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Factors influencing managerial challenges for smallholder and emerging sheep and goat farmers in the Thabo Mofutsanyana District, Free State Province, South Africa

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ABSTRACT

This study aimed to identify and analyse the determinants of managerial challenges for smallholder and emerging sheep and goat farmers in the study area by highlighting key factors in order to create an enabling environment for the farmers to improve production and income. A stratified random sampling technique was used to select 145 participants from a pull sampling frame of 251 participants. A semi-structured questionnaire was used to collect the data by interviewing 145 selected smallholder farmers. The Statistical Package for Social Science (SPSS), version 28.0, was used to analyse the data. Descriptive statistics and the probit regression model were used to analyse the determinants of the managerial challenges for smallholder and emerging sheep and goat farmers. The results of the study show that only 19% of the participants had business plans, and the absence of business plans impacted farm and livestock management negatively. The probit results indicated that the age of the respondents, off-farm activities, and access to market information had a positive and significant association with managerial challenges. It is recommended that youth and women be encouraged to engage in sheep and goat farming for better management and that farmers must focus their attention on livestock farming instead of off-farm income-generating activities. The Department of Agriculture and municipalities should initiate extension programs that focus on farm and livestock management as well as access to market information.

Contribution/Originality: This study employed the probit regression model to examine the determinants of managerial challenges for smallholder/emerging sheep and goat farmers; similar research has not been conducted in the study area. The study recommends the agricultural extension programme to focus on farm and livestock management as well as access to market information.

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1. INTRODUCTION

Agriculture remains the single largest source of income and livelihoods for rural households in the developing world, normally providing more than 50 percent of household income (Chilonda & Otte, 2006; Jayne et al., 2003).

Globally, agriculture provides livelihood for more people than any other industry, and since most of the world's poor live in rural areas and are largely dependent on agriculture, it plays a role in reducing the poverty in these rural areas (Molotsi, Oosting, Cloete, & Dzama, 2019). Despite the contribution of agriculture in the economy, the literature suggests that emerging and smallholder farmers still struggle with issues of production quality, market access, financial management, and managerial skills (Machete, 2020; Magingxa, Alemu, & van Schalkwyk, 2009; Marais, 2011; Stroebel, Swanepoel, & Pell, 2011). Smallholder and emerging farmers in developing countries play a key role in food security, but despite this, they face many challenges that hinder them from producing efficiently, forcing them to produce for household consumption and not for markets to earn ongoing revenue from their farming businesses. Smallholder farmers are key to ending hunger, but they increasingly face barriers to profitability because of the lack of access to value-adding markets and management skills to operate a large enterprise (Fan & Rue, 2020). Sheep and goats are important to the socio-economic wellbeing of people in developing countries in the tropics in terms of nutrition and income and provide both tangible benefits such as cash income from animal sales, meat for home consumption, manure, fiber, and skins and intangible benefits such as savings, insurance against emergencies, employment, and cultural and ceremonial purposes (Alemu, 2020; Dhaba, Belay, Solomon, & Taye, 2012). Lowder, Skoet, and Singh (2014) state that more than 80% (475 million) of the world's farms operate on less than two hectares of land. Although these farms account for only 12% of the world's farmland, they provide an estimated 80% of the food produced in Asia and sub-Saharan Africa. The rearing and sale of sheep and goat livestock are important for poverty reduction and food security in rural households. The livestock is managed not only for monetary benefits, but also for socio-economic benefits (including hide, manure, and a source of medium-term savings insurance in case of crop failure). It also a means diversifying investment and performing social and cultural functions such as religious traditional ceremonies (Weyori, Liebenehm, & Hermann, 2018). Ortmann and King (2007) effectively sum up the challenges smallholder farmers in South Africa face as being: (i) low levels of education and literacy; (ii) no access to technology; (iii) insecure land tenure; (iv) high transaction costs (such as no access to information and communication, as well as poor roads and long travel distances); (v) no access to credit and insurance; (vi) no access to inputs and services; (vii) no access to markets; and (viii) missing support systems, such as socially organised cooperatives and extension services. Other major constraints, such as poor nutrition, disease and parasite problems, poor flock management, poor credit, marketing, and transportation infrastructure, hinder the improvement of goat productivity (Escareño et al., 2012).

