# EVALUATION OF SMALL-SCALE GOAT FARMERS' PARTICIPATION IN THE AUCTION MARKET: A CASE STUDY OF POLOKWANE MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA

BY

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# ABSTRACT

South Africa's agricultural landscape is characterized by diverse livestock farming practices, with goat farming playing a crucial role in enhancing food security and rural livelihoods. Goats are cost-effective, easily raised livestock that significantly contribute to human nutrition. Despite that, Small-scale goat farmers in rural areas often struggle with low auction market participation due to limited access to assets and infrastructure. This kind of market holds immense promise to access broader markets, obtain fair prices for their produce, and foster sustainable livelihoods

The study employed a quantitative research approach and collected cross-sectional primary data from 73 small-scale goat farmers using a simple random sampling method. Face-to-face interviews were conducted with the farmers, and a questionnaire was utilized. The collected data was managed using IBM SPSS program version 29. Descriptive statistics, along with the Double-Hurdle and binary logistic regression models, were employed to analyze the study's objectives.

The study found that 28 small-scale goat farmers participate in auction markets, while 45 do not. Binary logistic regression model showed that household size, legal identification mark of goats, access to goat auction market information, and body condition score of goats are small-scale farmers' challenges in the auction market. The double-hurdle model found that age and body condition score affected small-scale goat farmers' decision to participate in auction markets. Factors such as marital status, household size, body condition score of goats, and access to an extension officer, household income level and availability of transport for goats to the auction market impacted participation.

Efforts should focus on supporting small-scale goat farmers to enhance their participation in auction markets through collaboration with government agencies and development organizations can help identify suitable auction markets and improve infrastructure. Tailored support programs should mitigate household size-related barriers, offering training and financial incentives. Extension officers play a crucial role in streamlining legal procedures and providing vital market information. Finally, addressing goats' health and nutrition ensures better market appeal, fostering sustainable growth in the sector.

KEY CONCEPTS

Small-scale goat farmers, goat, market participation, auction, Polokwane Municipality

# ACKNOWLEDGEMENTS

# DECLARATION

I, Malebati LV ▮▮▮▮▮▮ declare that the "Evaluation of small-scale goat farmer's participation in the auction market: a case study of Polokwane Municipality, Limpopo province, South Africa" is my own work. This mini dissertation has been submitted to the University of Limpopo for the degree of Master of Science in Agriculture (Agricultural Economics) only and it has not been previously submitted by me for a degree at this or any other university. All citations to other people's work that were included in this mini dissertation have been recognized and acknowledged with full citations.

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**Signature**

**09 February 2024**
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**Date**

# **DEDICATION**

Dedicated

To

Kutlwano Abigail Malebati and Moses Rapulana

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DALRRD         Department of Agriculture, Land Reform, and Rural Development

IBM SPSS       International Business Machines Statistical Package for the Social Sciences

NAMC          National Agricultural Marketing Council

R               South African Rand (currency)

# CHAPTER 1: INTRODUCTION

## 1.1    Background of the study

South Africa's agricultural landscape has long been characterized by diverse livestock farming practices, with goat farming playing a significant role in contributing to food security and rural livelihoods (Mbeki and Bahta, 2021). Goats are regarded as livestock that can be easily raised, tend to be cost-effective, and play a significant role in human nutrition (Csapó, 2019). Small-scale goat farming is traditionally important in rural areas, offering numerous advantages, such as lower investment costs, adaptability to varied ecological conditions, and the potential for income generation in resource-constrained settings (Ncube et al., 2022). Consequently, it has gained attention as a promising avenue for poverty alleviation and rural development initiatives, with access to viable markets being essential for sustainable growth.

The rise in goat product demand, attributed to factors such as rapid population growth, urbanization, and increased income levels, has led to the emergence of potential markets for goat products (Chimonyo and Mapiye, 2021). Goats are distributed across the country in Eastern Cape, Kwa-Zulu Natal, and Limpopo province, where they constitute the primary producers (Wyk et al., 2020). Limpopo, known for its diverse agricultural activities, including livestock farming, stands out as a vital region with a notable presence of small-scale goat farmers. The province is characterized by varied ecological conditions, ranging from semi-arid regions in the west to subtropical climates in the eastern parts (Maponya, 2021). Within Limpopo, small-scale goat farmers, often residing in rural communities within municipalities like Polokwane, play a crucial role in the local economy and food production.

The auction market serves as a platform connecting buyers and sellers, facilitating exchanges that uplift small-scale farmers and lead to higher incomes and sustainable livelihoods (Mbatha, 2021; Ndlovu et al., 2020). It plays a crucial role in ensuring sustainable growth and access to viable markets for small-scale goat farmers in the Polokwane Municipality, who are integral to the local economy and food production (Ndlovu et al., 2020). The market's pricing mechanisms, based on competitive bidding and transparency, enable small-scale farmers to receive fair

compensation for their products, despite challenges such as insufficient assets, infrastructure limitations, and high costs (Mbatha, 2021; Khoza et al., 2019). However, many small-scale farmers within South Africa, particularly those in distant regions with poor infrastructure and limited resources, are inactive participants in auction markets due to a lack of information and transportation amenities (Nwafor, 2020; Khapayi et al., 2018). This limits their ability to enter competitive markets, as they primarily focus on personal consumption and local sales, leading to a constrained market where few influential buyers dominate (Mapiye et al., 2019).

According to Nwafor (2020), numerous small-scale farmers within South Africa are presently inactive participants within auction markets. They often find themselves compelled to sell their final products at low prices even though they purchase inputs at high prices. This is due to a lack of information about transaction venues, they often end up as price takers (Khapayi et al., 2018). These are small-scale farmers who reside in distant regions characterized by poorly maintained road networks and market infrastructure. Additionally, Khapayi et al. (2018) highlighted that small-scale farmers lack proper transportation and storage amenities, have limited access to extension agents, and face deficits in skills and information. These circumstances result in elevated costs for market participation. Their primary focus is on producing for personal consumption and if they have a surplus, they then sell within their local communities without making significant efforts to enhance the value of the existing primary agricultural products (Khoza et al., 2019). The researcher further stated that this behavior in business results small-scale farmers into limited surplus generation preventing them from entering competitive markets, leaving them exposed to significant risks and transaction expenses. Consequently, they remain confined to a market where few influential buyers dominate, rendering the market non-competitive.

## 1.2 Problem statement

In South Africa, goat farming has long been recognized as a crucial contributor to food security and rural livelihoods, especially for small-scale farmers (Mbeki and Bahta, 2021; Csapó, 2019). Despite the advantages it offers, including lower investment costs and adaptability to varied ecological conditions, small-scale goat farming faces challenges in accessing viable markets

for sustainable growth (Ncube et al., 2022). Limpopo Province, known for its diverse agricultural activities, stands out as a vital region with a significant presence of small-scale goat farmers (Maponya, 2021). However, the informal and low-level marketing of goat products in South Africa, compounded by poor involvement in legitimate markets like auctions, impedes the sector's development, creating a bottleneck in the flow of agricultural products from producers to consumers and hindering the potential economic impact of goat farming on rural communities.

