Full Length Research Paper

Factors Influencing Agribusiness Profitability: An Analysis of Smallholder Pig Farming in Kenya's Tharaka-Nithi County

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Aims: To increase the profitability of the pig subsector for farmers, particularly smallholder farmers, there have been concentrated efforts to commercialize it. Smallholder farmers have not consistently made money in the field, despite advancements. Profits for smallholder farmers have been inconsistent and disappointing. Since the impact of institutional arrangements from a transaction cost perspective and managerial factors contributing to this inconsistency have not been thoroughly determined, the reasons for the disparate profitability have not been experimentally established. The study looked at how management practices and institutional structures affected the profitability of smallholder pig farming in Kenya's Tharaka-Nithi County.

Research Methods: Eighty smallholder pig farmers were chosen using a two-stage sampling process. Data was analyzed using the stochastic frontier production function and descriptive statistics after semi-structured interview guides were used.

Findings: According to the study, the majority of male respondents (75%) were of working age, had six years of experience raising pigs, and had only a basic education. Findings from the stochastic frontier production, respondents' profit efficiency was negatively impacted by feed costs ($p<0.01$) and breed type ($p<0.05$), but positively by herd size ($p<0.05$) and veterinary and medication expenses ($p<0.01$). While information trust ($p<0.05$) and experience decreased inefficiency, gender ($p<0.1$) and the debt-to-asset ratio ($p<0.01$) increased it.

Conclusion: The research area's mean profit efficiency was 0.40, indicating low profit efficiency. By adopting current technologies, reducing transaction costs, and making better use of the resources already available, the efficiency level may be raised by 60%. Adopting effective management techniques and marketing avenues would result in this acquisition. The gamma parameter (γ) was 0.63, indicating that profit inefficiencies account for 63% of the variation in net revenue. The study advances the subject of agribusiness and would enhance Kenyan policies related to the growth of agribusiness.

Key words: Smallholder farmers; institutional arrangements; management factors; stochastic frontier analysis; profit inefficiency.

INTRODUCTION

The demand for animal protein has increased to an all-time high due to urbanization and population growth. The rate of food production in Kenya is already out of step with the rate of demand. Kenya generates an estimated 12,000 tons of pig meat for KES 1.2 billion, hence this has forced the country to import pork worth USD 700,000. The number of pigs killed in Kenya has risen from 360,000 to 388,200 during the past five years, an increase of almost 8% [1].

One of the main causes of food disparity is the inability to supply the population's diets with the necessary quantity of animal protein [2]. The livestock industry in Kenya accounts for 12% of the country's GDP and 50% of all jobs. Dairy products, milk, meat, eggs, wool, hides, and skins make up the majority of this industry. Over the past ten years, meat consumption has been rising quickly, and by 2025, it is predicted to reach 13.3

million tons [3]. The consumption of meat (beef, chicken, mutton, goat, pork, and camel) is predicted to continue rising from the present average of 19 kg per capita annually as most urban centers continue to expand [4]. Through pig rearing, pork could be a significant factor in successfully lowering the inadequate amount of animal protein in diets. Unfortunately, smallholder farmers in Kenya lack proper agricultural methods and are poorly organized, which results in low yields and ultimately very low profits. Additionally, SHFs are not business-oriented, which means they do not run their agricultural operation as a business [5].