Poor education and high levels of illiteracy disadvantage smallholder and emerging farmers from meeting the market requirements. In the study area, smallholder and emerging sheep and goat livestock farmers faces similar challenges. Markets are often constrained by inadequate property rights and high transaction costs (Hall & Aliber, 2010), and it is not easy for small-scale farmers to access markets due to a range of factors such as poor infrastructure, lack of information, insufficient expertise, and inability to conclude contractual agreements (Cheteni, Mushunje, & Taruvinga, 2014; Cheteni & Shindika, 2017). Feeding, housing, and health challenges are among the challenges that constitute major constraints to the management of sheep and goats by smallholder and emerging farmers. Overcrowding in inadequate housing exposes livestock to diseases and promotes the spread of contagious diseases. Limited research focusing on the managerial challenges experienced by smallholder and emerging sheep and goat farmers has been conducted in the study area. Thus, to effectively assist the smallholder and emerging sheep and goat farmers to improve their livelihoods, food security, and profit, it is important to understand the determinants of managerial challenges and how they influence farmers' annual income from sheep and goat sales in the study area.

2. MATERIAL AND METHODS

2.1. Study Area

The study was conducted in the Thabo Mofutsanyana District of the Free State Province of South Africa (shown in Figure 1), which is one of the five districts of the province.

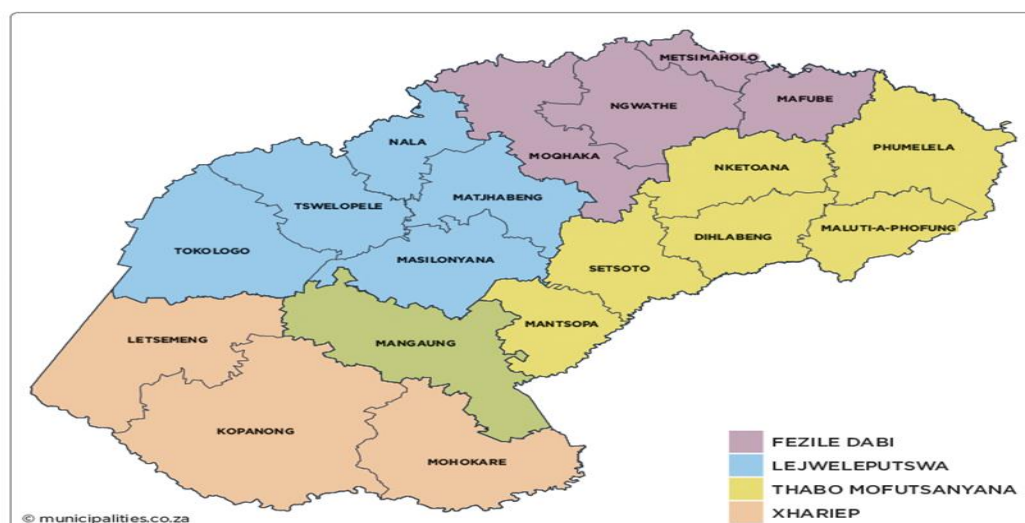


Figure 1. Map of the Free State Province, South Africa.

Source: www.municipalities.co.za (Accessed 22 August 2020).

The district was chosen because it differs in terms of agricultural potential and because smallholder and emerging farmers of sheep and goat livestock in the district face various challenges that exclude them from participating fairly in the high-value livestock market.

2.2. Sampling Procedure and Data Collection

A proportionate random sampling technique was used to select 145 smallholder and emerging sheep and goat farmers from a sampling frame of 251 smallholder and emerging sheep and goat farmers (see Table 1). An updated list of smallholder and emerging sheep and goat farmers was obtained from the Free State Department of Agriculture and Rural Development. Krejcie and Morgan (1970) formula to determine sample size was used as follows:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)} \quad (1)$$

Table 1. Sample sizes in the local municipalities.

Local municipality	Smallholder and emerging sheep and goat farmers	Sample per local municipality
Dihlabeng local municipality	21	$(21/251) \times 145 = 12$
Setsoto local municipality	6	$(6/251) \times 145 = 3.5$
Maluti-a-Phofung local municipality	183	$(183/251) \times 145 = 106$
Phumelela local municipality	23	$(23/251) \times 145 = 13$
Mantsopa local municipality	12	$(12/251) \times 145 = 7$
Nketoana local municipality	6	$(6/251) \times 145 = 3.5$
Total	251	Sample size = 145

2.3. Data Analysis

The data used in the study was collected by means of a semi-structured questionnaire during face-to-face interviews with the selected smallholder and emerging farmers. The Statistical Package for Social Science (SPSS), version 28.0, was used to analyse the data.

