SOCIOLGY | SOCIOLGY RESEARCH ARTICLE

Factors affecting the using information and communication technologies (ICTs) by livestock farmers in the Eastern Cape province

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Abstract: Livestock farming is a significant part of agricultural production in sub-Saharan Africa and is contributing immensely to household welfare. Livestock farmers have been exposed to different ICTs stations in developing countries. Nevertheless, efforts have been made to use ICTs but involvement does not replicate how ICTs influence livestock farmers to access and use to enhance productivity and farm returns of farmers. It is therefore imperative to investigate factors affecting the use of ICTs by livestock farmers in the Eastern Cape Province. The study made use of multi-stage sampling in selecting 170 livestock farmers. Descriptive statistics and binary logistic regression were used as analytical tools. Livestock farmers were using ICTs to enhance their production and farm returns respectively. The commonly used ICTs were radio and television, mobile phones, and computers. The use of ICTs by farmers was effective as they contributed significantly to enhancing the productivity of livestock farmers. Socio-economic and institutional factors influence the use and adoption of ICTs by livestock farmers. Therefore, the study recommends introduction training programs tailored to build knowledge and use of ICTs in increasing farmers’ awareness as well as

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PUBLIC INTEREST STATEMENT

ICTs are hot topic that always receives public attention, especially farmers as it makes their lives easier. The diffusion of ICTs is becoming a central policy issue for developing countries, being identified by international policy-makers and scholars as an important driver for knowledge innovation and economic growth. ICTs have been applauded worldwide for the support they have provided in the provision of information to upsurge productivity, for information on access to markets, information on innovations as an inexpensive and more consistent way of reaching a mass of people. ICTs have helped to convey lots of information on agriculture, marketing, health and social issues like water and food preservation. This article evaluates factors affecting the using information and communication technologies (ICTs) by livestock farmers in the Eastern Cape Province. We believe that the empirical results will provide many interesting evidences for this issue and encourages more farmers to invest in ICTs to improve their farm productivity.
gaining knowledge. Government must subsidize farmers so that they can be able to purchase data and ICT tools.

**Subjects**: Agriculture; Environmental Sciences; Agriculture and Food

**Keywords**: Eastern Cape province; factors; information and communication technology; livestock farmers; welfare

1. Introduction

Information and Communication Technologies (ICTs) are the technologies used for the extensive dissemination and sharing of information among people at a fast rate (Nwafor et al. 2020; Kante et al., 2016). As a result, this specifies that smallholder farmers’ need for relevant and timely market information can be met using ICT-based information sources. The use of ICTs forms part of the 4th Industrial Revolution, where things are done over digital usage and Oladele (2015) mentioned that there is a rapid growth of ICTs usage throughout the world as ICTs consolidate the global communication networks. Thus, ICTs use the latest technology to process and transmit information for livestock farmers (Serbulova et al., 2019). ICTs are playing a fundamental role in stimulating and disseminating agricultural information that is essential for enhancing farming (Kante et al., 2016). These ICTs involve hardware, software, networks, and information tools for collecting, storing, processing, transmitting, and presenting the information. They further include radio, television, telephones, computers, Internet technologies, and databases that disseminate information quickly and fast.