In Kenya, the number of pigs killed has been continuously increasing over time. With a poverty rate of 65% in Tharaka-Nithi County, pig farming is crucial to smallholders' and households' risk diversification and livelihood security because they are a valuable asset that can be used to generate income for emergency cash needs, school fees, and the purchase of farm inputs [6]. When improved husbandry techniques and management abilities are used, the small-scale pig farming business has been shown to be highly profitable [2]. In order to promote genetic improvement and raise pig production in Kenya, careful breeding stock selection and well-run breeding programs are required [6,7]. However, a variety of productivity and market-related barriers, such as illnesses, inadequate nutrition, and disorganized marketplaces, result in smallholder pig farmers in Tharaka-Nithi County earning inconsistent and meager returns from their business. Pig output rises with effective institutional structures and managerial abilities, raising farmers' incomes and ultimately their profit margins. Only if the pig subsector is operated like a business will this be possible [8]. Since all of the major chain participants help one another to increase efficiency and competitiveness, the growth of the pig value chain is significant since it affects farmers' profitability [9]. The county's subsector is primarily unorganized, with a lack of technology, information, and services, as well as poorly managed markets. Additionally, pig herds are at danger of disease during outbreaks due to a lack of feed quality control methods, which results in stunted growth and lower market value. The absence of farmer groups in the pig industry also hinders the exchange of useful information in the produce market. Low-binding relationships between smallholder farmers and traders result in high transaction costs [10]. Therefore, smallholder farmers must set up effective institutional arrangements in order to reduce these high transaction costs.

A few studies have assessed how institutional structures and management characteristics affect the profitability of smallholder pig farmers. The majority looked at how institutional, social, cultural, technological, marketing, and farmer and farm conditions affected farm-level profit efficiency [11,12,13,14,15,16,17,18]. However, identifying the key elements that affect profit efficiency is a top research objective. This is because smallholder pig farmers' profit efficiency is influenced by more than just management characteristics and institutional structures.

Research is therefore required to determine which institutional arrangements and management aspects should be prioritized in order for smallholder pig farmers to be profitable. This study made an effort to close this knowledge gap as well.

METHODOLOGY

Study Region, Sampling Method, and Data Gathering Tools

The study was conducted in Kenya's Tharaka-Nithi County. A descriptive study design was employed. Smallholder pig producers in the research area were chosen using a two-stage sampling procedure. The Maara constituency was purposefully chosen for the first stage due to the area's high concentration of pig farmers and its favorable agro-ecological conditions for pig rearing. The second step was a stratification random sample of 16 smallholder pig farmers from each of the five wards, for a total of 80 farmers. The farmers were traced within the stratified areas using the snowballing method.

Farmers were interviewed in-person using semi-structured interview schedules to gather primary data, which were then analyzed using the stochastic frontier production function and descriptive statistics.

Empirical Model Specification

To analyze the data, the Stochastic Frontier Production Function (SFPF) was used. The Stochastic Frontier Approach was utilized to determine which factors contributed to profit inefficiencies. It takes into consideration both the inefficiency component and random error [19]. By assuming a profit function that behaves in a way consistent with the stochastic frontier notion, this study applies the [21] model in accordance with [20]. In accordance with the work of [22], the functional form of the stochastic profit frontier was ascertained by fitting it with the less restrictive translog and evaluating the sufficiency of the highly restrictive Cobb-Douglas.

Equation 3, which is essentially the input-output transformation and transaction costs model [23], is the stochastic profit model that is employed. Equation 4 represents the inefficiency model. The econometric model was typically defined to be:

$$Y_i = x_i\beta + e_i \quad \cdots\cdots \quad (1)$$

$$Y_i = \beta_0 + \sum_{i=1} \beta_i X_i + V_i - U_i \text{ (Cobb-Douglas function) (2)}$$

$$lnY_i = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4$$

$+\beta_5 \ln X_5 + \beta_6 \ln X_6 + V_i - U_i$ (Translog function) (3)

Where:

$\ln Y_1$ = Normalized profit (net revenue per kilogram of output sold); X_1= Feed cost (kg); X_2=Wage rate (include wage rate for both hired and family labor) (man-days); X_3 = Breed type; X_4= Herd size; X_5= Search costs and X_6= Drug/Veterinary costs (Kshs); B_0, β_1,,,β_5= Parameters to be estimated;

U_i = Degree of inefficiency which is half-normal distributed (iid N|) (0, σu^2). U_i is closely related to the profit inefficiency which may arise from management factors and institutional arrangements.

V_i = statistical disturbance term that is caused by factors outside the scope of the farmers which is assumed to be identically and normally distributed with a mean of zero (iid) and constant variance of $V \sim N$ ((o, $\sigma 2v$) and independent of U.