2.4. Binary Logistic Regression (Probit Analysis)

To compute the dependent variable “managerial challenges,” a Likert scale of 1 to 5 was used for the farmers to indicate the level of their satisfaction with the managerial challenge variables: 1. very dissatisfied; 2. dissatisfied; 3. neutral; 4. satisfied; 5. very satisfied. The mean of the scores for the questions/responses with the themes (Business management skills, housing for the animals, extension service, level of education and literacy, support systems, such as socially organised co-ops and extension services, Record keeping and documentation, and Management of livestock) under the respective main challenges was determined. In Table 2, the mean for the sub-questions and responses was determined by adding the scores together and dividing it by the number of questions. The scores less than the average were classified as $y = 1$, while the scores equal to the average and more than the mean were classified as $y = 0$ (was not experiencing the challenge).

Table 2. Mean for level of satisfaction of managerial challenges.

Managerial challenges satisfaction level statistics	Units
Mean	20.5
Standard deviation	5.37
Variance	28.9
Minimum	7.00
Maximum	34.0

Source: Survey data (2022–2023).

The vector of regression X_i , comprising socio-economic and demographic factors and farming characteristics of farmers, are assumed to influence or be associated with the outcome \mathcal{Y} . Specifically, we assume that the probit model takes the form:

$$Pr(Y = 1 | X) = \Phi(X'\beta), \quad (2)$$

Where Pr denotes probability and Φ is the cumulative distribution function (CDF) of the standard normal distribution. The parameters β are typically estimated by maximum likelihood. The probit model as a latent variable model with an auxiliary random variable is expressed as:

$$Y^* = X'\beta + \varepsilon, \quad (3)$$

Where $\varepsilon \sim N(0, 1)$. Then \mathcal{Y} can be viewed as an indicator of whether this latent variable is positive:

$$Y = 1 \quad \begin{cases} 1 & \text{If } Y^* > 0, \text{ i.e. } -\varepsilon < X'\beta, \\ 2 & \text{Otherwise.} \end{cases} \quad (4)$$

The use of the standard normal distribution causes no loss of generality compared with using an arbitrary mean and standard deviation because adding a fixed amount to the mean can be compensated for by subtracting the same

amount from the intercept, and multiplying the standard deviation by a fixed amount can be compensated for by multiplying the values by the same amount.

To understand the equivalence of the two models, take note of this:

$$\begin{aligned}
 Pr(Y = 1 | X) &= Pr(Y^* > 0) = Pr(X'\beta + \varepsilon > 0) \quad (6) \\
 &= Pr(\varepsilon > -X'\beta). \\
 &= Pr(\varepsilon < -X'\beta) \text{ (By symmetry of the normal distribution).} \\
 &= \Phi(X'\beta).
 \end{aligned}$$

The model $\{y_i, x_i\}_{i=1}^n$ is estimated by the maximum likelihood approach.

Suppose that the data set contains n independent statistical units corresponding to the model above.

Then their joint log-likelihood function is:

$$\ln L(\beta) = \sum_{i=1}^n y_i \ln [\Phi(x_i'\beta)] + (1 - y_i) \ln [1 - \Phi(x_i'\beta)] \quad (7)$$

The estimator β that maximises this function is consistent, asymptotically normal, and efficient, provided that $e(xx)$ exists and is not singular. This log-likelihood function is globally concave in β , and therefore standard numerical algorithms for optimisation will converge rapidly to the unique maximum. Table 3 presents the independent variables for the analyses.

Table 3. Variable labels and their expected effects.