The agriculture sector continues to ensure sustainable futures, rural development and poverty reduction in the twenty-first century as many people especially in developing countries depend on it for deriving their livelihoods, especially South Africa (Chiwawa, 2019; Tijjani et al. 2017; World Bank, 2008; Tembo, 2008). Livestock farming is a significant part of agricultural production in sub-Saharan Africa as it contributes to more than 50% of the labour force and household food security. Livestock farming is one of the dominant agricultural activities being practiced because of socio-economic benefits by poor Southern Africa communities such as household food security, poverty alleviation, generating income, cultural custom, and cementing social relationships (Molotsi et al., 2019; Thamoga-Chitja & Morojele, 2014). Additionally, while livestock production is mainly focused on the economic well-being of the farmer, in most developing countries people keep livestock for other off-farm expenses such as payment of lobola, school fees, insurance against emergencies, and purchase of food (Chiwawa, 2019; Cholo et al. 2017). The dominance of livestock farming is because the total external area in South Africa is semi-arid which makes it inappropriate for everything but general philosophical livestock agriculture (Cloete & Olivier, 2010). Statistics South Africa (Stats SA) (2017) conveyed that in the 2016 household survey, 53 percentage of South Africa smallholder farmer households were involved in livestock production. Despite their importance and apparent advantages, Livestock farming is becoming inadequate and is facing various challenges that are affecting livestock farming either direct or indirect. As a result, about 26 percentage of the South African population is food insecure, which is very worrying some (Shemfe 2018). In addition, despite its contribution to households’ income and food security, the livestock production in South Africa has not been able to realize its real agricultural production potential as it is much lower than many other countries of the world (Aldosari et al., 2017). Furthermore, livestock farmers face challenges such as livestock diseases, pandemics, climatic conditions, globalization, market access and information, production information, theft, and lack of capital. Von Loeper et al. (2016) further specified that the lack of input, use of communal land, and lack of tags are also the challenges livestock farmers face. As a result, to mitigate these challenges affecting smallholder livestock production in developing countries, science and technology need to be unified using participatory and interdisciplinary approaches in livestock production. Livestock farmers must be exposed to different ICTs stations access and usage of agricultural information, new techniques and market information, access to traders and security personnel in developing countries.
Jabir (2012) has argued that ICT usage has gradually become imperative for effective decision-making by the farming community. This is because farming has rapidly been exposed to technological improvements and varying agricultural systems have significantly emphasized the need for effective transmission of progressive and real-time information and knowledge to farmers through various technological networks, communication systems, and media. Jiriko et al. (2015) and Angello (2017) specify that the ICT usage by farmers is advancing the information supply on improved farm technologies, treatment and emergence of diseases, breeding methods, and markets for their products, among much other information required which is the resultant effect on productivity and income of farmers. Yaseen et al. (2016) and Kaddu (2011) further postulate that the ICT usage by farmers (livestock farmers) is a pioneering technique for expansion of the farming sector which is the most vibrant part of the economy in most of the emerging countries where farming is the livelihood strategy. Abebow and Yared (2019) and Bosch et al. (2012) stipulate that the use of technology in agriculture (such as e-marketing) has impacted the exclusion of mediators, decreases expenses and benefits in finding customers as well as being user friendly.

Additionally, ICT innovations have been associated mainly with increasing agricultural productivity and efficiency, especially for livestock production, as there is a growing interest in solutions at the stages of post-harvest processing, transportation, and storage of agricultural products. This has assisted farmers in reducing transaction cost per unit for livestock and increased efficiency gains ever since livestock farmers have adopted their usage. The use of ICT has been a revelation in most developing countries such as South Africa and Swaziland as ICTs have increased rapidly the market access for farmers (Eskia, 2019). ICTs further increased livestock farmers’ co-operation and performance of agriculture sector largely as farmers started to recognize the importance of information sharing which is a crucial component in the development of any sector. Anim-Dankwa (2018) showed that the use of ICTs has improved properly the quality of life and for social cohesion among smallholder livestock farmers.

There is a rapid growth in ICT usage by livestock farmers due to the high demand for agricultural information, as it is the critical ingredient to improving small-scale agricultural production and linking farmers to profitable markets (Wawire et al., 2017). Nevertheless, efforts have been made to promote the use of ICTs by farmers; however, their involvement has not shown replicate how ICTs influence livestock farmers to access and use agricultural input and market information. According to Luqman et al. (2019) like any other developing country, South Africa, a wide variety of information sources are being used by livestock farmers to get modernized and updated knowledge about farm practices to maximize farm profit and thereby improve their livelihood. With various challenges associated with livestock farming and exposure of farmers to ICTs usage, there is no appreciation of whether livestock farmers have access to agricultural information, access to markets, production techniques, breeding techniques, control of diseases, and if they are using that information for farming. The main objective is to investigate and explore determinants of using information and communication technologies (ICTs) by livestock farmers in the Eastern Cape Province.

2. Conceptual framework of use and adoption of information and communication technology by livestock farmers
Timely information facilitated by ICT tools has the potential to fast-track the agricultural development of farmers by supplying farmers with the required information to improve farming operations and connect producers to profitable markets. Having required farming information and inputs, livestock farming has a great potential of improving agricultural development in developing countries as well as enhancing their contribution to the country’s GDP and meeting Sustainable Development Goals (SDGs). Figure 1 illustrates the factors that affect adoption and access to ICTs by livestock farmers and these factors include: socio-economic, farm to farm, cultural issues, and institutional factors. With farmers having access to ICTs which is a positive assumption, they will manage to increase their production, market-oriented information, weather and shocks information, agronomic practices to use, innovative input information, and access to financial information which will assist in farm operations. With this information, farmers will increase their farm returns,
enhance food security, and improve their livelihoods. Wawire et al. (2019) specified that adopting ICTs is the only solution for smallholder farmers in achieving their farm returns and improving their livelihoods as the farming landscape has changed significantly in the 21st century.