The coefficients of variables x1, x2, x3, x4, and x5 are estimated from the maximum probability of the profit function and are understood as the variables' elasticities. All of the coefficients have the proper sign. The link between the inputs used by the chosen smallholder pig farmers and their pig net revenue was ascertained using a stochastic frontier model.

The inefficiency model was used to examine the study's goal, and profit inefficiency (u) was the dependent variable, while the independent variables were the inefficiency factors.

The average county wage rate will be used in the study as a stand-in for the family workers' pay. The average salary is what the hired laborers in Tharaka-Niti County's pig farms make on average. This is calculated on the assumption that a worker would only be at the pig farm for two hours each day.

RESULTS AND DISCUSSION

Institutional Structures and Pig Management Techniques

The institutional setup and management procedures of the smallholder pig sample was on a modest scale, which could be a result of the farmer's financial circumstances.

According to the study, the majority of pig farmers used the semi-intensive management technique of penning (68%) and the intensive technique of stall-feeding (32%), which involved keeping the animals in a clean pigsty and providing them a balanced diet. In contrast to local consumers, who paid high prices with substantial search and contracting expenses, smallholder pig farmers in the study area sold their pigs to dealers directly 60% of the time, who provided exploitative prices. According to the study, 41% of smallholder pig farmers belonged to a farmer's group, whilst the majority (59%) did not. Participants in farmer groups gained from trainings that forced them to embrace new technologies and adhere to management techniques suggested by trainers and extension agents.

Pig Producers' Profit Efficiency in the Research Area

Table 2 displays the maximum likelihood estimates (MLE) of the parameters in the stochastic frontier model.

With the exception of labor and search costs, the majority of the inputs used were statistically significant at various levels, according to the production function results. With a coefficient of -0.255, the feed cost coefficient was correctly signed and statistically significant ($p < 0.01$), indicating that a 1% increase in feed prices would result in a 25% drop in the enterprise's net revenue level, which was consistent with the findings of [18]. Pigs' breed type coefficient was negative and statistically significant ($p<0.05$), with a coefficient of -0.100, meaning that a 10% decrease in net revenue would result from a 1% increase in the usage of subpar breeds. In line with the study of [27], the herd size was positive and statistically significant at the ($p<0.005$) level, with a coefficient of 0.080 despite being inelastic, meaning that a 1% increase in the number of pigs would result in an 8% increase in net revenue. Finally, the cost of medications and veterinary care was positive and statistically significant at $p < 0.01$. One of the main factors influencing the profit level of the pig firm in the research region seemed to be the coefficient, which was elastic in character. However, this suggested that a 1% increase in veterinary and medication costs would result in a 50% increase in the company's net revenue. This was consistent with the findings of [28], who discovered that a strengthened veterinary service system provided high-quality information about animal health and possible alternatives to antibiotic use, such as improved farm management, vaccines, and immunodulators.

Although there was a clear correlation, the cost of labor coefficient of 0.444 was not statistically significant, suggesting that it was not a significant factor in determining the profit efficiency of the pig firm in the research area. The net revenue level rose by 0.444 for every unit rise in labor costs. This was consistent with the results of [29], which showed that labor had an inverse relationship with mustard yield but was not statistically significant. The inelastic nature of the search cost coefficient, which was -0.052, suggested that it was not a significant factor in determining the profit efficiency of the pig firm in the research area. As a result, the net revenue level decreased by 0.052 for every unit rise in search expenses.

Factors Contributing to Pig Production's Profit Inefficiency

Gender was positive and significant at $p < 0.10$, according to Table 2's inefficiency model results. According to the study of [6], this suggests that profit inefficiency rises with gender, indicating that households led by women are more profit-efficient than those headed by men since they were more involved in farm activities. Lack of faith in market information was associated with a decrease in profit inefficiency, as evidenced by the negative and significant ($p<0.05$) trust in market information. Farmers had to pay more to find better clients and pricing due to information asymmetry, which resulted in transaction costs. These costs included personal time, travel expenses, and communication costs. The results of [30], who discovered that knowledge asymmetry causes opportunism and mistrust among the participants in the milk value chain, supported this. The results also aligned with the research of [9], which found that the more trust between company partners in the marketing channel, the better the circumstances for successful commercial operations. [31] found that the sources of knowledge in flood farming were reliable.