Independent variables description	Expected effect
Gender (Male = 1, female = 0)	+
Age (Continuous)	-
Household dependents (Number)	+
Level of education (Years of education)	+
Off-farm employment (Yes = 1, No = 0)	+
Own farm (Yes = 1, No = 0)	+
Years of farming experience (Continuous)	+
Herd size (Number/Count)	+
Do you have a reliable market? (Yes = 1, No = 0)	+
Livestock production skills (Yes = 1, No = 0)	+
Do extension officers visit the farm? (Number of visits per season)	+
Do you hire seasonal labour? (Yes = 1, No = 0)	+
Do you have access to credit? (Yes = 1, No = 0)	+
Do you keep farm records? (Yes = 1, No = 0)	+
Do you belong to a farmer association? (Yes = 1, No = 0)	+
Y (Dependent variable)	Challenge variable (0 = Score \geq average score (Mean), 1 = Score < average score (Mean))

Source: Survey data (2022–2023).

3. RESULTS AND DISCUSSION

3.1. Demographics, Socio-Economic and Farming Characteristics

Figure 2 indicates that the majority of the respondents were male (74%), compared to their female counterparts, who were 26%. The results suggest that the male farmers' involvement in livestock farming was higher than that of the female farmers. The results in Figure 3 show that most of the respondents were 41 to 60 years old (46%), which means that the majority of the respondents were middle-aged. Onyango (2010) and Maswikaneng (2002) found that older people tended to participate actively in agriculture because of family responsibility and the need for food security at a household level.

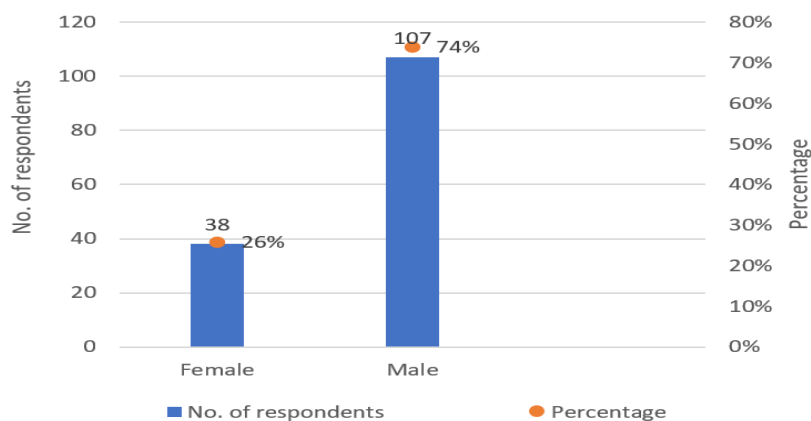


Figure 2. Gender of the respondents.

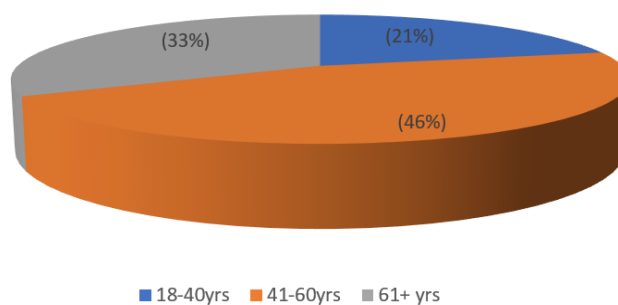


Figure 3. Age distribution of the respondents.

The results in Figure 4 show that 91% of the respondents were farm owners, compared to 9% who were farm managers. This suggests that farm owners performed the majority of farm managerial roles. This corresponds with the findings of Fischer and Qaim (2011) who state that the commitment of individuals can vary because the expected net benefits are not the same for all individuals and opportunities to free-ride exist. This implies that the farm owners' participation was higher than that of the farm managers. Figure 5 presents the results for the respondents' level of education, which show that 41% of the respondents had received a secondary school education. This implies that the farmers in the study area may not have studied or majored in agriculture, as they only completed high/secondary school or below. The education system itself may be thought of as a set of ideas about how a society is structured and should be structured in future (Modisaotsile, 2012).

