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Assessment of extension services on capacity building of smallholder livestock farmers in Midvaal local municipality, Gauteng province

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ABSTRACT

The purpose of this study was to assess the effectiveness of extension services on capacity building of smallholder livestock farmers in Midvaal Local Municipality, Gauteng Province, South Africa. A simple random sample technique was used to select the participants, so that individual farmers in the study population could have an equal chance of being selected in the study. A structured questionnaire was used to collect data from 148 smallholder livestock farmers. The data gathered from participants was coded and captured in Microsoft Excel. Descriptive statistics such as frequency counts, mean, percentages, standard deviation, ranking order, and inferential statistics such as binary logistic regression were used to analyse the data. Results showed that technical farm visits (M = 3.3, SD = ±1.36) and informal training (M = 3.2, SD = ±1.31) were effective extension methods. Furthermore, they showed that extension services were less effective at enabling farmers to penetrate formal markets (M = 2,0 SD = ±1.06) and access finance (M = 1.9, SD = ±1.01). The binary logistic regression model revealed that gender and farming status were the main variables that significantly (P<0.05) influenced smallholder livestock farmers' access to extension services. It was

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concluded that extension services in the study area were playing a major role in the capacity building of smallholder livestock farmers.

Keywords: Community development, Technology transfer, Agricultural production, Sustainable agriculture

1. INTRODUCTION

Agricultural extension can be defined in many ways, but it should be noted that it is one of the tools used to encourage agricultural development through scientific research, knowledge, and technologies to improve agricultural practices through farmer education, which will result in the growth of the beneficiaries (Integrating Gender and Nutrition within Agricultural Extension Services (INGENAES), 2015; Mbembela *et al.*, 2018). It plays a critical role in the empowerment of human and social capital required to maintain sustainable agricultural development (Stevens and Ntai, 2011). As a result, farmers will become better managers, make better decisions, contribute to agricultural development, and earn a higher income. (Norton and Alwang, 2019). This can be implemented through agricultural advisory services, involving subject matter specialists, private organisations, and government entities, through proper consultations and frequent advice from extension officers or agricultural advisors (Nkosi, 2017).

In South Africa, most smallholder farmers are classified as farmers residing on communal lands and are governed by traditional authorities. They are underprivileged, less educated, and have underdeveloped infrastructure (Thamaga-Chitja and Morojele, 2014). They are also known for having poor production management skills, a lack of adoption of modern technologies, not being market orientated (Tselaesele *et al.*, 2018), limited access to proper farm infrastructure, insufficient access to production inputs, inadequate access to formal markets, and no access to finance (Chepape and Maoba 2020). As a result, the sustainability and profitability of their enterprises will be compromised. Even in their predicament, they strive to contribute to food security so that everyone has constant access to adequate, safe, and healthy food for a healthy life (May, 2017). What makes matters worse is, according to Zantsi and Bester (2019), the agricultural extension service in South Africa has not yet achieved its mandate of transferring skills and technology, knowledge and solving problems of smallholder farmers to develop them. However, Chepape and Maoba (2020) found that smallholder farmers have access to

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technical and advisory services, as well as information and knowledge management through extension services in Gauteng Province, South Africa. According to Stevens and Ntai (2011), an investment in knowledge is important for sustainable agricultural development. Therefore, capacity building is key in the development of the farming community as it assists in the operations of an entity through the improvement of management skills (Lammert *et al.*, 2015). Thus, this study seeks to assess and document the extension services on the capacity building of smallholder livestock farmers in the study area.

2. AIM, OBJECTIVES AND HYPOTHESIS

2.1 Aim

The aim of the study was to evaluate the impact of extension services on the capacity building of smallholder livestock farmers in Midvaal Local Municipality.

2.2 The specific objectives of the study were

- To assess the effectiveness and accessibility of extension services to smallholder livestock farmers in the Midvaal Local.
- To identify the challenges faced by smallholder livestock farmers in Midvaal Local Municipality.
- To determine the association between dependent and independent variables using a binary logistic regression model**.**

2.3 Hypothesis

The following null hypotheses were made:

H_1: Extension services on capacity building of smallholder livestock farmers in the Midvaal area were not effective and accessible.

H_2: There were no constraints faced by the smallholder livestock farmers in the Midvaal area.

H_3: There was no significant relationship between the dependent and independent variables tested**.**

3. RESEARCH METHODOLOGY

3.1 Study area

The study was conducted at Midvaal Local Municipality (26.5837° S, 28.0654° E) in Gauteng Province (Figure 1). This municipality is situated within Sedibeng District Municipality, in the Southern region of Gauteng Province in South Africa.