Although auction markets play a crucial role in connecting small-scale farmers to buyers and facilitating fair compensation for their products, many farmers, particularly in remote rural areas, are inactive participants due to a lack of information and transportation amenities (Nwafor, 2020; Khapayi et al., 2018). This limits their ability to enter competitive markets, perpetuating a cycle of limited surplus and constrained market access (Mapiye et al., 2019). Additionally, high expenses and weather-related issues further hinder farmers' participation in auction markets, exacerbating the existing challenges faced by small-scale producers and widening the gap between rural and urban economies.

Furthermore, there is a dearth of comprehensive studies focusing on the dynamics of small-scale goat farmers' participation in auction markets in South Africa, particularly within the context of Limpopo Province. Existing research often overlooks the unique challenges and opportunities faced by these farmers, neglecting the broader socio-economic and cultural influences that shape their market participation (Barua et al., 2021; Majiwa et al., 2022). Addressing these gaps is crucial for formulating effective policies and interventions to support small-scale goat farmers and promote sustainable rural development and poverty alleviation in the region. Therefore, this study aims to fill this research gap by comprehensively examining the factors influencing small-scale goat farmers' participation in auction markets within the Polokwane Municipality, Limpopo Province. By analyzing the decision-making processes, market strategies, and livelihood impacts of participation, this research seeks to provide valuable insights for policymakers, agricultural stakeholders, and development organizations to improve market access and enhance the economic well-being of small-scale goat farmers.

## 1.3 Rationale

Small-scale goat farming has gained significant momentum in South Africa, particularly in Limpopo Province, due to its potential to contribute to rural development, poverty alleviation, and food security (Myeki and Bahta, 2021). As a critical component of the agricultural sector, small-scale goat farming has the capacity to empower local communities and stimulate economic growth. In this context, engaging in auction markets shows great potential for gaining access to wider markets, securing equitable prices for their produce, and promoting sustainable livelihoods. However, despite the growing importance of the goat industry and its connection to auction markets, there is a notable gap in empirical research that specifically examines the dynamics of small-scale goat farmers' participation in these markets. This research topic seeks to address this gap and provide a comprehensive evaluation of the factors influencing farmers' engagement in auctions and the subsequent impact on their economic well-being and social empowerment.

Over the course of time, multiple forms of research have been undertaken regarding the involvement of small-scale goat farmers in markets. Investigations by Chipasha *et al*. (2017), Barua *et al*., (2021), and Majiwa *et al.,* (2022) delved into the market participation of small-scale goat farmers. In this study, the literature on this subject will be shifted from focusing on the market broadly to being specific by analyzing the goat auction market. This is supported by Poudel (2021) research which revealed that live goats for meat and milk purposes were highly willing and able to be supplied by small-scale farmers in organized platforms of sellers and buyers. Literature on Sub-Saharan Africa has highlighted the difficulties that small-scale goat farmers face when they try to make sales at goat auction markets. These include inadequate market access, farmers' inability to afford market entry expenses caused by public services, and weak regulations, which increase transaction costs and significantly impact decisions about auction market participation, where Akintobi and Achu (2020) provided evidence. In addition, Rensburg *et al*., 2022 revealed that the lack of poor market information has an impact on the small-scale goat producer's participation in auction market.

Small-scale farmers in South Africa, including those in Polokwane Municipality, often face challenges of access to markets and price fluctuations. In 2002, a study conducted by Maesela

and colleagues (2019) unveiled the auction marketing efficiency of goats in Limpopo Province. The study also found that the lower marketing margins were associated with the producers' market choice. The study used the descriptive statistics and Probit regression model to evaluate the goat market's dynamics. The researchers revealed that the live weight, breed, and goat's age are the factors that affect the decision-making process of selling goats. This will help the producers plan their live goat sales and maximize revenue. These small-scale goat farmers have strongly influenced social and economic factors. Aside from being a source of food, goats are significant in local communities' production (Nenadović *et al*., 2021). Although the authors of this study acknowledge the importance of marketing efficiency and the choice of the marketplace for goat producers, they didn't consider the various factors that affect the small-scale goat farmer's participation rate in goat market types.

Numerous research endeavors have explored market involvement within livestock husbandry, encompassing cattle (Bk *et al*., 2021; Teferdegn *et al.,* 2020). Nonetheless, a significant portion of these studies have primarily concentrated on the broader market context without delving into specific market types. Consequently, there exists limited insight regarding the engagement of small-scale farmers within the auction market framework in the South African scenario. This research aims to bridge this gap by comprehensively examining the patterns of participation by small-scale goat farmers in auction markets within South Africa. This is done by conducting a detailed case study in Polokwane Municipality, Limpopo Province. This research will provide context-specific findings that can be compared to similar regions and contribute to a deeper understanding of the linkages between auction markets and small-scale goat farming in South Africa.

The results have the potential to shape future strategies for sustainable rural development, poverty reduction, and food security initiatives while advancing the broader goals of the agricultural sector in the country. This effort will contribute towards producing substantiated information for policymakers, enabling them to recognize the persisting disparities within South Africa's auction market and emphasizing the necessity for re-evaluating current policies. Therefore, the study provided new empirical data regarding the participation rate of small- scale

goat farmers in the auction market and the factors affecting their participation within the Polokwane Municipality.

## 1.4 Scope of the study

### 1.4.1 Research aim

To evaluate small-scale goat farmers' participation in the auction market in the Polokwane Municipality.

### 1.4.2 Research objectives

i. To identify and describe socio-economic characteristics of small-scale goat farmers in Polokwane Municipality.

ii. To determine the participation rate of small-scale goat farmers in the auction market in Polokwane Municipality.

iii. To identify and analyze factors affecting the small-scale goat farmers' participation in the auction market in Polokwane Municipality.

### 1.4.3 Research Hypotheses

i. Small-scale goat farmers are not participating in the auction market in Polokwane Municipality.

ii. There is no relation between identified factors of small-scale goat farmers and their participation in the auction market in Polokwane Municipality.

## 1.5 Limitations of the study

The study originally aimed to include 331 small-scale goat farmers, but logistical constraints limited the sample to 73 participants. This adjustment was necessary due to limitations in time and resources. Interviews were conducted with three to four small-scale goat farmers from each of the 21 areas within the Polokwane municipality.