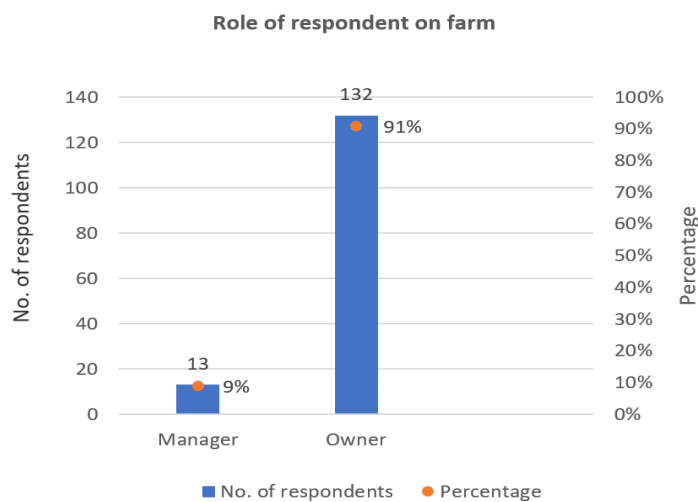


Figure 4. Role of the respondents on the farm.

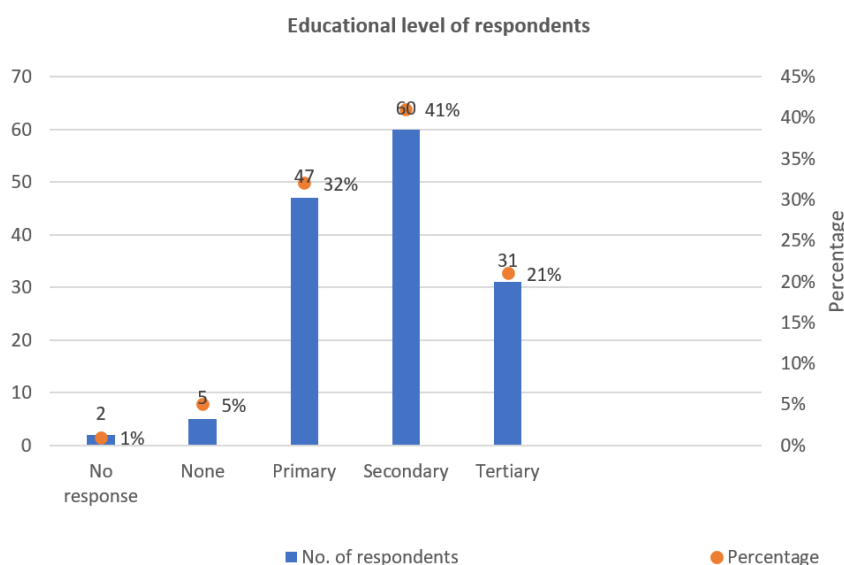


Figure 5. Education level of the respondents.

Figure 6 shows that 81% of the respondents did not have business plans, while 19% maintained that they did. This implies that most of the smallholder farmers did not have business plans. Figure 7 indicates that 50.3% of the respondents did not keep farm records, while 49.7% did keep farm records. The results of this study are similar to the

findings of a study conducted in the Gauteng Province of South Africa by Mthombeni, Antwi, and Oduniyi (2022) who reported that smallholder farmers who had received record-keeping and business planning training were 3.3% and 34.9%, respectively. Other training that the smallholder farmers had access to included agro-processing, marketing, and financial training.

