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FACTORS INFLUENCING THE PROFITABILITY OF PIG PRODUCTION IN ESWATINI

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ABSTRACT

The demand for pork is higher than the local production, hence the gap is filled by imports which indicate potential market opportunities that can be exploited by local pig producers. The objective of the study was to determine the profitability and factors influencing the profitability of pig production in Eswatini. A stratified sampling technique was used in selecting a random sample size of pig producers for the research. The study used primary data collected from 107 pig producers from the four regions of Eswatini. Data were analysed using descriptive statistics descriptive statistics such as percentages, frequency, gross margin model and multiple linear regression. The findings indicated that most farmers were females with an average age of 44.5 years, with 48.5% attaining high school education, and have less than 10 years pig farming experience. Most farmers kept the large white breed, fed their pigs concentrates, members of local pig farmer cooperatives, obtained extension services have market located within 40 kilometres. The results showed that pig producers earned an average gross margin of E 4.29, a rate of return on investment of 47% and a cost efficiency ratio of 69% per kilogram of pork. The factors influencing pig farmers' profitability were pig production experience, access to market information, access to extension services and target market. The study recommends that farmers

should familiarize themselves with the media and attend workshops in order to be aware of new developments in the pig industry. Government should try to subsidize the cost of production of pigs in order to increase the level of returns, and make the business more attractive to people.

Index words: Pig Farmers, Pig Production**,** Profitability, Cost Efficiency, Gross Margin

INTRODUCTION

Eswatini's agricultural sector is the second largest contributor to the economy after the manufacturing sector (International Trade Administration (ITA), 2019). Agriculture plays an important role in income generation particularly for the rural community; in provision of raw materials for the manufacturing industries and in the generation of export products for foreign exchange (Dlamini & Dube, 2014; Thompson, 2017). Livestock involves poultry, dairy, piggery, goats, sheep and beef production (World Bank, 2011; Thompson, 2013). Livestock plays an important role in Eswatini, both economically, culturally (Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), 2018; Dlamini & Huang, 2019) as well as serving as a source of food and income for most households, especially in the rural areas (World Food Programme (WFP), 2016).

Pig production in Eswatini is one of the developing industries which is not well established yet (Ngwenya, 2017). Commercialization of smallholder pig production in Eswatini was officially launched in 1990 (Swaziland National Agricultural Union (SNAU), 2014). Since then pig production has remained relatively low in Eswatini, failing to meet the domestic demand over the years (Taiwan International Cooperation and Development Fund (ICDF), 2015). In order to meet domestic market demand for pork, the country has heavily relied on imports (Ndwandwe & Weng, 2018).

Recent studies revealed challenges such as the inability of farmers to access high-value markets, unaffordable pig feed prices (Mavuso, 2017); the lack of storage facilities for pork products, distant markets, poor marketing structure (Maseko, 2000; Zwane, 2017) and lack of abattoirs (Masuku et al., 2011). Maseko (2000) and SNAU (2014) considered the poor marketing structure as a major factor impeding the development of the pig industry. The purpose of the study was to determine the profitability of pig production in Eswatini. The specific objectives were to describe the socio-economic characteristics of pig producers; to determine the costs and returns in pig production and identify the factors influencing the profitability of pig production in Eswatini.

Pig production in Eswatini is mainly carried out by smallholder farmers. Pigs serve as a source of food and are sold mostly in local markets as a means of earning income (MOA, 2012). Commercial pig producers use mainly the Large White, Duroc and Landrace crossbreeds in place of indigenous pigs (Ministry of Agriculture and Cooperatives (MOAC), 2004). Eswatini's pork industry has been stagnant over the recent years, failing to meet the domestic demand for pork (Masuku et al., 2011; Ndwandwe & Weng, 2018). Domestic production levels show stagnant growth: 816, 900, 856, 724, 967, 967, 1,115 and 1,482 tonnes between the years 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018, respectively (MOA, 2018). National accounts statistics have shown that the pig industry has had very little contribution over the years (Dludlu, 2014; SNAU, 2014).

