybean for home consumption whereas in Kamonyi, most farmers produce soybean for food and income (Mujawamariya, et al. 2012).It is important to note that Kamonyi district has a processing plant for soybean (COC) Soybean remains a minor crop compared to others in the crop production systems of farmers in Rwanda (Mujawamariya, 2012).

According to USAID (2009), area under production in 2008 was estimated at 27,000 ha. However, the RDB (2015) indicates that as of 2010, the estimated area under production was 42,160 ha. The same study indicates that annual soybean production had reached about 57,089 MT (Mujawamariya, 2012) ,show that soybean productivity is between 0.48-0.73 MT/ ha. Real average annual soybean output was estimated at 43.8 kg for an average soybean plot size of 0.06 hectare (Zhao et al., 2014). The studies conclude that farmer productivity is low and there is need for strategic intervention. Despite all the efforts made by the Rwandan Government to boast soya bean production, the efforts have not been fairly reflected in the productivity of farmers, which remain at downtown of return to scale. As shown in the table above of according to FAO STATT there is a decline in value of revenues obtained from soya bean production from 23,703 FRWS in 2006 to 21,942 FRWS in 2016 (FAO STAT, 2016).

This could be as a result of many constraints faced by farmers

and thus, making it very difficult for small holder farmers to get returns from their investments. Thus the food security situation in Rwanda is worsening due to declining agricultural productivity particularly in medium altitude and semi-arid areas which are more prone to drought. The effect of socio-economic factors on profitability of soya bean production by smallholder farmers in Eastern Rwanda especially Kayonza District have not been studied nor documented. Most research studies in Rwanda have concentrated on production of other crops more importantly export crops but little attention has been given to soya bean production and marketing. Thus this has necessitated the assessment of the effect of social-economic factors on profitability of soya bean production in order to inform the development of appropriate policy interventions for improved soya bean production and marketing.

Table 1: Revenues obtained from soya bean production

Year	Value (Rwfs)
2016	21,942
2015	21,739
2014	17,901
2013	24,838
2012	18,544
2011	37,426
2010	57,089
2009	54,000
2008	50,931
2007	39,819
2006	27,138
2005	23,703

FAO STAT, (2016)

2. EMPIRICAL STUDY

In a study of factors influencing adoption of protected soya bean farming practices, Ndegwa (2016),used multiple regression analysis to examine socio-economic characteristics of the farmers. The study established that family size, farming experience and level of education influenced adoption of protected tomato farming practices.

Masuku and Xaba (2013), also used multiple regression analysis in a study in Swaziland to determine factors affecting the productivity and profitability of vegetables production.

The study found that productivity of vegetable farmers was significantly and positively related to selling price and gender and using multiple regression analysis in a study done in Nigeria to estimate the socio-economic determinants of commercialization among smallholder farmers.

The study established that household size, income, farming experience, farm size, distance to market and membership in associations significantly influenced commercialization among the smallholder farmers (SHEWAYE, 2015).

3. METHODOLOGY

Study Area

Kayonza District is one of the seven Districts making the Eastern Province. Kayonza district is divided into 12 sectors (imirenge): Gahini, Kabare, Kabarondo, Mukarange, Murama,Murundi, Mwiri, Ndego, Nyamirama, Rukara, Ruramira and Rwinkwavu. The population of Kayonza district is 332,000; about 55% are aged 19 years or younger. People aged 65 years and above make up 3% of the population. About 52% of the population is female individuals and the majority of the population is young, with about 83% still under 40 years of age.

Research design

This section describes the nature of the pattern the research intends to follow. A research design is the overall plan or strategy for conducting the research. There are two main research strategies: qualitative and quantitative (Onen & Oso: 2012). This study used a cross section survey design. It will employ both descriptive survey and econometric analysis.

Sampling techniques

The cluster and systematic sampling was used to know the number of respondents to interview in each cluster. This method is most frequently used in the field. The objective of this method is to choose a limited number of smaller geographic areas in which simple or systematic random sampling will be conducted. It is therefore a multi-stage sampling method very often completed in 2 stages.

First stage is the random selection of clusters. The entire population of interest is divided into small distinct geographic areas. At this stage, the primary sampling unit is the village (Zone. Second stage is a random selection of households with in clusters.

Households was chosen randomly within each cluster using simple or systematic random sampling. Each respondent to this study area is selected according to their role in the management of soya bean production.

Data collection Instruments

The instruments used in research was mainly questionnaires, interviews and own observation.