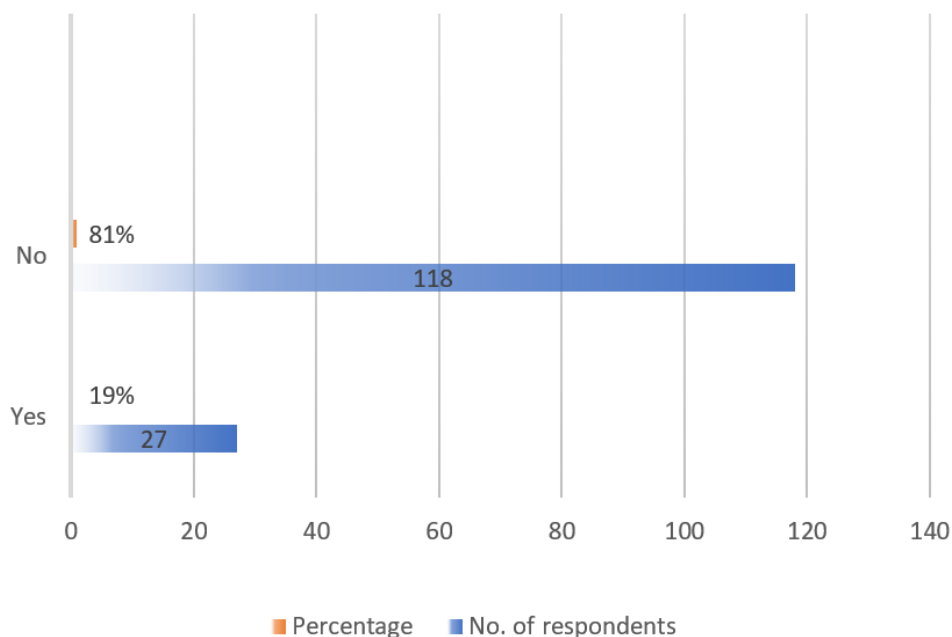


Figure 6. Do you have a business plan?

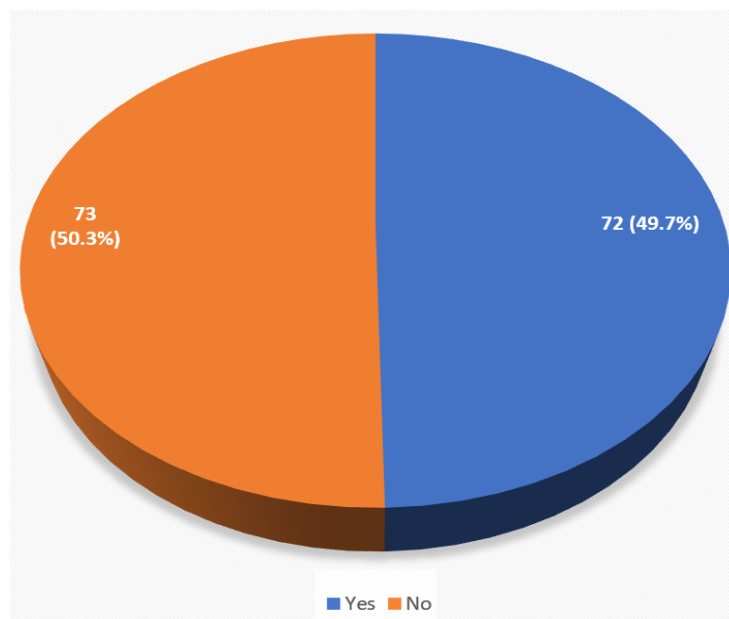


Figure 7. Do you keep farm records?

3.2. Factors Influencing Managerial Challenges for Smallholder and Emerging Sheep and Goat Farmers

The results of Pearson’s chi-square test (goodness of fit) shown in Table 4 show that there is a connection between the observed frequency and the theoretical distribution. This means that the model fits the analysis.

Table 4. Pearson’s chi-square test (n = 145).

Chi-square test			
Test	Chi square	df ^a	Sig.
Goodness of fit	1145.201	126	< 0.001***

Source: Survey data (2022–2023).

Note: *** represent significant levels at 10%, respectively; df^a represent the degree of freedom in the test.

Table 5 presents the probit analysis results of factors that influenced the managerial challenges of smallholder and emerging sheep and goat farmers in the study area.

Table 5. Results of probit analysis of factors influencing managerial challenges of the sheep and goat farmers.

Parameter	Estimate	Std. error	Z	Sig.	95% confidence interval	
					Lower bound	Upper bound
Gender of respondents	-0.116	0.046	-2.524	0.012*	-0.206	-0.026
Age of respondents	0.013	0.001	10.443	0.001***	0.011	0.015
Size of household	0.004	0.010	0.389	0.698	-0.016	0.024
Level of education	0.020	0.024	0.822	0.411	-0.027	0.067
Engage in off-farm income activity	0.230	0.043	5.299	0.001***	0.145	0.315
Role of the respondent on the farm	-0.482	0.062	-7.769	0.01***	-0.604	-0.361
Involvement in the day-to-day operations	-0.059	0.022	-2.691	0.007**	-0.102	-0.016
Do you have a farm business plan?	-0.175	0.067	-2.596	0.009**	-0.306	-0.043
Access to agricultural information	-0.262	0.054	-4.819	0.001***	-0.369	-0.156
Do you keep farm management records?	-0.095	0.056	-1.690	0.091	-0.206	0.015
Do you receive any veterinary services?	-0.066	0.038	-1.737	0.082	-0.140	0.008
What is the size of your land?	0.000	0.000	1.782	0.075	0.000	0.000
Do you sell your sheep and goats?	-0.091	0.067	-1.372	0.170	-0.222	0.039
Distance from the market to your farm	0.000	0.000	0.706	0.480	-0.001	0.001
Cost per single trip to the market	0.000	0.000	1.788	0.074	0.000	0.000
Access to market information	0.223	0.046	4.816	0.001***	0.132	0.314
Total number of sheep you sold in 2019	0.005	0.001	5.649	0.001***	0.003	0.006
Total number of goats you sold in 2019	-0.017	0.003	-6.094	0.001***	-0.022	-0.011
Intercept	-0.359	0.283	-1.267	0.205	-0.642	-0.076