## 1.6 Key concepts

### 1.6.1 Goat

According to Ganbold *et al*. (2020), the domestic goat, scientifically known as Capra aegagrus

hircus, represents a subspecies of C. aegagrus that has been tamed from the wild goat native to Southwest Asia and Eastern Europe. Archaeological findings suggest that its initial domestication occurred around 10,000 calibrated calendar years ago in Iran (Ganbold *et al*., 2020). Goats serve as multifunctional livestock in the majority of rural households, where they are utilized for their milk and meat (Nwafor *et al*., 2020). This study aligns with the definition that goats are considered livestock predominantly accumulated in rural areas. They play a vital role in the economic and social livelihood of households by contributing to the sustenance of living standards through the production of meat and milk. Additionally, goats serve as a source of income through sales, highlighting their importance not only as a practical resource but also as a cultural and economic asset in traditional ceremonies. Goats, including various breeds such as Indigenous Veld Goats, Savanna, Boer, Nubian, and Saanen, are commonly reared (Ndlovu *et al.,* 2020).

## 1.6.2 Small-scale farmer

The definition of small-scale farmer varies widely ranging from elements including family labor participation, food production technology, size, and economic influence (Côté-Boileau *et al*., 2019). According to Queenan *et al*., (2020), small-scale farmer is one who is operating under very little land (usually around 0.4 – 5 hectares) where the production is for own consumption and for the market. In less developed countries, small-scale farming is regarded as a vital approach to improving food security and sustainable food systems because it uses fewer industrial inputs. This definition from Côté-Boileau *et al*. (2019) is chosen because it accurately describes the focus of the study. According to this definition, a small-scale farmer, as portrayed in the research, operates on less than a hectare of land in rural areas. These farmers play a crucial role in enhancing food security and sustaining the food system within households and their communities.

Several academics and researchers make efforts to delineate the category of smallholder farmers in South Africa (Manyakanyaka *et al*., 2022; None *et al*., 2021; Manfouo and Fintel, 2022). According to the None *et al*., (2021), smallholder farmers are identified as those who cultivate for both personal consumption and the market, subsequently deriving sustained income from their agricultural enterprises, which contribute to their family's financial resources.

These farmers possess the capacity to enlarge their undertakings and transition into commercial farming, given access to comprehensive support.

### 1.6.3 Auction

An auction refers to a method of exchanging goods or services through the presentation of bids, the assessment of bids, and ultimately the transfer of the item to the bidder offering the highest price or acquiring the item from the bidder suggesting the lowest price (Al-Qaheri *et al.*, 2022). Al-Qaheri *et al.,* (2022) additionally emphasized that the open ascending price auction stands as perhaps the most prevalent auction format and has been utilized across time, involving an auctioneer declaring prices and bidders presenting their bids verbally or electronically. This research has embraced the description outlined by Al-Qaheri *et al.*, (2022) as it portrays the auction method being used in the study, where bids are presented, and the item is transferred to the bidder with the highest price.

### 1.6.4 Auction market

An auction market is a type of market where goods, services, or assets are bought and sold through competitive bidding among multiple buyers and sellers (Lestari et al., 2022). This represents a form of primary market characterized by competitiveness and officially established market structures that provide moderately competitive market rates determined by the interplay of supply and demand forces. In this setup, farmers realize favorable returns on their investments after accounting for the auctioneer's commission. In an auction, potential buyers place bids on the items being auctioned, and the highest bidder wins the item and pays the amount bid. Auctions can be conducted in various formats, such as live or in-person auctions, online auctions, sealed-bid auctions, or ascending/descending bid auctions, depending on the specific rules and procedures governing the event (Majid and Adjie, 2022). Understanding the specific modalities of goat auction markets in Limpopo Province and South Africa is crucial for comprehending their operational mechanisms and their implications for the participation and economic outcomes of small-scale goat farmers. The chosen definition by Lestari et al. (2022) aptly describes the competitive nature of these markets, highlighting the exchange of goods facilitated through bidding processes and the diverse auction formats employed.

### 1.6.5  Market participation

This research will adopt the definition proposed by Akouegnonhou and Demirbaş (2023), which describes market participation as the integration of farmers into agricultural goods' input and output marketplaces, aimed at increasing their revenue through sales. Farmers have the option to engage in the market as either seller of their outputs or buyers of inputs, signifying that market participation comprises both demand and supply aspects, influenced by breeding practices. The reason for selecting this definition of Akouegnonhou and Demirbaş (2023) is that this is the concept which explains what is depicted in the study where market participation is the action of taking part in transaction of goods and services.

## 1.7  Outline of the study

This section serve as the research structure description reflecting the layout from chapter one till five as follow: Chapter one which provides the background of the study, the problem statement, aim of the study, objectives, hypotheses, motivation of the study, limitations of the study, and key concepts; Chapter two entails literature review of the study by specifically focusing on the review of national and international literature on the participation to goat auction market; Chapter three which provides the research methodology outlines the method used to conduct the study and description of analytical techniques used; Chapter four gives the results and discussion of the study, presenting empirical results and further discussing the results observed in the study; Chapter five presents the research summary, conclusion, and recommendations based on the study the findings. Lastly, the list of references and appendices are presented.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Introduction

This chapter presents the review of national and international literature on goat auction market. The study elaborated on the auction market which is exposed on majority of small-scale goat farmers were challenges such as limited financial resources, feed shortage, diseases and parasites, and the literature review. The literature review emphasized the methods used in previous searches on a related topic, the study's conclusions, and suggestions based on those conclusions.

### 2.2 Importance of auction market

The importance of auction markets, with their operational modalities extending to online platforms, is underscored by several key elements. Bidding processes, a common feature in these markets, involve potential buyers competing for goats, with the highest bid securing the transaction (Sehar & Oyekale, 2020). Transactions take place in designated spaces, including physical setups like market yards or auction houses and virtual platforms for online participation. Online auctions introduce a digital dimension, allowing remote buyer involvement (Nwafor *et al*., 2020). The auctioneer, whether physically present or virtual, plays a pivotal role in facilitating the bidding process. Transactions, whether conducted in-person or online, are meticulously recorded, detailing buyer information and payment specifics, with immediate payment typically required. Both physical and online auctions adhere to regulations ensuring fair practices, although specific practices may vary based on local contexts and regulations governing goat auctions in specific regions (Nwafor *et al*., 2020).

For an extended period, the auction market has played a significant societal role in agricultural communities (Nugroho, 2021). According to the researcher, auction markets serve as venues where farmers with common backgrounds convene, exchanging information, engaging in rituals, and sharing notions of masculinity, thereby forging a collective identity. However, Brscic *et al*. (2021) found that only a limited number of empirical investigations delve into their functions extending beyond the mere trade of livestock. The arrangement of livestock auction markets and the interactions occurring therein probably has contributed to the persistence of behavioral norms, particularly those linked to displays of masculinity and resilience.

