

*Factors Influencing Profitability of Small-Scale Tomato (*Lycopersicon Esculentum*) Production in Mvomero District, Tanzania*

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Abstract -This study carried out in Mvomero district, Tanzania. It aimed at analysing factors that influence the profitability of tomato production among smallholder farmers. The study involved a total of 220 farmers. The cross-sectional research design adopted whereby household survey and documentary review methods were used in collecting data. The collected were analyzed using SPSS software. Demographic characteristics of farmers analysed through descriptive statistics while multiple linear regression used to analyze factors influencing the profitability of tomato production. The study revealed that 86.4% of farmers are males and 80.0% of them married while 15.9% are singles. About 96% of farmers have only attained primary school education level. Also, results from gross margin analysis revealed that tomato farmers earned a gross margin of Tanzanian Shillings (TZS) 1,781,331 per acre, implying that tomato production is profitable in Mvomero District. In addition, findings from a multiple regression analysis revealed that explanatory variables such as farm size, farming experience, access to market information in form of inputs and output prices and absence of farmers' groups significantly ($p < .05$) influenced tomato profitability. Therefore, the study concluded that tomato production is reasonably profitable and farming experience, absence of farmers' groups, farm size and access to the market information are among the predictors which significantly influencing tomato profitability in study area. Furthermore, the study recommended that in order to increase profitability among farmers, training of farmers through seminars, workshops, and strengthening extension services and demonstration farm plots is fundamental. Also farmers should be encouraged to form groups/organization in order to facilitate smooth marketing of their products.

Keyword - Determinants, Gross Margin, Profitability, Smallholder farmers, Tomato.

I. INTRODUCTION

Tomato, scientifically called *Lycopersicon esculentum* is famous due to its nutritional value and economic value. Tomato is one of the most popular and widely grown plants in the world [1]. Additionally, it is the second most important vegetable worldwide, in terms of the number of vitamins and minerals it contributes to the diet [2].

Overall, the annual global production of fresh tomatoes amounts to nearly 177 million tonnes. In contrast, three

times more potatoes and six times more paddy grown around the world [3]. However, about a quarter of those 177 million tonnes produced for the processing industry, which makes tomatoes the globe's leading vegetable for processing. According to Tomato news (2017) [4] approximately 40 million tonnes of tomatoes processed every year in factories belonging to the greatest labels of the global food industry.

The nutritive and economic values of tomato have made the crop develop into the world agenda in the international horticultural meetings [5], [6]. In many parts of the world tomato farming, acknowledged as a profitable, less risky, relatively short production cycles and labor-intensive cash crop compared with many other field crops [7].

Moreover, tomato production is higher than any other fruit and vegetable crop in Tanzania with a total production of 962684 tonnes, which represents 57.9 percent of the total vegetable production [8]. This is followed by cabbage with 457151 tonnes (27.5 %) and onions with 150249 tonnes (9.1 %). The production of other fruit and vegetable crops is relatively small. Furthermore, Morogoro region has the largest planted area of tomatoes (19,195 ha) which comprised 37.9 % of total area planted in Tanzania [9].

Tomato, both for processing and the fresh market has become one of the most paramount crops in agriculture for smallholder farmers [10]. In Tanzania tomato grown commercially wherever agronomic conditions permit. Consequently, the tomato is an important source of income for rural, urban and peri-urban farmers, provides employment, and supply nutrients for millions of Tanzanian people. This is supported by Koenig et al. (2008) [11]. They reported that tomato enterprises offer great potential to create employment opportunities and increase incomes of actors involved in the tomato value chain through commercialization in Kenya and Tanzania [11].

Tomato is widely accepted and commonly used in a variety of dishes as raw, cooked or processed products more than any other vegetable [12]. Tomato fruit provides 3 - 4% total sugar, 15 - 30mg/100g ascorbic acid; 7.5 - 10 mg/100ml titratable acidity and 20 - 50mg/100g fruit weight of lycopene - antioxidants for cancer prevention especially those of the prostate gland, lungs and stomach [12]. However, unlike cereals, the marketing of horticultural crops, in general; and vegetables and fruits in particular, is more complex and risky because of the special characteristics such as highly perishable nature, seasonality and bulkiness; thus, needs special care [13]. As a result, the supply of vegetables is subjected to various problems including wide fluctuation in prices. Despite the fact that tomato production is a viable option to increase farm income and hence alleviate widespread poverty, considerable attention has not been given to its marketing aspects; because of the imbalance in distribution system and lack of organized marketing system, there is always a market glut of tomato in main production season and scarcity of the commodity in other seasons [14]. On the

other hand, there is wastage of tomato annually as tomatoes harvested in the country are lost due to poor food supply chain management; price instability resulting from seasonal variation in production and the supply preference of farmers and middlemen for urban markets than direct users due to low farm gate prices. These factors and others can reduce profit accruable to marketers in the study area.