Note: *, ** and *** represent significant levels at 10%, 5% and 1% respectively.

Source: Survey data (2022–2023).

The results in Table 5 show that the gender and role of the respondents, their involvement in the day-to-day operations of the farm, a farm business plan, access to agricultural information, and selling more goats than sheep had a negative and significant association with managerial challenges, with all other factors being constant. This means that the male farm owners who were involved in the day-to-day operations of the farm, had a farm business plan, had access to agricultural information, and sold more goats than sheep did not experience managerial challenges. This may be because the male farm owners adhered to managerial principles and processes, unlike female farmers and farm managers, and they were able to identify managerial challenges and solve them immediately because they were involved in the day-to-day operations of the farm and used agricultural information effectively.

The results also show that age, engagement in off-farm activities, access to market information, and the total number of sheep sold had a positive and significant association with managerial challenges, with all other factors being constant. This means that the older respondents who engaged in off-farm activities, had access to market information, and sold more sheep than goats experienced managerial challenges. This may be because generally the older a person gets, the more their energy level drops and the more they engage in off-farm activities, the more their attention and commitment to farm activities decrease. Furthermore, the more the respondents accessed market information, the more they experienced managerial challenges. These results were unexpected and may mean that the more the respondents accessed market information, the more they realised the limitation of the resources on their farms. The results further indicate that when the respondents sold more sheep than goats, the more they sacrificed the breeding herd, and a farmer would not be able to manage the farm as well as the livestock activities. A study by Nyam, Ojo, Belle, Ogundeji, and Adetoro (2022) reported that with sheep livestock farmers, profit efficiency is influenced by level of education and household size, while gender and sheep loss increase that profit inefficiency. Furthermore, profit efficiency of the farmers can be significantly increased through effective education and training of farmers.

4. CONCLUSION

The study found that socio-economic factors such as age, gender, level of education, household size, access to extension services, engagement in off-farm income-generating activities, and involvement in livestock farming had an influence on managerial challenges experienced by smallholder and emerging sheep and goat farmers in the study area. The study suggests that the younger generation (youth) should be encouraged to engage in livestock farming, as their involvement will increase productivity, profit, and farm activities. More females should also be encouraged to engage in livestock farming to improve their farm and livestock managerial skills and eventually their livelihood or household income.

The results also suggest that the government should improve extension services to accommodate smallholder and emerging sheep and goat farmers in order to improve their management skills. The results further indicate that farmers who engage in off-farm income-generating activities should dedicate their time and attention to sheep and goat farming to improve their income from livestock production. The probit results reveal that the determinants of managerial

challenges were gender, the role of the respondent, involvement in day-to-day operations of the farm, a farm business plan, access to agricultural information, and selling more goats than sheep, as they had a negative and significant association with managerial challenges. Age, engagement in off-farm activities, access to market information, and the total number of sheep sold had a positive and significant association with managerial challenges.

Therefore, the findings of this study should inform policies and support for smallholder and emerging sheep and goat farmers. Thus, farmers are advised to involve youth in livestock farming for better management of the farm and to increase production on the farm, and to encourage women to engage in livestock farming to improve their knowledge of and skills in farm and livestock management. It is also recommended that farmers should focus their attention on farming to manage the farm better, to get support from the government in terms of market information and the use of market information, and to avoid selling more sheep than goats, as the breeding herd might be compromised.

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Institutional Review Board Statement: The Ethical Committee of the University of South Africa, South Africa has granted approval for this study on 6 June 2022 (Ref. No. 2022/CAES_HREC/106).

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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