Over the past two decades, auction market venues have undergone significant transformation, challenged deeply ingrained norms and promoted fresh conduct due to increased community seeking assistance (Nugroho, 2021). An investigation by Nye *et al.* (2022) disclosed that around 18 percent of surveyed auction markets provide some form of primary healthcare service on-site. Such changes within the auction market domain align with broader societal shifts observed by Farhall and Rickards (2021). The media has also played a role in influencing changes in men's perceptions about seeking assistance (Mijares *et al.*, 2021). While the act of seeking help among farmers has received some scholarly attention, the upsurge in on-site provision of primary healthcare services within livestock auction markets and its influence on instigating new behavioral norms among farmers remains inadequately explored.

Goat auctions are an integral component of South Africa's livestock sector, fulfilling a crucial function by facilitating the buying and selling of livestock, enabling goat farmers to engage with a platform that promotes networking (Chipasha *et al.*, 2017). These auctions hold particular significance for emerging farmers with limited livestock to trade, offering them a platform even in the absence of the advantages held by larger commercial farmers. Auction markets play pivotal roles within both the livestock industry and rural communities (Mbatha, 2021). According to Mbatha (2021), auction markets serve as mechanisms for instigating competitive bidding, ensuring optimal prices for livestock, and participation in the more prominent markets is associated with prestige in the field. Moreover, these auction markets serve as significant social gatherings within the farming community. To effectively implement appropriate monitoring and restrictions concerning trading at auction markets, it becomes imperative to evaluate their current potential role in the transmission of infections within the livestock industry.

## 2.3 Review of international literature

According to Donkor *et al.*, (2021), auction market is crucial in driving agricultural growth and sustainable development. The absence not only impacts local farmers, but it also hampers the overall potential of the entire nation. Donkor *et al.*, (2021) further asserted that the escalating demand for goats in both local and international markets, coupled with the improvement of transportation infrastructure and the knowledge amassed by small ruminant keepers, present tangible opportunities to augment the sector's contributions.

Based on research by Girma *et al., (*2023), traders (both urban and rural) who travel between villages to purchase goats are the main players in the live goat market. The study also demonstrated how end users' religious and cultural customs influence the live goat trade in Southwest Ethiopia. Furthermore, the survey showed that most farmers in the districts of Choma and Lusaka sell their live goats to final consumers by way of middlemen (Girma *et al*., 2023). Ngwako *et al*., (2021) found that smallholder producers participate in the market differently because of these factors: transaction costs; access to productive assets; infrastructure integration into local and international markets; and institutional frameworks.

## 2.3.1 An African perspective

Throughout the last decade, extensive research has been conducted on the difficulties faced by goat producers throughout Africa. A review of the literature reveals the ongoing difficulties that goat farmers who depend on farming for their livelihoods face. Several obstacles were found in research by Obinna and Onu (2021) that focused on goat husbandry in the Nigerian state of Abia. These included problems like high animal mortality rates, poor market information availability, high processing costs, and poor animal quality. As a result, even with the large number of goats in the area, the productivity per goat unit and the sector's contribution to the national economy showed relative fragility.

Research conducted by Conz *et al., (*2022) revealed that smallholder goat keepers in Inhorasso, Mozambique, had a desire to increase the size of their herds; however, this ambition was hindered by the inadequate market. Their research also brought to light a widespread pattern seen in many African countries, namely that insufficient information sharing between merchants and producers made it more difficult for producers to match their output to the market's demands for quantity as well as quality. According to Zewdie *et al.,* (2019), insufficient government investments in marketing resources help for goat industry characterize the goat meat market in the Western Lowlands of Ethiopia.

## 2.3.2 Goat Farming Challenges in Africa auction markets

Research conducted across the African continent has underscored the significance of auction markets within formal market structures and their accessibility for smallholder farmers in

fostering the advancement of goat farming (Girma *et al*., 2023). The research conducted by Ha and colleagues (2020) in Africa revealed that farmers are frequently dissuaded from value addition due to the lack of access to auction markets, which provide stable price and demand projections. This remains valid even in the face of governmental support programs or interventions. Insufficiently efficient markets and production planning have led to limited production, which in turn has limited consumption (Girma *et al*., 2023). According to Obinna and Onu (2021), the restricted availability of auction marketing systems for goat production and its derivatives acts as a constraint to commercial goat farming. This, in turn, leads to an underestimation of goats' potential contribution to both rural and national economies.

The location of small-scale farmers is mostly situated in marginalized areas where markets have been organized and trading or retail networks have been formed. This deficiency impedes the ability of goat farmers to effectively transport their animals to accessible slaughter facilities (Ouedraogo, 2018). For instance, in South and Southeast Asia, the primary methods of transporting goats to markets were on foot or using bicycles (Singh *et al*., 2020). The researcher further observed that nearly 97.5 percent of goat farmers undertook journeys of up to 10 kilometers on foot, while the remaining 2.5 percent covered distances exceeding 10 kilometers. Consequently, communal farmers often found themselves resorting to informal sales methods where pricing lacked transparency, thereby engendering ambiguity in pricing and demand. Alternatively, farmers opted to sell their livestock to traders or participate in periodic auction events.

Goats and the goods made from their flesh generally traveled through middlemen in the value chain from producers to final markets, while financial transactions happened in the other direction, returning funds from end markets to producers throughout the value chain. This dual directional flow of information was identified by (Nyakwawa *et al*., 2022). Nevertheless, Nyakwawa *et al*., (2022) investigation unveiled challenges related to transportation infrastructure and a noticeable scarcity of information flow. These issues were accentuated by the prioritization of more prevalent agro-pastoral activities, thereby relegating goat rearing to a secondary role within the spectrum of production endeavors. Additional research has asserted that the absence of advanced agricultural technologies was the primary impediment thwarting

the formalization of the goat meat market (Molla *et al*., 2022).

i.    Feed shortage

As outlined by Molla *et al*., (2022), Ethiopian agricultural practices encountered limitations due to the absence of implemented methods for feed preservation. These techniques include the storage of excess feed by means of ensilage or haylage, which entail the drying of hay and the storage of fodder, respectively. Following that, these forage forms are supplemented during times of decreased rainfall (Molla *et al*., 2022). Within the context of communal farmers, the goats were predominantly sustained by grazing on available vegetation, making them susceptible to fluctuations in seasons. During the dry season, these small-scale farmers often relocated their herds based on vegetation availability; however, the quality and availability of such vegetation experienced seasonal variation (Karous *et al*., 2021). The failure to apply feed preservation techniques led to overgrazing and bush encroachment, which in turn caused differences in the quality of feed resources that were available.

ii.    Diseases and parasites

Ngarava and Mushunje (2019) pointed out that in the northern communal areas of Namibia, goat marketing encountered significant challenges attributed to traditional valuations of the animals, disease and parasite prevalence, frequent droughts, and the absence of marketing infrastructure. A crucial indicator for evaluating the effectiveness of goat farmers is the death rates of both young and mature goats. In instances where farmers faced financial constraints, their goats, especially the vulnerable young kids due to their delicate immune systems, were prone to diseases and parasites. Consequently, smallholder farmers are confronted not only by challenges related to informal markets, financial limitations, and climate change, but also by the burden of diseases and parasites. Further indicators of inadequate health management resulting in weight loss (Das *et al*., 2022). Across most communal farms, livestock were exposed to contaminated water sources, increasing their susceptibility to infectious agents (Shrivastava *et al*., 2020).