FIGURE: 1: Map of Midvaal Local Municipality: Source: Midvaal maps

3.2 Study population, sampling, and sample size

Makapela (2015) described the population as a group of individuals on whom the researcher will be focused, and the results obtained will represent the overall view of the population. To minimise the sample error, a database of smallholder livestock farmers in the study area was obtained from the Gauteng Department of Agriculture and Rural Development (GDARD). Therefore, the database was adopted as the study population (238 smallholder livestock farmers). A simple random sampling technique was used to select the participants, so that individual farmers in the study population would have an equal chance of being selected. The sample size consisted of 148 smallholder livestock farmers selected from the study population using the 7th version of the Raosoft software sample calculator.

3.3 Data collection

A structured questionnaire was used to collect data from the targeted participants from the 11th of January to the 31st of March 2021 and was administered face to face. However, prior to its finalisation it was pre-tested on some farmers not selected for the study purposes. The

questionnaire contained closed-ended questions and was divided into four sections based on the objectives of the study.

3.4 Data analyses

The data gathered from participants were coded and captured in Microsoft Excel (Ms Excel) 2016 Office 365. Descriptive statistics such as frequency counts, mean, percentages, standard deviation, rank order and inferential statistics such as binary logistic regression were used to analyse the data. All the data collected were summarised and presented in table format. The analyses of extension and advisory services on capacity building of smallholder livestock were measured using a 5-point Likert scale; (1) Highly ineffective; (2) Ineffective; (3) Moderately effective; (4) Effective; (5) Highly effective. The mean score for each extension and advisory services was computed. The tested services with a less than 3 mean scores were depicted to be less effective, while those with greater than or equal to 3 mean scores were denoted as being effective. The constraint index (CI) was used to establish the order of the challenges faced by smallholder livestock farmers in accessing extension and advisory services on capacity building in the study area, using the following formula:

Constraint Index (CI) = PLHC x 4 + PLMC x 3 + PLLC x 2 + PLNC x 1

Where, PLHC – denotes percentage of livestock farmers who had high constraints

PLMC – denotes percentage of livestock farmers who had medium constraints

PLLC – denotes percentage of livestock farmers who had constraints

PLNC – denotes percentage of livestock farmers who had no constraints

3.5 Binary logistic regression model

The binary logistic regression model was adopted in this study because the dependent variable had binary outcomes and it permits determination of the likelihood of a certain event occurring. The dependent variable was an agricultural extension service measured on a dichotomous scale, namely, received or not received extension services and denoted as 1 or 0, respectively. The predictions were based on gender, age, marital status, level of education, household size, employment status, and farm size of the livestock farmers in the study area. The independent variables had both categorical and continuous variables. The association between the dependent and independent variables was not linear, therefore a logistic regression model was used, which was the logit transformation of y. The variables used in the model were presented in Table 1 and computed as follows:

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$$\text{Logit (p)} = \text{In}\left(\frac{P}{1-P}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + U_i$$

$\frac{P}{1-P}$ is the odds ratio

P = The probability that livestock farmer is receiving extension services

1-P = probability that livestock farmer is not receiving extension services

α = the constant of the equation

β = the coefficient of the independent variables

X = the independent variables

U_i = the disturbance term

TABLE 1: The independent variables used in the binary logistic regression

Variables	**Description of variables**	**Units**
X_1 = Gender	Male = 1, Female = 0	Dummy
X_2 = Age	Age in years	Number
X_3 = Marital status	Married = 0, Not married = 1	Dummy
X_4 = level of education	Non-post matric = 0, Post metric =1	Dummy
X_5 = Household size	Number of household members	Number
X_6 = Farming status	Full time = 0, Part time =1	Dummy
X_7 = Farm size	Size of the farms in hectares	Number

3.6 Ethical considerations

The study considered the ethical consideration which was addressed through voluntary participation, and the respondents' right to privacy was respected by obtaining direct consent from them. Ethical clearance was obtained from the ethics committee of the North-West University Mafikeng campus.

4. FINDINGS AND DISCUSSIONS

4.1 Accessibility and effectiveness of extension services on capacity building of smallholder livestock farmers (N = 148)

The findings on the accessibility and effectiveness of extension services on capacity building towards smallholder livestock farmers are shown in Table 2. The results showed that the technical farm visits (M = 3.3, SD = ±1.36), informal training (M = 3.2, SD = ±1.31) and access