Farmers produce pigs individually, while some affiliate to farmer's organisations. Co-operatives coordinate pig producers with regards to marketing, access to finance, procurement of inputs, and create improved linkages with other value chain actors such as input suppliers, retailers, butcheries and consumers. Co-operatives also facilitate bulk purchasing of inputs from suppliers so that members can share transportation costs and enjoy bargaining power (SNAU, 2014). The local marketing of pork has two channels; formal and informal. The informal market involves the direct sales of pigs to consumers at the farm gate. Farmers can sell their pigs either on cash basis or on both cash and credit basis (Masuku et al., 2011). In the formal market producers supply their pigs to abattoirs/butchers/wholesalers/retailers /processors (Mavuso, 2017). Eswatini Meat Industries operates the main abattoir and remains the only meat exporter in the country **(**Wane et al., 2019).

Age has been used as a measure of experience especially for operations that have been continuing over time (Birachi, 2006). Age is an important factor that influences the probability of adoption of new technologies because it is said to be a primary latent characteristic in adoption decisions. Ephraim (2003) described the insignificance of gender of the farmer suggesting that female controlled farms are more efficient even though gender is not an important factor in explaining efficiency. Education level is very useful in technology adoption for improved animal productivity. Education increases the efficiency of searching for and processing information (Birachi, 2006). It is believed to be important as it enlightens farmers on how best to strategise and to adapt to better marketing conditions (Wongnaa et al., 2014). Productivity and profitability

of pigs is connected to trained and skilled employees (Isberg, 2013). High level of experience makes certain information and search costs easier or cheaper for farmers (Pingali et al., 2005).

According to Essa et al. (2011), access to credit contributes positively to technically inefficiency. This implies that farmers who utilize credit are less efficient than those who do not. Access to credit generally improves efficiency by leveraging cash constraint to buy better quality inputs and services (Jabbar & Akter, 2008). Market information relates to timely and accurate prices, buyer contacts, distribution channels, buyer and producer trends, import regulations, competitor profiles, grade and standards specifications, postharvest handling advice and storage and transport recommendations (Adjognon, 2012). Information is essential for farmers, since it allows them to allocate resources in a way that reflects relative scarcity and meets market demand. Expensive, imperfect and asymmetric information generates problems for farmers such as increased risks associated with marketing, inefficient allocation of resources, higher transaction costs and poor decisions about marketing (Urquieta, 2009).

Access to market information gives farmers knowledge about prevailing prices in various markets (Urquieta, 2009). Limited access to market information is one of the marketing constraints in developing countries (World Bank, 2011). A majority of marketing systems in developing countries are characterised by transaction costs, poor access to appropriate and timely information and high transport costs **(**Arua, 2007). Poor market infrastructure may increase risks for all market participants or shift risks to participants who are less able to manage them. Transaction costs amongst other factors influence the choice of marketing outlets used by smallholder farmers (Siyaya, 2013).

Membership to a farmers' association is assumed to expose the farmer to a bunch of information about better production technologies and market opportunities, enabling farmers to link to buyers at lower cost and thereby lowering the fixed transaction costs of market participation (Adjognon, 2012). Marketing channels for agricultural differ in efficiency thus farmers tend to choose the market channel that will increase their gross margins. Van Schalkwyk et al. (2012) asserts that smallholder farmers tend to prefer farm gate sales because they receive immediate payments and do not incur marketing costs such as transportation costs and tax payments. Profitability of a pig production unit increases with an increase in the number of live-born piglets per litter (Kyriazakis & Whittemore 2006). Breed is a very important factor affecting the reproductive performance of pigs. The pigs may be indigenous/local breeds, pure lines and cross breeds.

Exotic breeds are preferred mainly because of their rapid growth rate, easy feeding and high littering ability (Njuki et al., 2010).

Duniya et al. (2013) employed descriptive statistics, multiple regression model, t-test of significance and net farm income to analyse the profitability of swine farmers in Zangon Kataf and Jema Local Government areas of Kaduna State, Nigeria. The results showed that profitability of swine farmers was influenced by socio economic characteristics such as production experience, herd size, age and level of education. Sanders et al. (2012) studied the determinants of profitability in Niche swine production. Profitability was measured by the net margin. The multiple regression analysis showed that profitability across producers was explained by feed costs, labor efficiency, production efficiency, management experience, and the production of more specialized niche pork.