iii.    Poor breeding techniques

Research findings have highlighted the failure of numerous livestock breeding programs due

to issues related to adaptability, deficient performance data recording, and the identification of desirable traits (Ndlovu *et al*., 2020). Challenges of inbreeding and unregulated mating are prevalent concerns within communal areas. The absence of organized selection initiatives and a lack of defined breeding seasons contribute to this predicament. Scientific investigations underscore the vital role of utilizing appropriate and well-suited goat breeds within any production system (Girma *et al*., 2023). Indigenous goat breeds are the primary choice for many communal farmers on the continent. The rationale behind this preference is that, despite their lower production performance compared to exotic species, native breeds have shown to be more adapted to challenging environmental conditions (Oguntunji *et al*., 2020). However, these criteria are not geared towards commercial success and thus yield suboptimal outcomes. Moreover, the lack of structured breeding practices has led to issues such as inbreeding, stunted growth rates, and an elevated incidence of stillbirths (Rumanta *et al*., 2020).

## 2.4   Review of national literature

According to goat production statistics, South Africa have approximately six million goats mostly found in three provinces: Kwa-Zulu Natal, Limpopo, and the Northern (Maponya, 2021). According to extensive study, non-commercial small-scale farmers and households own and care for a substantial share (63%) of South Africa's goat population, which is primarily made up of indigenous veld goats (Tsvuura *et al*., 2021).

### 2.4.1.  Goat Farming Challenges in South Africa auction markets

The marketing of livestock presents a complex system influenced by a multitude of factors affecting the sales process (Akouegnonhou and Demirbaş, 2023). Akouegnonhou and Demirbaş (2023) also emphasized that deficiencies in infrastructure, transportation, financial resources, and limited access to market information led to elevated marketing costs. These elevated costs hinder small-scale livestock farmers from entering formal markets and constrain their potential for devising successful strategies. The study conducted by the National Agricultural Marketing Council (2020), examining the potential of South African goat industry, revealed that most rearing is done for subsistence.  According to NAMC (2020), most goat transactions in South Africa transpire through private interactions within the informal market. Building strong market ties and including small-scale goat farmers meaningfully in the value

chain are essential to improving productivity and efficiency (Nyam *et al.*, 2021). Furthermore, (Nyam *et al.*, 2021) added that the advancement of smallholder goat farming remains an underdeveloped realm, despite the recognition that expanding both formal and informal markets can open doors for impoverished communities. Numerous factors influence the engagement of small-scale farmers in auction markets, falling under the categories of institutional, technical, and socio-demographic aspects. The identification of constraints encountered by small-scale farmers in their involvement within auction markets holds paramount importance for this study:

i.    Institutional aspects

Institutional factors encompass elements such as transaction costs, contractual setups, policy inadequacies, and the flow of market information. Numerous investigations conducted in developing countries' rural economies have verified that smallholder farmers confront challenges regarding both market information availability and formal contractual agreements, inhibiting their full participation in the market. Ngwako et al., (2021) found that these circumstances give rise to elevated transaction costs, which may result in farmers either ceasing their market engagement or opting for informal market participation.

Khapayi et al., (2018) found different factors, including market knowledge, ability to grade and adhere to standards, social connections, contractual agreements, and traditional practices, significantly impacted household marketing behaviour of small-scale farmers in Eastern Cape Province. Most farmers have abstained from market involvement due to inadequate market information, lack of proficiency in grading and standards, and absence of contractual arrangements. The study also showed that a small percentage of farmers received visits from extension agents who gave them information about new and improved varieties as well as market availability, which improved their knowledge and expanded their alternatives. This highlights the differences in the services that farmers in rural areas receive.

iii.    Technical aspects

Technical factors encompass elements that facilitate cost-effective access to market inputs and outputs and enable market diversification. Organization, laws, and technology

developments are some of the common elements that affect these factors (Ali et al., 2020). They include things like storage capacity, availability of extension services, telephone networks, road infrastructure, ownership of household assets, and transportation facilities. Many small-scale farmers in South Africa reside in remote regions characterised by limited road infrastructure and insufficient facilities for both storage and transportation. Moreover, they continue to have limited ability to raise the value of their produce (Rajkhowa and Qaim, 2021).

In a study published in 2018, Khapayi et al., looked at the variables impacting smallholder farmers' market involvement in peri-urban and rural settings. The results showed that this discrepancy resulted from elements that affected rural farmers' sales, such as the distance between the farm and the market, a lack of market knowledge, and bad road conditions affect them. These results were confirmed by Rahayu and Riyanto's (2020) study, which discovered that having a media source such as radio etc. improved dispersal market information and help households decide to participate in Zimbabwe's soybean market.

iii.    Socio-demographic aspects

The sociodemographic elements that impact smallholder farmers' participation in markets include things like the head of household's age, marital status, size of the household, source of labour, level of education, and gender. Women are the primary agricultural supervisors in rural areas, where they actively participate in subsistence farming (Nguyen et al., 2018). They frequently take up the duties of running complex families, making labour contributions to the agriculture industry, and pursuing a variety of economic options. However, cash crops, which are produced to generate income tend to be grown by male farmers while female farmers predominantly focus on subsistence crops which are intended for household consumption (Savari et al., 2020).

Farmers' participation in markets is impacted by their marital status in a variety of ways. Marital status was found by Harpina et al., (2020) to be a significant factor of market activity, with a positive and significant influence in Enrekang District. Donkor et al. (2021) results contradicted although the variable was found significant, but the results revealed unfavourable correlation between market participation and married status. According to Andaregie et al., (2021), 80%

of married farmers in Nigeria participated in market activities, whereas the remaining 20% did not. Considering the challenges farmers face, the consistent results from various research highlight the need to initiate training programs to support farmers' involvement in markets.

The accumulation of the limitations leads to elevated transaction costs, effectively thwarting farmers from reaping substantial benefits from their trading endeavours and subsequently dampening their enthusiasm for engaging in marketing activities. The majority of smallholder farmers work in unofficial production systems, depending on established social networks and channels to help sell their output. Mbatha (2021) emphasized that these informal channels cater to over 90% of farmers' essential needs. Within this context, most smallholder goat farmers tend to conduct their goat sales through informal means, particularly during festive periods like December and Good Friday (Nyakwawa et al., 2022). Most of their trading activities transpire within the community, involving exchanges among peers of similar social status and individuals within their limited accessibility range.