3. Methods and Material

3.1. Study area

The study was conducted in the Eastern Cape Province of South Africa. Eastern Cape is the second largest province in the country at 168,966 km² after Northern Cape Province. The Province was formed in 1994 out of Xhosa homelands of Transkei and Ciskei, together with the eastern portion of the Cape Province. It covers approximately 170,000 square kilometers, which comprise about fourteen percent (14%) of the total landmass in South Africa (Nwafor et al. 2019). Eastern Cape Province is the third supreme inhabited Region in South Africa with 6,562,053 (12.7%) after Gauteng and KwaZulu Natal provinces, which are estimated to have populations of 12,272,263 million (23.7% of national) and 10,267,300 (10.8%; Hlomendlini P, 2015; Mdoda & Obi, 2019). According to Stats SA (2013), the Province is a poverty-stricken province with an average poverty level of 74.9% which is above the national poverty average of 64%, and a food insecurity level of 78%, making the province the most food insecure province in the country. The Province is comprised of rural dwellers situated in rural areas who derive their livelihood through practicing agriculture, tourism, and formal employment.

The climatic conditions of the Eastern Cape coastal areas lie between the sub-tropical conditions predominant in KwaZulu-Natal and the Mediterranean climate of the Western Cape. The Karoo in the West experiences extended scorching summers and temperate winters while having the high elevations of the Great Escarpment towards Lesotho and the Free State regularly experience snow in winter. The Province parades a bimodal precipitation pattern, with a winter rainfall zone in the west, and a summer rainfall zone in the east. Due to varying rainfall seasons, growing times also differ throughout the Province. In the north, east and along the coastal belt, summer seasonality encourages C4 grass production, crop, vegetable, and the focal focus is livestock (cattle and sheep) production. In the semi-arid central and western regions, C3 grasses and shrubs predominate, and
this favors crop, citrus, and livestock (sheep and goat) production. The study focuses on livestock that is suitable in both C4 and C3.

The research was a descriptive survey. The study used the cross-sectional survey design which refers to the collection of data during a specified duration of time. The design is suitable for the study as it sought to investigate the factors influencing ICTs use and adoption in livestock production (Nzonzo & Mogambi, 2016). We used both qualitative and quantitative to enhance the reliability and validity of the findings as each method strengthens the others’ weaknesses.

3.2. Sampling procedure and sampling size
The Eastern Cape Province was purposively selected due to its leading status as the province with the largest number of livestock in South Africa. The study made use of a multi-stage sampling procedure. The first stage was to select three District municipalities in the province. The selected districts were Alfred Nzo, Joe Gqabi, and OR Tambo due to active participation in livestock farming and contributing extensively to farmers’ livelihoods (food security and farm revenues). The second stage was to select two local Municipalities within the District and wards that practice livestock farming. These local municipalities were Umzimvubu and Mbizana Local Municipalities (Alfred Nzo District), Elundini and Walter Sisulu Local Municipalities (Joe Gqabi), and Ingquza Hill and Nyandeni Local Municipalities (OR Tambo). The third stage was selecting livestock farmers using random sampling. Random sampling was used to select as a list was obtained. The units of analysis were livestock farmers (110 farmers participating and 60 farmers not participating). The list of livestock farmers using ICTs and those not using ICTs was obtained from the Department of Agriculture, farm organizations, and field extension officers working with livestock farmers in the province. The sample size was 170 livestock farmers. The study used a sample of 170 due to financial constraints as the study was self-funded and could not reach the whole province rather select district municipalities that are actively involved in livestock farming and contribute to farmers’ welfare.

3.3. Data collection
The research paper made use of both qualitative and quantitative approaches to discover the determinants of using information and communication technologies (ICTs) by livestock farmers. Primary data was the tool used to collect data. A structured questionnaire was used to collect and gather information. The questionnaire comprised three sections that included the respondents’ demographic information, the types and use of ICTs adopted, the barriers faced by livestock farmers in adopting ICTs, and lastly, factors influencing farmers’ decisions. The questionnaire embraced close-ended questions. Data was collected through a single-visit farmer survey. This was done in the form of face-to-face and self-administered questionnaires between the 23 May 2018 to 18 July 2019 seasons. Interview questions were compiled to produce a reliable response from the sample to determine what participants do, think and feel about ICTs and specific factors affecting them. The questionnaire was first pre-tested with 10 livestock farmers from the target livestock farmers in Libode to determine the effectiveness of the questions and this area was not used when collecting data.