Moreover, the Tanzania's National Agriculture Policy of 2013 [15] revolves around the goals of developing an efficient, competitive and profitable agricultural industry that contributes to the improvement of the livelihoods of Tanzanians and attainment of broad-based economic growth and poverty alleviation. Cropping is the major livelihood activity in Mvomero District. Over 90% of farmers earn half or more of their cash income from this activity [16]. The available information confirms that for 52% of farmers, the cultivation of tomatoes is the most fundamental source of cash income from cropping [16]. Hence, this study aimed at assessing various factors that might be responsible for influencing tomato profitability among smallholder farmers in Mvomero district.

II. RESEARCH METHODOLOGY

2.1 Study Area

This study took place in Mvomero District. The district, located at the northeast of Morogoro region at 6°14' 8.2212' South and 38° 41' 37.4928'' East. The area was selected since tomato farming is extensively practiced by the majority of smallholder farmers. The district is endowed with good climatic condition which is favourable for most agricultural activities.

2.2 Research Design and Data Collection Methods

The study adopted a cross-sectional research design. This research design involves collecting data from different respondents at one point at a time. In addition, this design is cost-effective and takes little time while assuring the appropriate quality of data. A structured questionnaire used to collect data from the respondents involving in tomato production. The study also used a documentary review method to gather secondary data.

2.3 Sampling

Cochran (1977) [17] formula of the unknown population adopted to get a total of 220 farmers that participated in the current study. A simple random sampling used to select 220 households involving with tomato farming for the interview. In addition, purposive sampling used to select key informants. The key informants were useful in order to gain

more information about study topic since some farmers tends to give superficial information about some crucial aspects in relation to the study objectives.

2.4 Data Analysis

Collected data analyzed using Statistical Package for Social Science (SPSS) version 20. The descriptive statistics analyzed included frequencies and percentages. Multiple linear regression analysis used to analyze factors influencing the profitability of tomato production. The profitability from tomato estimated using the farm enterprise budget analysis. The farm enterprise budgets represent estimates of receipts (income), costs and profits associated with the production of agricultural products. Therefore, the formula used to calculate the Gross Margin (GM) is as shown below:

$$GM_i = \sum TR_i - \sum TVC_i$$

Where;

GM_i = Gross margin per acre of tomato

$\sum TR_i$ = Total revenue from sales from one acre of tomato

$\sum TVC_i$ = Total variable cost spent on one acre

Hence, gross margin per acre used as a proxy for profitability. The model used is expressed below:

$$Y_i = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \epsilon_i$$

Whereby:

Y_i = is the profitability of tomato farming, measured by gross margins per acre

a = Constant

X_1 = Sex of the of the farmer

X_2 = Education level of the farmer

X_3 = Farm size

X_4 = Farming experience

X_5 = Access to market information (prices of inputs and outputs)

X_6 = Absence of farmers' groups

β_1 to β_6 = Regression coefficient parameters to be estimated

ϵ_i = Error term

The independent variables were hypothesized to have a relationship with the dependent variable and their expected signs are presented in Table 1.

The effects of multicollinearity were tested using Variance Inflation Factor (VIF). Multicollinearity is a statistical phenomenon in which two or more predictor variables in a multiple regression model are highly correlated [18]. Multicollinearity is a problem if the VIF is greater than 10[19], [20]. The VIF test shows that all the variance inflation factors are smaller than 2, indicating that there is no serious multicollinearity problem, therefore, all variables were included in the model.

Table 1: Summary of Variables for Regression Analysis on Tomato Profitability

Variable	Description	Expected effect
Y_i = Tomato Profitability	Measured by gross margins per acre	
Sex (X_1)	Sex of the household head(Dummy: 1 = if male 0 = if otherwise)	+/-
Education (X_2)	The education level of household head(Years in school)	+/-
Farm size (X_3)	Farm size (acres)	+
Experience (X_4)	Farming experience (Years)	+
Market information (X_5)	Access to market information(Dummy: 1 = if yes 0 = if otherwise)	+
Absence of farmers' groups	Access to market information(Dummy: 1 = if yes 0 = if otherwise)	-

III. RESULTS AND DISCUSSION

3.1 Demographic Characteristics of the Respondents

Findings in Table 2 revealed that 51.8% of respondents aged between 35-60 years, followed by those aged between 18-34 years (39.5%), and few (8.5%) aged above 60 years. This implies that most of the farmers are in the economically productive age group with huge experience in tomato farming. According to Mandara (1998) [21], household members are considered economically productive from the age of 16 to 64 years. The age brackets below 16 years are children, a number of them may be attending school and others too young to participate in farming activities. Also, the age group above 64 years considered less economically active since the members are too old.