to production inputs (M = 3.0, SD = ±1.37) were effective extension services in the study area and 64 % of the participants had access to them. Although, farmers had access to production inputs (57%) in the current study, but they were only 7% less compared to farmers in the Bronkhorstspruit area (Chepape and Maoba 2020). The findings of this study agreed with Maoba (2016a), who reported that study groups, farmers' day, and farm visits were effective extension methods. However, the following tested extension services were found to be less effective, with only 29% of smallholder livestock farmers having access to them: demonstrations (M = 2.6, SD = ±1.26), workshops (M = 2.6, SD = ±1.21), formal training (M = 2.5, SD = ±1.21), access to farm infrastructure (M = 2.2, SD = ±1.22), access to formal market (M = 2,0 SD = ±1.06), and access to finance (M = 1.9, SD = ±1.01). Although the results were conversely to Maoba (2016a), indicating that training and demonstration were effective extension methods, there was agreement that workshops were less effective. Chepape and Maoba (2020) reported that smallholder farmers' access to infrastructure development and formal markets in the Bronkhorstspruit area was at 53 and 10%, respectively. While, in the present study, access to infrastructure and the formal market remained at 25 and 22%, respectively. That was an indication that more work was still needed to capacitate smallholder livestock farmers with the infrastructure development and access to formal markets in the Midvaal area. These results confirm the finding of Chepape and Maoba (2020), that most smallholder farmers still don't have access to marketing and business development opportunities. Furthermore, according to Chepape and Maoba (2020), that was a demonstration of the failure of government programmes to close existing gaps to accommodate smallholder farmers into the marketing opportunities. However, the cause of some extension services' being less effective may be attributed to the availability of the budget, the capacity of agricultural advisors, lack of collaboration among stakeholders, stringent requirements by financial institutions, and the quality of the products, amongst others. Thus, according to Mahlangu *et al.,* (2020), it is vital to consider the available resources within the unit, consult with relevant stakeholders, and come up with a viable approach or approaches that will respond to the needs of the participants.

TABLE 2: Accessibility and effectiveness of extension services on capacity building of smallholder livestock farmers (N = 148)

	Accessibility		**Effectiveness of extension services**							
Extension services	**Yes**	**No**	**(1): Highly ineffective**	**(2): Ineffective**	**(3): Moderately effective**	**(4): Effective**	**(5): Highly effective**	**Mean**	**SD**	**Ranking**
Technical farm visits	110 (74)	38 (26)	26 (18)	11 (7)	29 (20)	51 (34)	31 (21)	3.3	1.36	1st
Formal training	44 (30)	104 (70)	36 (24)	49 (33)	30 (20)	23 (16)	10 (7)	2.5	1.21	5th
Informal training	91 (61)	57 (39)	23 (16)	24 (16)	30 (20)	48 (32)	23 (16)	3.2	1.31	2nd
Access to proper farm infrastructure	37 (25)	111 (75)	54 (36)	46 (31)	21 (14)	19 (13)	8 (5)	2.2	1.22	6th
Access to formal market	32 (22)	116 (78)	60 (41)	43 (29)	30 (20)	12 (8)	3 (2)	2.0	1.06	7th
Access to production inputs	83 (56)	65 (44)	26 (18)	32 (22)	25 (17)	40 (27)	25 (17)	3.0	1.37	3rd
Access to finance	27 (18)	121 (82)	59 (40)	55 (37)	20 (14)	11 (7)	3 (2)	1.9	1.01	8th
Access to workshops	57 (39)	91 (61)	30 (20)	44 (30)	30 (20)	36 (24)	8 (5)	2.6	1.21	4th
Demonstrations	60 (41)	88 (59)	34 (23)	46 (31)	25 (17)	32 (22)	11 (7)	2.6	1.26	4th

Source: Field survey 2021, SD-Standard deviation

4.2 Capacity building challenges faced by smallholder livestock farmers in the Midvaal area

The findings on the constraints faced by the participants in the study area are shown in Table 3, and it should be noted that constraints with a mean (M) value of less than 2.5 were minor constraints, whereas those above and equal to the mean value were major constraints. The results revealed that high costs of feed and medication (M = 3.6, SD = ±0.64), access to the formal market (M = 3.5, SD = ±0.69), access to funding (M = 3.4, SD = ±0.77) and access to sufficient land (M = 3.1, SD = ±1.14) were the main constraints faced by the participants. Also, Maoba (2016b) noted that the cost of feed was the major challenge faced by poultry farmers in the Germiston region. These challenges have a direct impact on the sustainability and development of smallholder livestock farmers. Therefore, it is crucial that the appropriate steps be taken to address them in order to maximize the potential of smallholder livestock farmers. However, access to the informal market (M = 2.4, SD = ±0.95) and access to agricultural practitioners and technical advice (M = 2.0, SD = ±1.15) were noted as minor constraints confronted by smallholder livestock farmers in the Midvaal area. That is an indication of the high visibility and dedication of extension practitioner in the study area. Although access to the informal market is not a problem, it is vital to note that the formal market is more lucrative than the informal market.