Data entry, data cleaning, management of missing data, and descriptive analysis were done using STATA software for examination and interpreted both qualitatively and quantitatively. The study made use of descriptive statistics in the form of averages, ratios, means, ordinary deviation, and occurrence distribution to capture smallholder farmers’ features. Thereafter, a Logistic model was used to examine the factors affecting the usage of information and communication technologies (ICT) by livestock farmers in the Eastern Cape Province.

3.4. Analytical Model
This study adopted the Logistic model to measure factors affecting the usage of information and communication technologies by wool marketers in the Eastern Cape Province. The method has been used for this kind of a state where the calculation of the existence or lack of a consequence is established on standards of agreed forecaster variables required. Wawire et al. (2019) and Chauke et al. (2013) stated
that logistic regression measurement is used mostly to estimate likelihoods relations for all of the autonomous variables in the model. The logistic regression model is suitable to a wider variety of exploration circumstances than discriminant examination. This model was used and preferred over than Probit model because of its powerful comparative mathematical simplicity (Wawire et al. 2019). The Logit was selected because of its capacity to better answer our main research questions and because of our data and sample characteristics (association between variables, slope tells how the log odds ratio in favor of adoption ICTs). Additionally, the significant explanatory variables do not have the same level of impact on the adoption decision of farmers. The relative effect of a given quantitative explanatory variable on the adoption decision is measured by examining adoption elasticity, which is why Logit is the most suitable model to be used as other regressions do not provide such. The variables that were assumed to influence the adoption decision of ICTs were tested for multicollinearity. The Logit model was used as it offers the possibility to save the predicted variables used to estimate drivers of adoption automatically. Logit fits this type of study due to the cumulative nature of the variables used in the study since they assume a cumulative normal distribution, which leads to efficient estimators. This model characterizes adoption by the sample farmers so that it allows maximum likelihood estimation. The regression scrutiny comprises two distinct substitutes and in this case, adoption of ICT usage by farmers is a qualitative reliant variable where it takes the values 0 and 1, which is binary. This study custom a binomial logistic model given that the reliance on the variable is binary: 0 when a farmer has adopted and used ICT in the farm and 1 when not adopted and using ICT in the farm.

For this paper, two choices existed and were accessible, specifically “usage of ICT” or “no usage of ICT” a twofold regression was established up to explain $Y = 1$ for a state anywhere the livestock farmer use ICT and $Y = 0$ for states wherever the livestock farmer do not use the ICT in the farm. Assuming that $X$ is a trajectory of descriptive variables and $p$ is the likelihood that $Y = 1$, dualistic probabilistic associations as quantified by Wooldridge (2009). This can be measured as follows:

$$p(Y = 1) = \frac{e^{\beta X}}{1 + e^{\beta X}}$$

(1)

$$p(Y = 0) = 1 - \frac{e^{\beta X}}{1 + e^{\beta X}} = \frac{1}{1 + e^{\beta X}}$$

(2)

Where

Calculation (2) is the lower answer level, that is, the prospect that livestock farmers did adopt and use ICT in their farm, this will be the likelihood to be demonstrated through the logistic technique by settlement. Together, the calculations illustrate the effect of the logit alteration of the likelihoods proportions which can otherwise be symbolized as:

$$\log \text{it}(\theta(x)) = \log \left[ \frac{\theta(x)}{1 - \theta(x)} \right] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n$$

(3)

Besides thus permitting its approximation as a linear model for which the ensuing descriptions apply:

$\Theta =$ logit alteration of the likelihoods ratio; $\alpha =$ the intercept term of the model

$\beta =$ explanatory variables exhibited and

$X_i =$ forecaster variables.

The previous processes were possible within the STATA. In relative to Calculation (3), the examination created the odds relations exhausting the supreme probability technique. The logistic regression in this study can be stated as follows:
\[ Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \ldots + U_n \]  

(4)

Where

- \( Y_i \) (ICT) = the reliant on variable distinct as the adoption and use ICT by livestock farmer = 0 and 1 otherwise
- \( \alpha \) = constant and capture of the equation
- \( \beta \) = slope of the discrete predictor (or instructive) variables demonstrated
- \( X_i \) = forecaster variables.
- \( U_n \) = correction error term.