## 2.1   Chapter summary

Based on studies conducted in different nations, this review of the literature has given a general overview of goat farming in South Africa and throughout Africa. A thorough examination of the difficulties faced by small-scale goat producers throughout the continent, and particularly in Africa, was also included, along with an emphasis on the significance of the auction market in findings light.

# CHAPTER 3: RESEARCH METHODOLOGY AND ANALYTICAL PROCEDURES

## 3.1 Introduction

The chapter outlined research methodology which provided information on the research techniques that were employed to gather information and thoroughly examined the variables taken into account in this study. The first section presented information on the study area, followed by data collection tools, and lastly, provided details on the analytical techniques that were employed to address the objectives of the study.

## 3.2 Study area

The area of focus for this study is Polokwane Municipality, situated in the Limpopo Province of South Africa, forming part of the Capricorn District Municipality. This municipality shares borders with neighboring local municipalities such as Waterberg and Mopani. Spanning an area of 3,775 km2, Polokwane Municipality stands as the largest metropolitan area in the province, encompassing 38 wards and serving as a major economic center. The municipality includes diverse regions, including Bjatladibja Dikolobe, Ga-Dikgale, Ditlou Machidi, Ga-Mashashane, Maja, Makgoba, Mankoeng, Mankweng, Mixed TA, Mojapelo, Molepo, Moletji, Moloto Solomon Kgabo, Mothiba, Pietersburg Part 1, Pietersburg Part 2, Seshego Part 1, Seshego Part 2, Thabamoopo, Tholongwe, and Turfloop.

In Polokwane Municipality, smallholder farmers actively engage in goat farming, rearing various breeds including indigenous veld goats and the Savanna breed, for both meat and milk production despite facing challenges such as limited resources and infrastructure. Nonetheless, they benefit from convenient market access due to the municipality's strategic location near Polokwane's fruit and vegetable markets. The demographic diversity of the municipality, predominantly comprising Northern Sotho, Tsonga, and Afrikaans speakers, adds complexity to understanding the dynamics of goat farming in this unique context. Notably, weekly goat auctions are conducted in Pietersburg (Polokwane) every Tuesday, where sellers assess available goats at their location and ensure their safe transportation to the venue. Before the auction commences, goats undergo tattooing, branding, and are loaded in ascending order. Buyers are informed in advance about the available goats and

must register before bidding on specific lots.
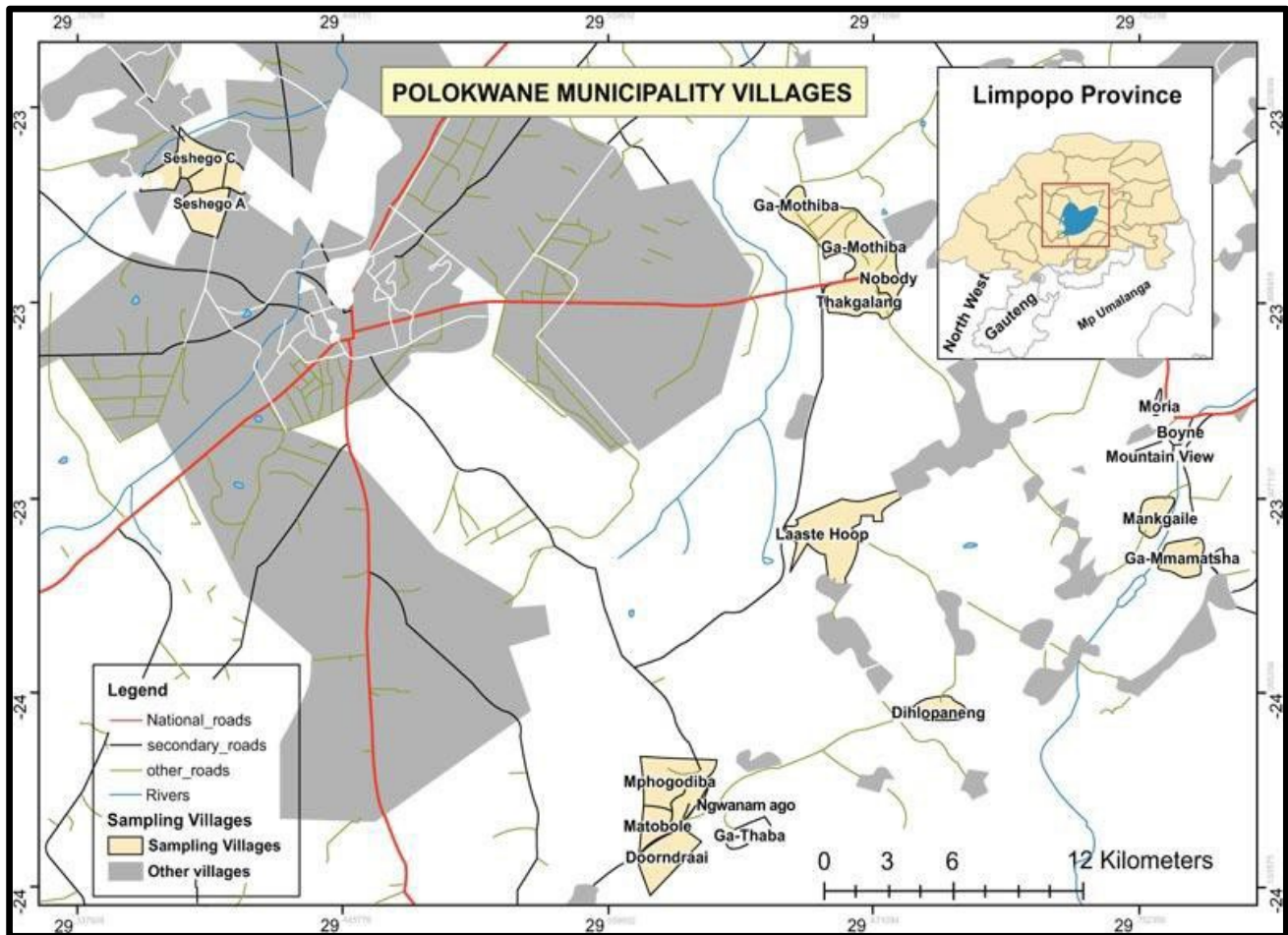
Figure 3.1: Map of Polokwane Municipality

## 3.3   Data collection

This research utilized primary cross-sectional data obtained through structured questionnaires. The structured questionnaires were used to collect primary cross-sectional data from small-scale goat farmers, selected through a combination of simple random sampling and stratified random sampling techniques (Kihoma et al., 2021). According to Güven and Uyulgan (2021), a cross-sectional survey is an observational study that uses data collected at a particular moment. It does not use a variety of complication-causing variables when processing the data.

## 3.4 Sampling

The study utilized stratified random sampling to select participants from various areas within the population of 2400 small-scale goat farmers in the Polokwane municipality. The use of stratified random sampling allowed for a more accurate representation of the diversity within the population of small-scale goat farmers, ensuring that participants were selected from various regions or categories based on specific criteria. Within each stratum, random sampling techniques were used to select the farmers to be interviewed, ensuring that the sample is representative of the entire population.