At $p<0.01$, the debt-to-asset ratio was statistically significant and positive. This suggested that when the debt-to-asset ratio increased, so did profit inefficiencies. The greater the ratio, the greater the liabilities of the farm business relative to the assets, which needed to be balanced. A high ratio rendered agricultural businesses insolvent and prevented them from obtaining additional credit [32]. [33] believed that dairy farms in the UK with a low debt-to-asset ratio were more productive.

Table 2 showed that the results of pig rearing experience were negative and significant at 5%. This implies that specialization evolved throughout time, resulting in better manufacturing techniques and increased profitability. This result was consistent with that of [34], who found that more agricultural production experience improves critical assessment of the applicability of superior production choices, such as the effective use of productive resources.

With a coefficient of 0.119, the age variable showed a positive indication but was not statistically significant. These outcomes aligned with the conclusions of [18]. They found that older farmers are less likely to embrace modern inputs and innovative methods. Additionally, since young farmers are more likely to have received some formal education, they may be better able to learn new techniques and gather information, which will increase technical and allocative efficiency and profit efficiency. Years of formal schooling are typically used to measure

There was no statistically significant correlation between schooling and either variable. This is in line with the research of [35], which found that farmers in the study area who had received formal schooling did not demonstrate greater levels of profit efficiency.

Distribution of Profit Efficiency

The calculated stochastic frontier model's individual profit efficiencies for the sampled pig farmers are shown in Table 3. The farmers' estimated profit efficiencies ranged from 0.094 to 1, which is a significant difference. The projections are left-skewed, with an estimated mean profit efficiency of 0.40.

According to the study, the production level was almost 60% below the border, with pig farmers in the study region producing at about 40% of the possible production level. A study by [32] found that this was a sign of product waste brought on by farmers' inefficient use of resources. The results also indicated that by using more variable inputs to increase production and making better use of the resources already available, profit efficiency in pig farming in the research area could be raised by 60%.

CONCLUSION

The purpose of the study was to evaluate the variables influencing the profitability of smallholder pig farmers in Kenya's Tharaka-Nithi County. The aforementioned study suggests that pig profit inefficiency is negatively impacted by household head experience and faith in market information. Also, the debt-to-asset ratio had a favorable impact on profit inefficiency on the farms in the research region. Pig farmers were not entirely profit-efficient, according to the study, but there is a lot of room for further profitability.

RECOMMENDATIONS

1. To achieve the required economies of scale, pig farmers should create groups like producer organizations or cooperative societies. This will lessen knowledge asymmetries and increase countervailing market power.
2. The study's conclusions lead to the following policy recommendations: sufficient pig production training (to introduce them to new developments) and fundamental financial management knowledge, such as the ideal debt-to-asset ratio and debt utilization.
3. In the research area, males predominate in pig production. Pig farming, however, should be the starting point for programs aimed at empowering women because it offers substantial financial access prospects. To improve their livelihoods and raise their income, women must also be encouraged to work in the pig industry.

To solve the fundamental issues smallholder pig farmers confront, the industry's major participants should develop a logical and comprehensive solution. To guarantee coordination and cooperation among various national institutions and agencies, both at the federal and municipal levels, as well as between private sector organizations, producer groups, and development partners, the government can collaborate with other stakeholders.

Suggestions for Further Research

Since the study concentrated on the variables that affect smallholder pig farms' profitability, it would be wise to conduct additional research on the use of smart farming in smallholder pig farming, since this could help to promote an integrative management strategy. Capturing the effects of smart solutions in smallholder pig farming could be taken into consideration when redesigning the study.

CONSENT

The author(s) have gathered and preserved the respondents' written consent in accordance with international or university standards.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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