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TABLE 3: Capacity building challenges faced by smallholder livestock farmers in the Midvaal area (N = 148)

Constraints	**(1): No constraint**	**(2): Low constraints**	**(3): Medium constraints**	**(4): High constraints**	**Mean**	**Standard Deviation**	**Ranking**
Access to agricultural practitioner and advice	77 (52)	25 (17)	22 (15)	24 (16)	2.0	1.15	10th
Livestock management skills	29 (20)	47 (32)	41 (28)	31 (21)	2.5	1.03	8th
Access to formal market	1 (1)	14 (9)	47 (32)	86 (58)	3.5	0.69	2nd
Access to informal market	29 (20)	51 (34)	48 (32)	20 (14)	2.4	0.95	9th
Access to modern technology	14 (9)	41 (28)	49 (33)	44 (30)	2.8	0.96	5th
Access to relevant stakeholders	21 (14)	48 (32)	33 (22)	46 (31)	2.7	1.06	6th
Access to funding	3 (2)	16 (11)	45 (30)	84 (57)	3.4	0.77	3rd
Poor record keeping	33 (22)	44 (30)	41 (28)	30 (20)	2.5	1.05	8th
Financial management skills	28 (19)	43 (29)	49 (33)	28 (19)	2.5	1.01	8th
Disease control	30 (20)	45 (30)	31 (21)	42 (28)	2.6	1.11	7th
High costs of feed and medication	2 (1)	7 (5)	34 (23)	105 (71)	3.6	0.64	1st
Access to enough land	25 (17)	11 (7)	30 (20)	82 (55)	3.1	1.14	4th

Source: Field survey 2021

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4.4 Regression analysis

The results of the binary logistic regression model are presented in Table 4. The model was deployed to establish variables which may have an influence on livestock farmers' access to agricultural extension services in the study area. The variables tested were gender, age, marital status, level of education, household size, farming status (farming full time or part time) and farm size. The results revealed that gender and farming status were the main variables that significantly ($P<0.05$) influenced livestock farmers' access to extension services. The negative coefficients observed for gender (-1.204) suggest that male livestock farmers are less likely to receive extension services compared to the female livestock farmers. The odds ratio observed for gender indicated that men were 0.3 times less likely to access extension services than women. The discovered gender differences indicate a positive stride towards women's empowerment in the livestock sector in the study area. However, measures should be taken to ensure that male counterparts are not neglected and end up abandoning farming because that would put pressure on existing social challenges like food security, poverty alleviation, and job creation, among others.

Also, the negative coefficient recorded for farming status (-1.195) insinuated that livestock farmers farming part time are less likely to receive extension services. The odds ratio noted for farming status suggested that livestock farmers farming part time were 0.3 times less likely to receive extension services in comparison to those farming full-time. The finding may be attributed to the easy accessibility and availability of farmers farming full time compared to those farming part time. However, other variables such as age, level of education, household size, and farm size had positive coefficients but were not predictors ($P>0.05$) for livestock farmers to access extension services. The goodness-of-fit test was used to determine how well the model fit the data, and the chi-square analysis revealed that the model fit the data well ($P<0.05$).

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TABLE 4: Binary logistic regression analysis on the access of livestock farmers to agricultural extension services

Variables	β (Coefficient)	SE	Wald Statistics	df	P-value	e^{β} (odds ratio)
Gender (1)	-1.204	0.456	6.975	1	0.008	0.300
Age	0.021	0.018	1.338	1	0.247	1.021
Marital status (1)	0.048	0.478	0.010	1	0.919	1.050
Level of education (1)	0.536	0.515	1.084	1	0.298	1.709
Household size	0.153	0.150	1.049	1	0.306	1.166
Farming status (1)	-1.195	0.512	5.446	1	0.020	0.303
Farm size	0.053	0.055	0.928	1	0.335	1.054
Constant	0.268	1.231	0.048	1	0.827	1.308
Model tests			χ^2	df	P-value	
Chi-square (χ^2)			20.532	7	0.005	
-2 Log likelihood	141.379					
Cox & Snell R^2	0.130					
Nagelkerke R^2	0.195					

SE - Standard error, df - Degree of freedom

5. CONCLUSIONS

The study has shown that extension services in the study area were playing a major role in the capacity building of smallholder livestock farmers. The most effective extension services were farm visits for the provision of technical advice, informal training, and production inputs. The accessibility to extension services was significantly influenced by gender and farming status, i.e., whether they were farming full time or part time. Male and part-time livestock farmers were 30% less likely to receive extension services. The major constraints faced by the farmers in question need to be addressed to maximize their potential to maintain sustainability and develop smallholder livestock farmers.

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6. RECOMMENDATIONS

Based on the results of the study it was recommended that:

- Some extension services that are less accessible must be improved in order for extension to be more effective in capacity building.
- A comprehensive developmental plan is needed to boost the provision of formal training, farm infrastructure, access to formal markets and access to finance.
- The major challenges faced by smallholder livestock farmers must be addressed urgently to maintain their sustainability and growth.
- All the support from extension services should respond to the needs of the farming community within a reasonable time frame.

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