### 3.5. Data

This section represents characters that can be considered for the study. But the variables were selected based on the consultation of specialists and relevant personnel working in the study area and related issues. The data was shown in Table 1 below.

| Variable | Description | Measurement | Expected sign |
|----------|-------------|-------------|---------------|
| \( X_1 \) | Gender of the farmer | 1 = male, 0 = otherwise | ± |
| \( X_2 \) | Age of the farmer | Actual years | - |
| \( X_3 \) | Marital status of the farmer | 1 = married, 0 = otherwise | + |
| \( X_4 \) | Family size of the farmer | Actual number of people | + |
| \( X_5 \) | Years spent in school by the farmer | Actual years | + |
| \( X_6 \) | Household source of income by the farmer | Actual amount | + |
| \( X_7 \) | Farming years by the farmer | Actual years of farming | + |
| \( X_8 \) | Distance to the agricultural marketing center | Actual kilometres | - |
| \( X_9 \) | Access to extension agents by the farmer | 1 = access to extension agents, 0 = otherwise | + |
| \( X_{10} \) | Access to a financial institution by the farmer | 1 = access to finance, 0 = otherwise | - |
| \( X_{11} \) | Member of farm organization | 1 = member of farm organization, 0 = otherwise | + |
| \( X_{12} \) | Household monthly income | 1 = > 1500, 0 = otherwise | + |
| \( X_{13} \) | Occupation by the household head | 1 = full time farmer, 0 = otherwise | + |
| \( X_{14} \) | Farming as the only source of income | 1 = farming as an only income source, 0 = otherwise | - |
| \( X_{15} \) | Knowledge of using mobile phones for agricultural purposes | 1 = can use mobile phone for agricultural purposes, 0 = otherwise | + |
4. Results and discussion

4.1. Demographic characteristics of farmers

The study results indicate that most of the livestock farmers in the Province are headed by male farmers (in a proportion of 68% males to 32% females). These results were in line with Chikaire et al. (2017) and Onyeneke et al. (2016) findings that males were dominating farming and agriculture because males are landowners and head of the family who makes family decisions. This entails that the livestock farmers were primarily males. The average age of farmers’ heads was 52 years with an average family size of 5 people. This means farming is practiced by elderly people in the Province due to the retrenchment of people from mines and government departments countrywide. Smallholder livestock farmers in the Province are literate and they have spent 6 years in school, denotation mainstream of the farmers has primary education. These findings agree with Lugmon et al. (2019), Mdoda and Obi (2019), and Onyeneke et al. (2016) that smallholder farmers were literate which made it easy for them to understand agricultural information and adopt innovative technologies aimed at improving farm output. This means farmers can interpret information and use advanced technologies in their farms. The majority of the farmers have 8 years of farming experience, which is valuable in operating the farm and they know exactly what is best for their farming. Livestock farmers were married with 58% and that played a role in
assisting with family labor. These results agree with Nwafor et al. (2020) that married farmers were very important with the provision of family labor which assists in decreasing hiring as most farmers do not have much to pay for labor.

The study found that about 89% of livestock farmers had access to and own both radio and mobile phones which most they use for farm and household activities. These findings agree with Tambo et al. (2019) that ownership and access to radio and mobiles are very crucial sources of agricultural information and communication technologies that assist the majority of the farmers with current information and agricultural techniques. The study has found that the majority of livestock farmers have access to extension services with a proportion of 71.34% having access to extension services and the study revealed that 54.14% of livestock farmers are members of farm organizations. These findings were in line with Chikaire et al. (2017) that participate in their organizations and associations as well as having access to extension services, assist farmers with knowledge and information which in turn is likely to help farmers acquire leadership potential which will help them in disseminating information on important techniques or innovation and also have a good administrative structure within the organization. Livestock farming was the major activity being practiced with 60.23% as their only source of income and they were using information and communication technologies with 64.91% using ICTs to 35.09% not using ICTs in their farming as they have ownership of ICT tools. Farmers agreed they have access to farm size both privately owned and communal land for grazing of their livestock. The majority of the livestock farmers were full-time farmers with 78% as such results agreeing with literature that unemployment is very high in the province. The findings were in line with Chikaire et al. (2017) that most of the farmers in Africa, with South Africa included, were full-time farmers as they derive their living from farming.