Obayelu et al. (2017) utilized the budgetary and ordinary least square regression model to examine the economics and determinants of pig production in Ogun State of Nigeria. The findings showed that experience, access to credit had positive and significant effect on the level of output and revenue generated by pig farmers. Nabikyu and Kugonza (2016) conducted a study to determine the drivers of profitability in pig farming in Wakiso district in Uganda. A multi linear regression model was used to measure the factors affecting profitability among the farmers. Results revealed that the profit per pig was influenced by family size, making and keeping of a farm budget, extension services, veterinary services and breed of pigs. Ngwenya (2017) used a multiple linear regression model to assess the determinants of commercialization among the smallholder pig farmers in the Manzini region of Swaziland. The study showed distance to market had no significant influence on the level of commercialization of smallholder pig farmers in the study area. Umeh et al. (2015) conducted a technical efficiency analysis of pig production in Nigeria. The study revealed that most of the farmers (60.0%) were in farmer association and derived huge benefits. The author recommended that pig farmers should affiliate to pig farmers' association around them so as to have access to relevant information about new technologies or practices.

METHODOLOGY

This study employed a descriptive and quantitative research design with a purpose of determining the profitability of pig production in Eswatini. The target population were 426 pig producers in Eswatini. The study adopted a stratified sampling technique. Farmers were stratified according to the four administrative regions of Eswatini, Hhohho, Manzini, Shiselweni and Lubombo. The study used 25% (Cooper and Schindler, 2013) of the total farmer population selected from each strata hence the total of 107 farmers. A structured questionnaire consisting of both open and closed-ended questions was administered to sampled pig farmers through the use of face to face personal interviews. The questionnaire was reviewed by experts in the Department of Agricultural Economics and Management to establish content and face validity. Questionnaires were further pretested using farmers who were not part of the sample and a final questionnaire was prepared using responses obtained from the farmers.

Data on socio-economic variables were analyzed using Statistical Package for Social Sciences (SPSS) to obtain descriptive statistics. The gross margin model was used to determine the profitability of pig farmers. The multiple linear regression model was used to analyse the determinants of profitability among pig producers. Gross margins were used to determine the relative profitability of pig farmers. Average gross margins per farm were computed as a difference between average revenue (per year) and average total variable costs (per year). Gross margins per kilogram of pork were obtained by calculating difference in average revenue per unit and average variable cost per unit. The Gross Margin model is presented in the following equation

$GM = TR - TVC$

Where: GM = Gross Margin per kg of pork (E/kg); TR = Total revenue from pork (E); TVC = Total variable cost incurred in pork production (E)

The cost efficiency ratio at farm level was calculated using the following formula

$$CER = \sum_{i}^{m} \frac{PxQx}{Py\ Qy}$$

Where: CER = Cost efficiency ratio; P_x = Price of inputs; Q_x = Quantity of variable inputs
Q_y = Quantity of output; P_y = Price of output

ROI allows the determination of net returns (profit) per amount of money invested in production and helps the farmer to form sound and economically viable decisions on the farm. ROI is a

profitability ratio suitable for measuring the efficiency of different enterprises. It was estimated using the equation below.

$$ROI = \frac{TR - TVC}{TVC}$$

Where: *ROI* = Returns per lilangeni invested; *TR*= Total revenue; *TVC*= Total variable costs

A multiple linear regression model was used to evaluate the determinants of the profitability of pig farmers. The model used for farmers' gross margins was expressed as:

$$Yi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + ei$$

Where: Yi = Gross margin in E/kg (derived as TR – TPC, where TR = Total Revenue (or returns) from sales, TPC = Total Production Cost); β_0 = the intercept of the regression equation ; β_1 to β_{12} = estimated coefficient of the explanatory variables; Xi = explanatory variables-X_1 = Age of farmer in years; X_2 = Gender of the farmer (Dummy, 1 = male, 0 = female); X_3 = Education level of the farmer (1=primary, 2= secondary 3=high school, 4 =tertiary); X_4 = Experience (Years in pig farming); X_5= Distance to market (Kilometres); X_6 = Access to credit (Dummy. 1=Yes, 0=No); X_7 = Access to market information (Dummy. 1=Yes, 0=No); X_8 = Type of feed given (1= concentrates, 2= formulated, 3= kitchen waste, 4 = other); X_9 = Access to extension services (Dummy. 1=Yes, 0 =No); X_{10} = Breed of the pig (1=landrace, 2= large white, 3=Berkshire, 4 =Duroc, 5=hempshire, 6 =indigenous); X_{11} = Group membership (Dummy. 1=Yes, 0 =No); X_{12} = Target (1= direct to consumer, 0 = intermediary); ei = disturbance term

RESULTS AND DISCUSSION

The findings shown in Table 2 indicate that a majority (58.9%) of respondents were females, while males accounted for 41.1%. This result agrees with Abiyong et al. (2019) study where a majority of pig farmers were females. The findings indicate that the respondents were aged between 20 and 85 years old, while the mean age for the sampled farmers was 44.5 years. This also conforms to Dorh et al. (2019) and Abiyong et al. (2019) study where a majority of the pig farmers were aged between 36 and 45 years with an average age of 44 years. This implies that a majority of the pig producers were in their youthful age and were strong enough to perform the laborious and productive activities. The findings also show that, about 45.8% respondents attained high school. However, only 35.5% of respondents have attained a tertiary education. This indicates that the literacy level of the respondents is high, where less than 5% of the respondents had primary education. This finding is in line with previous studies (Ogunniyi & Omoteso, 2011).

The findings further show that, respondents who had less than 10 years' pig farming experience formed 82.2% and 16.8% respondents ranged between 10 and 20 years of experience, while the mean value was 6.14 years of experience. This result is in line with the study by Obayelu et al. (2017) and Ibitoye et al. (2016). This implies that most of the respondents were experienced pig farmers. Most (60.7%) pig producers kept the large white breed, while 28% kept the landrace breed. Uddin and Osasogie (2016) also found that Nigerian farmers stocked more of large white breed in their farms. This is technically justified because large white breeds are highly prolific, disease resistant and are widely used for upgrading local breeds. Table 2 shows that most (93.5%) pig farmers fed their pigs concentrates. However, 6.5% used formulated feedstuff. This finding corroborates to Dorh et al. (2019) where 93% of the pig farmers used formulated feedstuff to feed their pigs.

Table 2: Characteristics of pig producers

Respondent characteristics	**No.**	**%**
Sex		
Male	44	41.1
Female	63	58.9
Total	107	100
Age		
Less than 25	4	3.7
25 -35 years	26	24.3
36 -45 years	29	27.1
46 - 55 years	24	22.4
Above 55 years	24	22.4
Total	107	100
Mean = 44 years (Std Dev. = 14.0)		
Education levels		
Primary school	4	3.7
Secondary school	16	15
High School	49	45.8
Tertiary	38	35.5
Total	107	100
Pig farming experience		
Less than 10 years	88	82.2
10 - 20 years	18	16.8
21 - 30 years	1	0.9
Total	107	100
Mean = 6 years (Std Dev. = 4.8)		
Breeds of pigs		
Landrace	30	28.0
Large White	65	60.7
Berkshire	2	1.9
Duroc	7	6.5
Hampshire	3	2.8
Total	107	100

Type of feed used		
Concentrate	100	93.5
Formulated	7	6.5
Total	107	100

Source: research data 2019

The results in Table 3 indicate that 93.5% of respondents obtained extension services from the government, while 6.5% indicated to have no access to extension services. Farmers need extension services in order to be aware of new developments in the swine industry. Extension services enable farmers to manage their pigs well, resulting into higher production rates; hence a higher proportion of the stock of pigs may be sold. About 83.2% of farmers are members of local pig farmer cooperatives while a majority (91.6%) of farmers has a market located within 40 kilometres.