Additionally, the study depicted that a good number (86.4%) of farmers are males, while only 13.6% are females regardless of the fact that women are the key group of actors in nearly all farming activities. This is probably due to the nature of the study by targeting households' heads as respondents. With exception of the minority households which are female-headed, the majority are male-headed. Occasionally, females are supposed to answer on behalf of their husbands when they are not around. Sarris (2001) [22] reported that largely in African agricultural societies the families commonly headed by males.

On the marital status, the findings revealed that the majorities (80.0%) of respondents married and 15.9% of them were single. Furthermore, the findings revealed that divorced, widowed and separated respondents altogether composed of 4.1%. According to Defoer [23] (2003) most of the African crop producers live in families to facilitate the production of their farm crops. The members of the families are crucial in the provision of the workforce for farm activities.

On education level, findings showed that most (94%) respondents interviewed attained primary education and 6% accomplished secondary education. According to Haggblade (2002) [24] in African countries, the majorities of the crop growers have no or incredibly low education since they expend most of their time in producing crops. Only exceptionally few attended the primary level of education. Moreover, Defoer (2003) [23] revealed that the majority of Africans who depend on agricultural activities has the lowest level of education.

Table 2: Demographic Characteristics of the Respondents

Variable	Frequency	Percent
Age		
18-34	87	39.5
35-50	114	51.8
60+	19	8.5
Sex		
Male	190	86.4
Female	30	13.6
Marital status		
Married	176	80.0
Single	35	15.9
Divorced	3	1.4
Widowed	2	0.9
Separated	4	1.8
Education Level		
Primary	207	94
Secondary	13	6

3.2 Gross margin analysis for tomato production

The profitability of tomato production depends to a large extent on the kilograms produced per acre and price of tomato. The gross return computed by multiplying the yield per acre from the sampled farmers by the average price of tomato for the 2017 season. The average yield was 9182.9 kg per acre. Tomato price usually tends to vary considerably during the year. However, the average tomato price for the 2017 season was Tanzanian Shillings (TZS) 400 per kg of tomato, which used to determine gross return. The gross return was, therefore, TZS 3673160 (USD 1,543.3) per acre, while the total variable cost was TZS 1891829 (USD 794.9) per acre (Table 3).

Moreover, the gross margin represents the difference between the total returns (gross returns) and the total variable cost. Therefore, results from gross margin analysis revealed that tomato farmers earned a gross margin of TZS 1781331 (USD 748.5) per acre, implying that tomato production is profitable in Mvomero District. Conversely, gross returns and gross margin obtained from the current study are contrary to the findings of Romaza and Islam (2017) [25] in Bangladesh. They obtained USD 1243.9 and 560.9 as gross returns and Net returns, respectively. Probably high costs of labour and fertilizers as reported in

Bangladesh's study and the lower yield obtained (5,520 kg/acre) might be the sources of variations observed.

Table 3: Gross margin analysis per acre of tomato

Item	Quantity	Cost (TZS)	Total value (TZS)
Gross returns			
Average yield (kg/acre)	9182.9	400	3673160
Variable cost			
The hiring of plot	0.25 acre	4	100000
Seed buying		300,000	300000
Nursery preparation	1	30,000	30000
Main field clearing	Man day	4	30,000
Planting	Man day	4	10,000
Fertilizer application	2	75,000	150000
Irrigation			300000
Pesticides and disease control			400000
Weeding I, II, III	Man day	4	30,000*4*3
Harvesting	(Kg)	9182.9	10
Total variable cost			1891829
Gross Margin			1781331

3.3 Factors Influencing Tomato Profitability

In order to realize how various factors influencing tomato profitability, the study conducted a multiple linear regression analysis. Thus, gross margins per acre used as a proxy for profitability as it measures relative profitability. Table 4 Indicate the results of the regression analysis for the factors that contemplated to account for the variations in the tomato profitability.

In addition, the F-value was 128.8 with a p-value of 0.0001, indicating that independent variables included in the model collectively had a significant influence on profitability. Besides, adjusted R^2 was 0.744 meaning that about 74.4% variability of the dependent variable (tomato profitability) was due to the explanatory variables included in the model.