4.2. ICT ownership tools used by livestock farmers
Livestock farmers in the study have different access and ownership of ICTs as shown by Figure 2. The majority of the farmers were Mobile phones owners (59%) while other farmers confirmed owning radio and television (24%) and Computer (17%). Livestock farmers indicated that they were using mostly radios to listen to market information and new agricultural inputs when are being advertised on the radio as well as when agricultural officials were announcing them. Livestock farmers owning mobile phones were using the mobile phones to seek market information and selling livestock via call/SMS to traders, abattoirs, Farm organizations, people living near towns, and extension services while remaining computer they were using to access market information and sending/receiving some e-mails from brokers, production, markets, and government officials updating them about new agricultural inputs. These results were in line with Chikaire et al. (2017) that most of the farmers in developing countries were using mobile phones, radios, and televisions as the only ICT devices available to them. These ICT devices played a major role in

![Figure 4. Constraints faced by farmers in using ICTs.](image-url)
changing the lives of livestock farmers with the provision of new farming techniques and information relevant to farmers.

4.3. Reasons for not using ICTs in livestock farming

The study did find some farmers in the Province who do not use ICTs in their farming. Figure 3 illustrates those reasons which were given by farmers.

Poor eyesight due to aging was the dominating reason with 76% and was because most farmers in the study area were old farmers with old age crippling in. Other reasons were phone problem issues and having no idea how to use it with 13% and 11%, respectively. These were common reasons because the majority of the farmers have primary education which did not expose them to more advanced technologies and other farmers still using those old model phones such as Nokia.

Table 2. Effects of using information and communication technologies (ICTs)

| Effects of using ICT                                      | Percentage (%) |
|----------------------------------------------------------|----------------|
| Increases agricultural information availability           | 89             |
| Increase Knowledge on farming activities and breeding techniques | 86             |
| Improved quality of marketing information and access to markets | 84             |
| Improved access to agricultural input, disease control, and record-keeping | 78             |
| Improved awareness of agricultural events and training    | 76             |
| Encourages information sharing, dissemination and strengthen farm partnership | 64             |
| Enhanced productivity and farm returns                    | 90             |

Table 3. Factors influencing ICT usage by livestock farmers

| Variable                              | Logit results | Marginal effect |
|---------------------------------------|---------------|-----------------|
|                                       | Co-efficient  | P-value         |                  |
| Gender                                | 1.265         | 0.000***        | 0.253            |
| Age                                   | −1.863        | 0.001***        | −0.34            |
| Years spent in school                 | 1.235         | 0.023**         | 0.361            |
| Marital status                        | 1.486         | 0.028**         | 0.608            |
| Access to extension services          | 1.768         | 0.000***        | 0.465            |
| Family size                           | 1.245         | 0.038**         | 0.596            |
| Member of farm organization           | 1.973         | 0.008**         | 0.236            |
| Electricity outage                    | −1.895        | 0.01**          | −0.875           |
| Network coverage and interruptions    | −1.836        | 0.005***        | −0.431           |
| Access to credit                      | −1.563        | 0.000***        | −0.230           |

Number of observers = 170 Likelihood = −278.789 Pr>Chi = 0.001
LR Chi² (9) = 104.99 Pseudo R² = 0.901

Note *** and ** significant at Level 1% and 5%, respectively.
1100, Mobi cells, and Siemens which are giving them problems as they are no longer available in shops and few using Android phones.

4.4. Effects of using information and communication technologies (ICTs) in livestock farming

Livestock farmers have experienced an improvement in their farming since they use the ICTs in the farm. Some farmers stated that the ICTs usage made things very easy for them in terms of agricultural updates and thus, helped them in improving their farming fortunes. The effects of using ICTs are listed in Table 2.

The study found out the usage of ICTs has improved livestock farming in the Province. Study results showed that the use of ICT has increased productivity and farm return (90%), agricultural information availability (89%), and knowledge on farming activities (86%). As a result, the livestock farming rate has improved in the Province and youth is starting to be involved in farming as compared to the past as there is more information about agriculture, high farm returns and exposure, and which farming activities to practice. Some farmers argued that the use of ICTs has brought improvement in the quality of market information they received and access to markets with 84%. The quality of market information is more than they do receive without the ICTs usage as they got such information from the internet, brokers, and abattoirs as well as supermarkets they sell to. In terms of market, access has improved as they are now participating with markets as they know the type of standards they have to meet, which markets to sell, and also post some of their products via social media. The ICTs usage has further brought improvement in accessing agricultural inputs and record-keeping with 78% as they have access to a different agricultural website where they can see inputs used and can read about them in the National Department of Agriculture, Land Reform, and Agrarian. They do read about the importance of keeping farm records which resulted in many farmers keeping records now and they can reflect on them in terms of improving farm operations.