Table 3: Pig production and marketing characteristics of pig producers

Respondent characteristics	**No.**	**%**
Access to credit		
Yes	77	72
No	30	28
Total	107	100
Access to extension services		
Yes	100	93.5
No	7	6.5
Total	107	100.0
Access to market information		
Yes	95	88.8
No	12	11.2
Total	107	100
Cooperative membership		
Yes	89	83.2
No	18	16.8
Total	107	100
Target market		
Individual consumer	29	27.1
Restaurant	28	26.2
Butchery	38	35.5
Wholesaler	6	5.6
Abattoir	6	5.6
Total	107	100
Market distance (km)		
0 -10	37	34.6
11 -20	29	27.1
21 – 30	19	17.8
31 -40	13	12.1
41 -50	7	6.5
+ 50	2	1.9
Total	107	100.0

Source: research data 2019

About 72 % of the farmers accessed credit from banks (25.2%), cooperatives (32.7%) and money lenders (9.3%). Only 28 % of the respondents were found to have not accessed credits. On the contrary Obayelu et al. (2017) found that 68.3 % of the respondents were not beneficiaries to any agricultural or production credit in Ogun State, Nigeria. Access to credit is regarded as one of the crucial elements in elevating agricultural productivity as it allows the purchase of raw materials and other enterprise inputs. About 88.8 % of pig farmers have access to market information. The main sources of information for the famers are farmers and friends (36.4%), the media (29%) and workshops (14%). The results further show that the target market for most pig farmers are the butcheries (35.5%), individual consumers (27.1%) and restaurants (26.2%).

Table 4: Gross margin analysis for pig producers (N=107)

Item	**Quantity (Kg)**	**Value (E)**
Revenue (per year)		
Sales of pork (@ E37.00/kg)	1217.40	45043.98
Sales of piglets (@ 43.00/kg)	91.40	3930.20
Average Total Revenue		48974.18
Average Variable Costs (per year)	Average cost (E)	% of ATVC
Labour costs	4278.97	12.68
Feed costs	22745.57	67.40
Transport costs	1816.16	5.38
Veterinary and vaccination	1234.52	3.66
Hygiene and disinfection	165.51	0.49
Water	1069.27	3.17
Breeding	108.29	0.32
Electricity	445.6	1.32
Labour for loading and unloading pigs	29.81	0.09
Slaughtering pigs	1038.03	3.08
Slicing	113.17	0.34
Communication	62.47	0.19
Miscellaneous costs	637.98	1.89
Average Total Cost	33745.35	
Average gross margin per farm	15228.75	
Average revenue per kilogram	38.19	
Average cost per kilogram	33.90	
Gross margin per kg	4.29	
Cost efficiency ratio	0.69	
Rate of return of investment	0.47	

Source: own data, 2019

The findings in Table 4 show that feed costs represent 67.40%, labour cost account for 12.68%, , while transport (5.38%) and vaccines represent 3.66% of the total cost of production. Water accounted for 3.17%. The average gross revenue was E48974.18 per farm. The average gross margin per respondent was E15228.75. The average gross margin per kg was E 4.29. The cost

efficiency ratio was 69%. The rate of return on investment in the study area was 47%. This means that for every E1.00 invested, E47 is gained in the piggery business.

Factors influencing pig producers' profitability

The resultant multiple regression analysis in Table 4 reveal that only four independent variables (experience, access to market information, access to extension services, target market) were found to affect the profitability of pig farmers. The R^2 value of the model was 0.362 and the adjusted R^2 value was 0.349 (Table 5). This indicates that about 35 percent of the variation in gross margin per pig was attributed to the hypothesised variables. Farmer experience was statistically significant at 5% level of probability and positively related to the gross margin.

Table 5: Factors influencing pig producers' profitability

Variables	**Coefficients**	**P-value**	**Std. Error**
(Constant)	8.939	0.00	31.085
Age (years)	-0.13	0.564	0.225
Sex (1=male, 0 = female)	-1.265	0.832	5.938
Education (1=primary, 2 = secondary, 3=high school, 4= tertiary)	1.957	0.587	3.587
Experience (years)	0.764	0.007***	0.643
Distance to market (kilometres)	0.191	0.326	0.193
Access to credits (1=yes, 0=no)	-8.251	0.191	6.26
Access to market information (1=yes, 0=no)	11.85	0.018**	8.935
Type of feed used (1=concentrates., 0=other)	-16.894	0.131	11.099
Access to extension services (1=yes, 0=no)	1.876	0.009***	12.263
Breed of pigs reared (1=exotic,0=indigenous)	-0.596	0.824	3.124
Member of a cooperative (1=yes, 0= no)	3.73	0.646	8.082
Target market (1= direct to consumer, 0=intermediary)	0.767	0.085*	6.401
R		0.602	
R Square		0.362	
Adjusted R Square		0.349	
(***), (**) and (*) Significant at 1%, 5% and 10% level			