Kothari (2004) defines a questionnaire as that consisting of a number of questions printed or typed in a definite order on a form or set of forms. The researcher constructed close-ended and open-ended questions, which was administered to the

farmers of maize crop within Gatsibo district. A questionnaire contained social economic, marketing characteristics and production costs of farmers designed for the purpose of gathering information from respondents.

Data analysis

In this study multiple regression analysis was used to determine the socio-economic factors influencing smallholder soya bean production and soya bean marketing by traders. Multiple regression analysis is useful in determining the effect of independent variables on the dependent variable while allowing explicit control for many other unobserved factors. The regression analysis was used to estimate the effect of **social-economic** factors influencing soya bean profitability. Regression model used in this study is specified as follows:

Y = f(X1, X2, X3, X4, X5 ...Xn)..... (1)

Where:

Y = Profit

X's are different inputs that take part in the production of Y

LnY= β0+ β1Ln X1+ β2 ln X2+ β3 Ln X3+ β4 Ln X4+ β5 Ln X5+ β6 Ln X6+ β7 Ln X7+ β8 Ln X8+ ε.....(4)

Where:

Y = Profit

β0=Constant

β1-β8= Parameters to be estimated

X1 = land for soya bean (ha);

X2 = Cost of labor used for all activities in soya bean production (person days);

X3 = Cost of organic fertilizer applied in FRWS

X4= Revenues in FRWS

X5=Education level in term of years spent in School

X6= Yield

X7=Farming experience in term of years

X8=Price of soya bean per kg in terms of Rwf

Ln=Natural logarithm

ε= Error term

Application of Cost benefit analysis

The gross marginal analysis was used to determine the overall the gross margin and net return per hectare as well as to measure net returns analysis was used to determine the level of profitability of improved maize varieties. Okon and Enete (2009) used gross margin analysis to estimate the cost and return to urban vegetable production in Nigeria. Odoemenem (2011) used gross margin analysis to do economic analyses of rice in Cross River State Nigeria.

In this study gross margin was used to analyze the profitability of improved soya bean production by comparing gross margin and net returns of farmers who use local soya bean seeds and those used improved soya bean seeds in the study area. Profitability is measured with income and expenses. There was a significant difference between two varieties towards the farmer's profit. In short run business Gross margin equal to Profit.

Gross margin and net returns were estimated as two equations (1) and (2):

GM = TR –TVC ..... (1)

NR=NP = TR –TC ..... (2)

Where: TR = Total Revenue TR=Price x Quantity

TVC = Total Variable Cost

TC= Total Fixed costs +Total Variable costs

TC = Total Cost

4. RESULTS AND DISCUSSION

The results of the study found that, if the producer allocates more land to soybean production, he could be expected to produce more and supply more amount of soybean to the market. There is a positive relationship between the land allocated for soybean production and profitability and thus the coefficient of land allocated for soy bean production are almost absolutely equally in magnitude. The increase in land allocated for soybean production by one unit area, the expected profit increased by 10.35 percent and/ or 10.76 to its profit in season 2017A and 2017B respectively. The results of the study are supported by the empirical study conducted by Tadesse (2011) in Daro Lebu district of Oromia region, using tobit model found the major factors that affects vegetables supplied to the market were irrigation access, farmers experience in vegetables production and total cultivated land.

The results from ordinary least square estimation presented in table 2 revealed that education of soybean producers was statistically significant to influence the profitability of soybean production in the study area at 5% level of significance. This meant that the higher the level of education, the more the profit. This has to do with understanding of smallholder new farming techniques and proper post harvest management operations as a business more than uneducated farmers. This assumption results in proper management of crop management and inputs usage, thereby improving soy bean yield and profits.

A unit increase in level of education leads to an increase in profit by 0.5 percent for small holder soybean producers in the study area and these findings are coherent with the study findings of Mumba et al. (2012) in their study of econometric analysis of the socio-economic factors affecting the profitability of smallholder dairy farming in Zambia.

The results from table 2 indicated that farming experience in soybean production was statistically significant at 5% level of

significance influencing the profitability of soybean production. Farmers' experience increases the skills and knowledge in adopting new technological package in crop production. Experienced farmers are better in growing modern varieties, with better access to input markets compared to farmers with lesser experience. The findings in this study are in line with the results of Kasso and Bekele (2016) on study of vegetables market chain analysis in Amhara region of Fogera district found that farming experience are key determinants of vegetables marketed surplus (Adenuga et al., 2013; Panda & Sreekumar, 2012).

The results from the ordinary least square presented in table 2, showed that the marital status of the soybean producers influence statistically significant the profitability of soybean production.