The sample size was determined following Kothari (2004) formula:

$$n = \frac{z^2 . p . q . N}{z^2 . p . q + e^2 . (-1 + N)}$$

Where n = sample size, z = alpha value of p < 0.05 for statistical significance, e= an acceptable error of estimates (5%), p= sample distribution of the target population (5%), and N= population size.

$n$ = (1.96)$^2$ × 0.05 × (1 − 0.05) × 2 400) / (1.96)$^2$ × 0.05 × (1 − 0.05) + (0.01)$^2$ × (-1 + 2 400)

$$n = 331.35$$

Therefore, the sample size for the study is 331 small-scale goat farmers. Fifteen to sixteen small-scale goat farmers were interviewed in each of the 21 areas of the Polokwane municipality.

## 3.5    Analytical techniques

The study analyzed the data with descriptive statistics, binary logistic regression, and the double-hurdle model using IBM SPSS program version 29.

### 3.5.1    Descriptive statistics

The first objective of the study was analyzed using this analytical technique. According to Anggraini *et al*., (2021), descriptive statistics are a summary statistical instrument that can be used to measure the frequency and central tendency of various factors. This type of statistical tool can be used to measure the variation in various parameters such as the standard deviation, variance, and inter-quartile range.

## 3.5.2   Double-hurdle model

Double-hurdle model was utilized to estimate small-scale goat farmers' auction market participation rate using two equations (second objective of the study). In a hurdle model, variables are modelled using two processes considering the probability of achieving a value of 0 and non-zero values.  In this study, percentage was used as a unit of measurement of rate. Cragg's model (1971) has been used for both stages of estimation of participation rate of small- scale farmers in auction market where they are assumed to first either participate in auction market or not and number of goats sold by the small-scale goat farmer at auction market in 2022 (quantity sold at auction market). This model allows non-participation of the sample to be considered; that is, small-scale goat farmers who sold 0 number of goats at auction market in 2022.


Model Specification

The double-hurdle model first went through a stage where a dependent variable equation was computed using the probit model as described below. This method helped to predict the likelihood that a small-scale goat farmer will participate in the auction market. The probit model considered the clustering of zero values to estimate the likelihood of a small-scale goat farmer engaging in the auction market.

First stage: Auction market participation equation is as follows:

$Y_i = \beta_i X_{i,} k + U_i$………………………………………………………………………………. (1)

$Y_i = 1$, if $Y_i > 0$, $E_i = 0$, if $Y_i \leq 0$,

Where $Y_i$ represents a dummy variable where 1 if a small-scale goat farmer participates in the auction market and 0 if not.  $X_i$ is the random variable's vector, k is the number of independent variables, $\beta_i$ explanatory variable coefficient vector and $U_i$ is the error term. The objective of the regression was to estimate the actual rate of goat farmers participating in the auction market in 2022

Additionally, the second aspect of this hurdle pertained to the frequency with which small-scale goat farmers visited the auction market to sell their goats during 2022.The model was adjusted to accommodate the truncation of lower values, with the goal of gauging how participation rate influence goat's quantity goats sold. The outcome of the model was used

for this stage where it was estimated using truncated normal regression model for the intensity or quality of participation in auction market where sample has been truncated for dependent variable will consider response of more than 0 number of goats sold at auction market in 2022.

Second Stage: Quantity of goats sold at auction market in 2022 equation:

The second stage of the double hurdle Tobit model aims to analyze the determinants of the Number of goats sold by the small-scale goat farmer at auction market in 2022. The equation for this stage is represented as:

$D_i = \beta_0 + \beta_1X_1 + \beta_2X_2 + ... + \beta_nX_n + U_i$.………………………………………………………………. (2)

Where: $D_i$ represents the number of goats sold by the small-scale goat farmer at auction market in 2022. $X_1$, $X_2$,…, $X_n$ are the independent variables influencing the number of times farmers sold goats. $\beta_0$, $\beta_1$, $\beta_2$…, $\beta_n$ are the coefficients associated with the independent variables. $U_i$ represents the error term capturing unobserved factors influencing the number of goat sales.

To compare the outcomes of two models, the study used the log-likelihood function, which is expressed as:

$$LogL = \sum In\left[(1 - §Zi\ \tau)\left(\frac{Xi\vartheta}{\omega}\right)\right] + \sum In\left[§(Zi\ \tau)\frac{1}{\omega}\varsigma\left(\frac{yi - xi\vartheta}{\omega}\right)\right]$$………………………………….……(3)

Where § and ς represents standard normal likelihood and weight models, accordingly, $Z_i$ and $X_i$ portrays probit model regressors. Additionally, the truncated model, accordingly, τ, ω, and $\vartheta$ are parameters to be estimated. Corr (ui, Ei) = p. Unobserved factors affecting auction market participation may also influence the number of times small-scale goat farmers sold goats at the auction market.


3.5.1 The binary logistic regression model

The kind of regression model which the study used is the binary response model, in which the dependent variable, Y, is a binary random variable with two possible values: zero and one (Balta and Topal, 2018). In this research, the binary dependent variables for auction

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market participation are twofold: 1 if small-scale goat farmers engage in the auction market and 0 otherwise. Supported by (Gebrie and Dessie, 2021), the outcome of the response was estimated using logistic model using logistic regression to estimate the coefficients in the linear combination. This statistical model is intended to forecast the likelihood that an event will occur by calculating the log-odds of that occurrence through a linear combination of independent variables. As such, this model has been employed to assess the likelihood by establishing the connection between several explanatory variables and a binary output variable, specifically to address the study's third objective.

The general Binary logistic regression model according to Agresti (2007) is as follows:

$$log\ log\ (P)\ = ln\ ln\ \left(\frac{pi}{-pi+1}\right)\ =\ \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \ldots + \beta_{18} X_{18i} + U_i \ldots\ldots\ldots\ldots (4)$$

Where $In\ (p_i\ /\ (-p_i + 1))$ – odds nature, $P_i$ represents the likelihood which small-scale goat farmers participate in the auction market, $1\ -\ P_i$ is for those who don't participate, $\beta_1$, $\beta_2$, $\beta_3\ldots\beta_{18}$ represents a vector of unknown parameters, X₁, X₂, … X₁₈ is the random variable vector, and $U_i$ is an error term.