Livestock farmers have noticed an increase in awareness of agricultural events taking place, and training happenings that involve livestock farming with 76%. This is something new that is very encouraging to farmers as they are no longer feeling left out by policymakers and Agricultural Department. The last important effect of ICTs is that of promoting information sharing, dissemination, and strengthening farm partnership among themselves with 64%. This is important as farmers can keep each other informed and able to share positive results with another farmer to encourage the farmer in his improvement of farming as well as working together in achieving their goals. The study is very content that the usage of ICTs by livestock farmers has yielded much improvement in farming in the Eastern Cape Province and has managed to motivate those farmers not using ICTs to think about it as results are speaking for themselves for the usage of it.

4.5. Barriers in using ICTs in farming

Farming is one agricultural activity that is exposed to many challenges. As a result, the usage of ICT in farming is not exceptional as there are challenges associated with it. Figure 4 demonstrates is barriers faced by farmers in using ICT.

Livestock farmers in the Eastern Cape are using ICTs for their farming but they encounter some challenges in using them. The majority of farmers have indicated that network coverage (40%) is the challenge main challenge faced farmers which makes it difficult for them to use the ICT as they have found a good network to access it while others decide not to use it at all. Financial support is the second challenge (30%) as most of the farmers depend on farming and social grants for income, making it hard to purchase the ICTs tools for farming use. Another challenge was the lack of agricultural programs aired on radio and television (18%) which make it harder for farmers to be exposed to ICT usage and understand the importance of ICTs in the farming context. Lastly, knowledge and information with 12% and is due to lack of exposure and knowledge in understanding the usage of ICT by farmers.
4.6. Factors affecting the use of ICTs by livestock farmers

The study made use of the Logit regression model to examine factors affecting the use of Information and Communication Technologies (ICTs) by livestock farmers in the Eastern Cape Province. The explanatory variables were quantified as those related to socioeconomic and institutional factors. For all the variables with a positive coefficient, it implies that as any of them increases, so does the increase of ICT usage by the livestock farmer. Table 3 summarizes the empirical results of logit regression. The model explained −278.789 (Likelihood ratio Chi-square) of all the variables which were significant at p < 0.01. This specifies that the addition of an independent variable will generate a statistically significant model. The study found to have the likelihood of with a Pr>Chi = 0.0010. The study Pseudo R² = 0.901, which means that R² was 90% and means that the model better fit the data. The Pseudo R² states that the applied model is appreciated and efficient to be used to analyze the determinants of ICT usage by farmers.

The results indicate that farmers’ age has a negative coefficient and is significant at 1%. The negative coefficient implies an inverse proportional relationship with ICT usage. This implies that a unit increase by 1% in age will induce a decrease in the likelihood of use of the ICT tool by 0.3. Also, it suggests that younger farmers are more open to new ideas and innovations compared to older ones. Old people are reluctant to change, especially the technology base as they are not familiar with and not used, unlike younger ones who can use the ICT to access information on production, markets, agricultural technique, extension services, and involvement in markets. These results are in line with Katunyo et al. (2018) and Wawire et al. (2017) who found age to have a negative influence on the usage of ICT by farmers. The results confirm the conclusion that age will negatively influence technology adoption and usage (Jabir, 2012; Soule et al., 2000).

The gender of the farmer was found to be positive and statistically significant at a 1% level. This means that the gender of the farmer plays a crucial role in influencing the use and adoption of ICTs by livestock farmers. The study found that men are 0.3 times more expected to use and adopt ICTs tools than women. This can be explained by the fact that men are easily approachable and share information regarding farming practices that enhance productivity as compared to women. This is also because the majority of women are not involved in farming and are exposed to new agricultural techniques than men who are exposed and have an association with extension personnel. These results concur with Wawire et al. (2017) that men have more access to agricultural information than women due to cultural practices which allocate most of the domestic responsibilities to women, leaving them with almost no extra time to allow them to pursue additional services related to farming.

Years spent in school is one of the important indicators for ICT usage and adoption by farmers. The study found years spent in school positive and statistically significant to ICT usage by livestock farmers at 5%. This implies that a 1% increase in years spent in school will induce an increase in the likelihood of use of the ICT tool by 0.4. The positive relation between years spent in school with ICT usage by livestock farmers will improve farming practices used by integrating new production and management techniques. These results are in line with Yaseen et al. (2016) who found a positive correlation between years spent in school and technological usage such as ICT being adopted by farmers to improve their production. This means that farmers can be able to interpret the information they have and use it for decision-making than those with fewer years spent in school.