In Rwandan now days, the married farmers are more likely to assess the banks services like access to credits than the single families considered as unstable societies. The findings further showed that there is negative relationship between marital status and soy bean profitability production ($P<0.05$) as shown in table 2.These estimates are nearly identical to those in the selection equations estimated in the treatment-effect models and our findings are supported by the study results of (Theuri, 2012).

Table 2: Social-economic characteristics influencing profitability of soya bean

Income from soybean	Coef.	Std. Err.	T	P>|t|
Total area	0.013	0.028	0.45	0.650
Area cultivated 2017A	1.035	0.414	2.5	0.014*
Area cultivated 2017B	-1.076	0.421	-2.56	0.012*
Education levels	0.005	0.004	-1.14	0.048*
Farming experience	0.004	0.001	3.25	0.002*
Revenues from soybean production 2017A	0.000	0.000	0.07	0.945
Revenues from soybean production 2017B	0.000	0.000	0.75	0.453
Gender	-0.031	0.026	-1.19	0.237
Age	0.001	0.001	0.88	0.379
Marital status	-0.153	0.038	-4.02	0.000*
Household members	0.003	0.005	0.48	0.632
Total production cost 2017A	0.000	0.000	0.940	0.351
Total production cost 2017B	0.000	0.000	0.270	0.785
_cons	0.948	0.071	13.44	0.000
Sample Size = 121; Wald Test = 56.8772 P-Value > Chi2(13) = 0.0000; F-Test = 4.3752 P-Value > F(13 , 107) = 0.0000; (Buse 1973) R2 = 0.3471 Raw Moments R2 = 0.9838; (Buse 1973) R2 Adj =0.2677 Raw Moments R2 Adj = 0.9818 and Root MSE (Sigma) = 0.1336 Log Likelihood Function = 79.2971				

Profitability by smallholder soybean farmers in kayonza district

Table 3 detailed the farm gross margin from the investment in soybean production. Results showed that the average Gross farm income per hectare was 84,313.15Frws/ha and 123,349Frws/ha and the corresponding net farm income was ranged from 40,527 Frws to 123,349 for both farming season of 2017A and 2017B respectively.

The higher gross farm income is a result of joint action of soybean cooperatives using their collection centres and the management of the buyer mainly which help them to control local traders and commission agents used to buy their produce at lower/ disadvantaging price. These findings conflict with the findings of (Gaspar, Mitchell, & Conley, 2015).

Table 3: Cost benefits analysis smallholder soya bean farmers

		2017A			2017B		
Variables	Unit	Obs	Mean	std. Dev.	Obs	Mean	std. Dev.
Area	Ha	136	0.36	0.27	136	0.36	0.27
Yield	Kg/ Ha	137	219.15	279.31	137	222.39	309.46
Price	Frws	136	412.50	24.54	136	520.82	90.53
Fixed cost							
Land Hiring	Frws	6	7,500.00	9,874.21	7	7,571.43	9,015.86
S/B Total	Frws		7,500.00			7,571.43	
Operational costs							
Cost of seeds	Frws	50	5,840.20	8,743.65	50	5,456.20	9,160.55
Cost of inorganic fertilizers	Frws	123	6,069.35	4,721.52	123	6,210.81	4,841.95
Cost of pesticides	Frws	10	2,720.00	3,098.67	9	3,355.56	4,500.86
Cost of Labor	Frws	135	19,977.78	12,911.56	135	14,145.93	9,542.89
Cost of transportation	Frws	119	1,679.16	3,442.81	117	1,464.19	2,352.04
S/B Total	Frws		36,286.49			30,632.69	
Total Cost investment	Frws	136	43,786.49	21,471.00	136	38,204.12	17,874.40
Revenues	Frws	130	84,313.15	100,149.40	130	123,348.90	220,947.40
Net Farm Income	Frws		40,526.66			85,144.784	
CBR			**1.93**			**3.23**	

5. RECOMMENDATIONS

It was concluded that area under soya bean production farm size positively influenced profitability. Therefore study recommends that policy makers and implementers in Rwanda in order to increase profitability of soya bean should first base on existing strengths of farmers.

Policy makers and implementers in Rwanda need to promote current polices of land tenure systems that would link farmers to financial institutions.

In order to increase the profitability of soya bean, there is need to promote adult education through trainings.

This study focused only focused on social economic factors, given the limited scope of the study, this research suggests that further research should be undertaken on the effect of transaction cost factors and market factors on profitability of soya bean farming using transaction cost analysis.

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