Results in Table 4 revealed that the explanatory variable farming experience had significant ($p < 0.05$) influence on tomato profitability. Also, the coefficient obtained suggests that an increase in the farming experience among farmers associated with an increase in tomato profitability by TZS 49520. The possible explanations for this are that as farmers become more experienced in production and marketing, their probability to participate in economic transactions will be greater, hence becoming more

profitable. Additionally, this finding is in line with that of Wairimu et al. (2015) [26] who suggested that farming experience significantly influenced the profitability of diversified cash crop farming among smallholder tea farmers in Gatanga District, Kenya.

The farm size was an important factor influencing tomato profitability, whereas results showed that farm size had significantly ($p < 0.05$) influenced tomato profitability. The coefficient for farm size was 289959.6 signifying that an increase in one acre under tomato production would result to increment in profitability amounting to TZS 289959.6. This implies that the amount of land cultivated under tomato production positively associated with profitability. Correspondingly, the more land put under production, the higher would be the profitability of the crop because of the possible economies of scale. These findings are in agreement with that of Bongiwe (2013) [27] who conducted a study on factors affecting the productivity and profitability of vegetable production in Swaziland which revealed that the land significantly influenced profitability.

Moreover, explanatory variable market information had significant ($p < 0.05$) influence on tomato profitability. As expected, the coefficient was 193938.0 suggesting that as access to market information increases among farmers, profitability will increase by TZS 193938.0. Market

information in this study included knowing the prices of both inputs and output. The results concur with Siziba *et al.* (2011) [28] who argued that access to market information reduces the risks of getting the loss. Moreover, this finding is consistent with that of Martey *et al.* (2012) [29] in Ghana who viewed that market information warranty producer's flow of insight on market requirements and opportunity sets that allow effectively plan on commercialization of smallholder agriculture.

The absence of farmers groups significantly ($p>0.05$) affected profitability of tomato farmers. The coefficient was negative indicating that farmers in the study area lose TZS 214979.9 per acre in terms of profit due to failure to form organizations or groups. It is anticipated that by forming groups, farmers could be in a better position while bargaining for a reasonable market price for their produce.

The education level of the farmer expected to have a positive sign and significantly influencing the farmer's profit because as a farmer becomes educated, his/her knowledge

on how best to strategise and adapt to better farming conditions will increase. However, results from this study revealed that education level was not statistically significant ($p>0.05$). The coefficient was 27359.99 suggesting that by increasing level of education, the profitability will increase by TZS 27360. This finding corresponds with that of Bongiwe (2013) [27] who found that with an additional year of education, vegetable profitability would tend to increase.

The study anticipated that due to differential access to productive resources and access to information, male-headed households would report higher profitability than a female-headed household. However, findings revealed that the sex of the household head was not significant ($p>0.05$) and negatively influencing profit among tomato farmers. This finding is inconsistent with that of Wairimu *et al.* (2015) [26]. They reported that the gender of the household head was positive and significantly affected profitability. Also, male-headed diversified farms make more profits from cash crops than their female-headed counterparts.

Table 4: Regression Analysis Results for the Factors Influencing Tomato Profitability

Variables	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-132937.329	177675.236		-.748	.455
Market information	193938.003	86837.252	.082	2.233	.027*
Education level	27359.988	59044.293	.016	.463	.644
Farming experience	49519.965	8014.383	.273	6.179	.000**
Farm size	289959.568	18073.783	.628	16.043	.000**
Sex of household	-6195.775	92493.699	-.002	-.067	.947
Absence of farmers' groups	-214979.919	83112.912	-.118	-2.587	.010*

$R = 0.866$, $R^2 = 0.751$, Adjusted $R^2 = 0.744$ $F = 128.762$ *Significant at $P < 0.05$ ** Significant at $p<0.001$

IV. CONCLUSION AND RECOMMENDATIONS

The findings from the study have revealed that tomato farming is male-dominated and that most of the farmers are in the economically productive age group with huge experience in tomato farming in the study area. However, the majority of farmers have a low education level; nevertheless, it can suffice in relation to tomato farming. Furthermore, the results revealed that tomato farming leads to substantial profit. This can be higher if adequate agronomic practices are put in place, coupled with the low fluctuation of market prices. In addition, the study concludes that factors such as farming experience, farm size and access

to market information significantly and positively influencing tomato profitability among farmers. While absence of farmers' groups' significantly but negatively influencing tomato profitability

The study recommends that farmers should be looking seriously for market information from multiple sources in order to boost their profitability from tomato farming. Moreover, training of farmers through seminars, workshops, and strengthening extension services and demonstration farm plots is also fundamental in order to increase tomato productivity which consequently, might lead to higher profit.

Also, local government authorities should persuade farmers to form groups/organizations which will assist them substantially in finding markets and bargain for a better market price. Furthermore, they will support farmers in seeking loans aimed at meeting the costs of inputs such as seeds and pesticides with affordable interest rates to smallholder farmers.

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