The study results found marital status positive and are statistically significant at 5%. This implies that married respondents are more likely to use ICTs for agricultural purposes. This suggests that a 1% increase in marital status will induce an increase in the likelihood of use of the ICT tool by 0.6. These results are in line with Tambo et al. (2019) and Nyamba and Mlozi (2012), which show that married people are involved in agricultural activities using ICTs such as mobile phones to access market and agricultural information as equated to their single counterparts.
Network coverage and interruptions have a negative coefficient and are statistically significant at 1%. This implies that there is a negative relationship between network coverage and interruption and ICT usage. This suggests that a 1% increase in network coverage and interruptions will induce a decrease in the likelihood of use of the ICT tool by 0.4. The majority of the farmers are struggling to use ICT due to network problems in pastoral areas where their farm is situated. The network coverage and interruptions have become a problem in South Africa recently which contributed significantly to reluctance in technology used by farmers.

The access to extension services was found to have a positive effect on ICTs and was statistically significant at 1%. This implies that an increase of 1% in extension services will induce an increase in the likelihood of use of the ICT tool by 0.5. This is important as having access to extension services means that you have knowledge of new farming techniques and inputs used to enhance livestock production. These results were in line with Tambo et al. (2019) that having access to extension services plays an imperative role in improving livestock production and use of innovation to the farm. This is primarily because an upsurge in extension services through the use of ICTs is likely to increase the movement of information distribution by youth. This could be endorsed by the fact that youth are the chief users of ICTs especially mobile phones to source information.

Member of farm organization has positive coefficient and is statistically significant at 5%. This means a 1% increase in household income will induce an increase in the likelihood of use of ICT tools by 0.2. Being a member of a farm organization is very beneficial to farmers as information is disseminated better in farmer organizations and members of those organizations obtain more knowledge about existing services than non-members. These results agree with Wawire et al. (2017) that belonging to farm organizations contributed definitely to the probability of using ICTs than non-adopters in enhancing their productivity and marketing.

Access to credit had a negative and was significant at 1%. This implies that a 1% increase in access to credit by farmers will decrease the likelihood of the use of ICT tools by 0.2. This is a challenge for livestock farmers as they rely on social grants and farm returns to operate the farm. The lack of financial support to farmers results in many farmers not using ICTs to enhance their farm productivity.

Electricity outage was negative and statistically significant at a 5% level. This means that there is an inverse relationship between ICT usage and electricity outage. This implies that a 1% increase in electricity outage by farmers will decrease the likelihood of the use of ICT tools by 0.9. This is the challenge for the country as the country is facing high failure in electricity supply and thus result in damaging many appliances. Livestock farmers are reluctant to use ICTs due to constant electricity outages. Smallholder livestock farmers are affected by electricity outages because depending on batteries and solar systems make it difficult for them to always have their phones working or to be able to watch TV any time of the day.

The family size was found positive and statistically significant at 5%. This implies that an increase in family size will yield an increase in the likelihood of the use of ICT tools by 0.6. This suggests that the more family size increases, the more people in the household are exposed to ICTs so that they can enhance their lives and farming through using ICTs. Having big family size is beneficial to the farmers as they can use some members of the family to train the farmers in using ICTs and to act as correspondents through ICTs as farmers busy work the farm.

5. Conclusion
The paper investigated factors affecting the usage of information and communication technologies by wool marketers in the Eastern Cape Province of South Africa. The use of ICTs facilitates the transition to agricultural food sustainability through the provision of innovative strategies to enhance agricultural outputs and connect food chain actors. The introduction of ICTs led to far-reaching changes affecting individuals, society, and the environment. The study reveals that livestock farmers
have adopted ICTs and enhanced their farm productivity extensively. Mobile phones, computers, and radios & televisions are the most frequently used and utilized. Farmers were constrained by a lack of financial support, network coverage, knowledge & information, and lastly, few programs aired on radios and television. In conclusion, socio-economic and institutional factors influence the use and adoption of ICTs by livestock farmers in the study area. Therefore, the study recommends that government and financial institutions do assist farmers with financial support so that they can be able to purchase relevant inputs such as ICTs to improve their productivity. The study recommends that policymakers and farm organizations address gender discrepancies in farming to enhance access and use of ICT tools for the agricultural transaction. The paper recommends the introduction of educational teaching of livestock farmers on using ICTs that can improve livestock farming in yielding higher returns and welfare of farmers. Policymakers must develop technologies aimed at taking care of older farmers as this age group is more dominating farming in Africa and must also encourage young people to partake in farming. It is further recommended that policymakers make farmer fields schools and training more often to promote maximum gain and utilization of technological knowledge and information that will lead to improved farming practices, increased productivity as well as an improved standard of living of the farmers.

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