The coefficient of experience (0.764) had positive influence on the farmer' revenue. This means that a unit increase in years of experience leads to an increase in the returns by E 0.764. This finding is in consonance with Duniya et al. (2013) where similar result was obtained in a study carried out on measurement of pig production profitability in Zangon Kataf and Jema'a Local Government Areas of Kaduna State, Nigeria. The coefficient for target market was significant at 10% level of probability and positively related to the gross margins. The coefficient was 0.767 indicating that, when the farmer switched from selling to intermediaries to selling directly to

consumers, the gross margins per kilogram increased by E 0.767. It was hypothesised that a farmer would choose the marketing channel that would increase his/her gross margins.

The findings show that information of pork markets was statistically significant and positive at 5% level of probability. Access to market information increased pig producers' gross margins by E 11.85. Market information dissemination is an important issue for producers to help them decide on marketing their products. The findings however are in contrary with Bahta and Baker (2015) who found that farmers who had less access to market information proved more efficient. The relationship between access to extension services and gross margins was found to be statistically significant at 1% level of probability and positively related to gross margin. This result is in consonance with Antwi and Seahlodi (2011) who found that access to quality extension service had a positive and significant effect on pig farmers' net incomes in the Gauteng Province of South Africa. This implies that those farmers who received veterinary from extension officers had higher chances of earning larger profit than other farmers who did not have extension services. According to the findings, pig producers who got veterinary services earned a gross margin of E 1.88 more income than those who do not get the service.

CONCLUSION AND RECOMMENDATIONS

The gross margins analysis for pig producers showed that feed costs represented 67.40%, labour cost account for 12.68%, while the cost of transport and vaccines represent 3.66% of the total cost of production. Water and transportation of pigs to the market accounted for 3.17% and 3.08% respectively. To reduce costs, farmers should form groups when buying inputs so that they get discount and free transport from the input suppliers. This might help minimize production costs such as those of feed, medication, slaughtering, slicing and transportation of pigs to the market. To reduce costs of water, farmers can use more storage containers such as tanks, earth dams than to rely on local water service providers. Farmers can also grow yellow maize because it constitutes the largest part of pig feed in order to produce formulated feed which could help reduce their costs. The average gross revenue was E48 974.18 per farmer per year. The average gross margin per respondent was E15 228.75. The average gross margin at farm level was E 4.29 per kilogram. The rate of return on investment in pig production was 47% and a cost efficiency of 69%.

The multiple linear regression analysis showed that farmers' experience was statistically significant at 5% level of probability and positively related to the gross margin. The coefficient for experience (0.764) had positive influence on the farmers' gross margins. The coefficient for

target market was significant at 10% level of probability and positively related to the gross margins. The findings show that information of pork markets was statistically significant and positive at 5% level of probability. The relationship between access to extension services and gross margins was found to be statistically significant at 10% level of probability and positively related to gross margin. It can be concluded that experience, access to market information, access to extension services, target market were the significant factors that affect profitability of pig producers. The null hypothesis that socio-economic and institutional factors have no influence on the profitability of pig farmers was rejected.

The government should set policies and strategies in order to enhance pig producers and small scale market agents participate fully in pork markets. This can be done through establishing new acts and guidelines in order to foster the pig industry. Government should try to subsidize the cost of production of pigs in order to increase the level of returns, and make the business more attractive to people. Government should also provide training for farmers to be able to access information about the pig industry. Policies that would guarantee adequate access to credit facilities by the pig farmers are strongly advocated. This will enable producers to effectively raise pigs and also expand the scale of production.

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