Table 3.1: Description of variables and their unit of measure

| Variables | | Description | Unit of measurement | |
|---|---|---|---|---|
| Dependent variable | | | | |
| $Y_1$ | PART | Participation of small-scale goat farmers in the auction market | 1 if small-scale goat farmers participate in the auction market, 0 = otherwise | Dummy |
| $D_1$ | NSA | Number of goats sold by the small-scale goat farmer at auction market in 2022 | Total number of goats sold by the small-scale goat farmer at the auction market in 2022 | Per head |
| Independent variables | | | | |
| $X_1$ | AGE | Age | Actual age in years | Years |
| $X_2$ | GND | Gender | 0 if the small-scale goat farmer is male, 1 Female | Dummy |
| $X_3$ | MRS | Marital status | 1 if the small-scale goat farmer is married, 0 otherwise | Dummy |
| $X_4$ | HHS | Household size | The actual number of household members | Per head |
| $X_5$ | EDL | Education level | 1 if the small-scale goat farmer has formal, 0 otherwise | Dummy |
| $X_6$ | HLI | Household-level of income | 1 if the small-scale goat farmer income is at least R3 500, 0 otherwise | Dummy |
| $X_7$ | SHI | Household income source | 1 if the small-scale goat farmer receives a salary, 0 other | Dummy |

| X8 | NGO | Number of goats owned by the small-scale goat farmer in 2022 | Total number of goats owned by the small-scale goat farmer in 2022 | Per head |
|---|---|---|---|---|
| X9 | BCS | A body condition score of the goats | 1 if the goat body condition score is 2.5-4.0, 0 Otherwise | Dummy |
| X10 | GLM | Goats' legal identification mark | 1 if the small-scale farmer's goats have legal identification mark, 0 otherwise | Dummy |
| X11 | NSA | Number of goats sold by the small-scale goat farmer at auction market in 2022 | Total number of goats sold by the small-scale goat farmer at the auction market in 2022 | Per head |
| X12 | AMI | Access to auction market information | 1 if the small-scale goat farmer has access to auction market information, 0 otherwise | Dummy |
| X13 | DAM | Distant to the auction market | The distance travelled to the auction market | Kilometres |
| X14 | SRA | Status of the road to auction market | 1 if the road to auction market is good, 0 otherwise | Dummy |
| X15 | ATA | Availability of transport for goats to the auction market | 1 if the small-scale goat farmer has transport for goats to the auction market, 0 otherwise | Dummy |
| X16 | AEO | Access to an extension officer | 1 if the small-scale goat farmer has access to an extension officer, 0 otherwise | Dummy |

| X₁₇ | ACR | Access to the certificate of removal at local stock theft unit | 1 if the small-scale goat farmer has access to the certificate of removal at local stock theft unit, 0 otherwise | Dummy |
|------|-----|-----|-----|------|

Source: Author's compilation (2023)

# CHAPTER 4: RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter details the findings of the data collected from the study area presenting them in pie charts, bar-graphs and table form. It is divided into three sections, each of which presents and discusses the study's findings in accordance with the objectives of the study:

i. The first section presents descriptive statistics results,

ii. The second section present Double-hurdle model results, and

iii. The last section presents binary logistic regression model results.

## 4.2 Descriptive statistics on socio-economic factors that affect participation of small-scale goat farmers in auction market

This section presents descriptive statistics on socio-economic factors that affect participation of small-scale goat farmers in auction market at Polokwane Municipality which were the first section of the questionnaire. It is divided into continuous and categorical socio-economic shown in Table 4.1 and 4.2 below based on a sample of 73 small-scale goat farmers who completed a questionnaire which was administered in April 2023.

4.2.1 Descriptive statistics of continuous socio-economic factors
The results presented in Table 4.1 below show continuous socio-economic factors results of small-scale goat farmers in Polokwane Municipality. Several descriptive statistics were gathered and presented below:

Table 4.1: Descriptive statistics of continuous socio-economic factors

| Variables | Minimum | Mean | Maximum | Standard deviation | Variance |
|---|---|---|---|---|---|
| Age | 21 | 49.6027 | 79 | 14.51411 | 210.659 |
| Household size | 1 | 5.4932 | 11 | 1.74899 | 3.059 |
| Number of goats owned by the small-scale goat farmer in 2022 | 7 | 21.2055 | 46 | 9.86289 | 97.277 |
| Number of goats sold by the small-scale goat farmer at auction market in 2022 | 0 | 3.0548 | 26 | 6.20907 | 38.553 |
| Distant to the auction market | 12 | 33.6301 | 60 | 12.73393 | 162.153 |

Source: Research Data (2023)

In the study area, the small-scale goat farmers demonstrated a broad age range of a minimum of twenty-one (21) years and a maximum of seventy-nine (79) years, with an average age of 50 years, indicating a mix of younger and older individuals engaging in goat farming. This diversity in ages suggests a wide spectrum of experience and knowledge within the sector. Older farmers may rely on traditional methods, while younger ones might be more receptive to adopting modern technologies. The standard deviation of 14.51411 reveals significant age variation among these farmers, reinforcing the findings of Guo *et al*., (2023), which emphasize the link between age and farming performance. Additionally, the study found that the average household size is 5.4932, ranging from one to eleven members, excluding the respondent. This diversity in household size implies that most households have multiple individuals who can assist small-scale farmers, thereby reducing labor costs and potentially enhancing goat farming productivity. These findings align with Belewu *et al*.'s (2020) report, emphasizing the crucial role of household size in agriculture.

In 2022, small-scale goat farmers in the Polokwane Municipality owned an average of 21.2055

goats, indicating a trend towards small-scale operations, with farmers typically rearing a modest number of goats ranging from 7 to 46. This finding aligns with Ayinde *et al*.'s (2018) research, highlighting the prevalence of small farms with limited livestock posing challenges in meeting consumer demands. Despite their limited scale, these farmers provide sufficient space within their households for the goats. The study showed that these small-scale farmers participated in the auction market, where they sold an average of approximately 3 goats. The annual sales, however, exhibited significant variation, spanning from no sales to a maximum of 26 goats. The substantial standard deviation of 6.21 underlines the diverse nature of the market, influenced by factors such as market conditions, herd size, and individual sales strategies.

Lastly, the distance to the auction market has recorded an average of 33.63 kilometers, with a range from 12 kilometers as a minimum to 60 kilometers as a maximum. This wide range suggests that farmers' proximity to the market varies considerably, potentially impacting their access to and participation in the auction market. Furthermore, the standard deviation of 12.73 indicates moderate variability in these distances, implying that while some farmers share similar proximity to the market, disparities in accessibility exist. The findings are aligned with Khapayi *et al*., (2018) who found that small-scale goat farmers who reside in distant regions resulting in selling their goat informally at the farm gate where they are price takers.

4.2.2 Descriptive statistics of categorical socio-economic characteristics

The results presented below shows descriptive statistics of small-scale goat farmer's gender, household-level of income, goat's legal identification mark, access to auction market information, availability of transport for goats to auction market, and access to an extension officer.

i.   **Small-scale goat farmer's gender**

The descriptive statistics presented in the figure indicate small-scale goat farmer's gender in Polokwane Municipality. The findings are presented below:
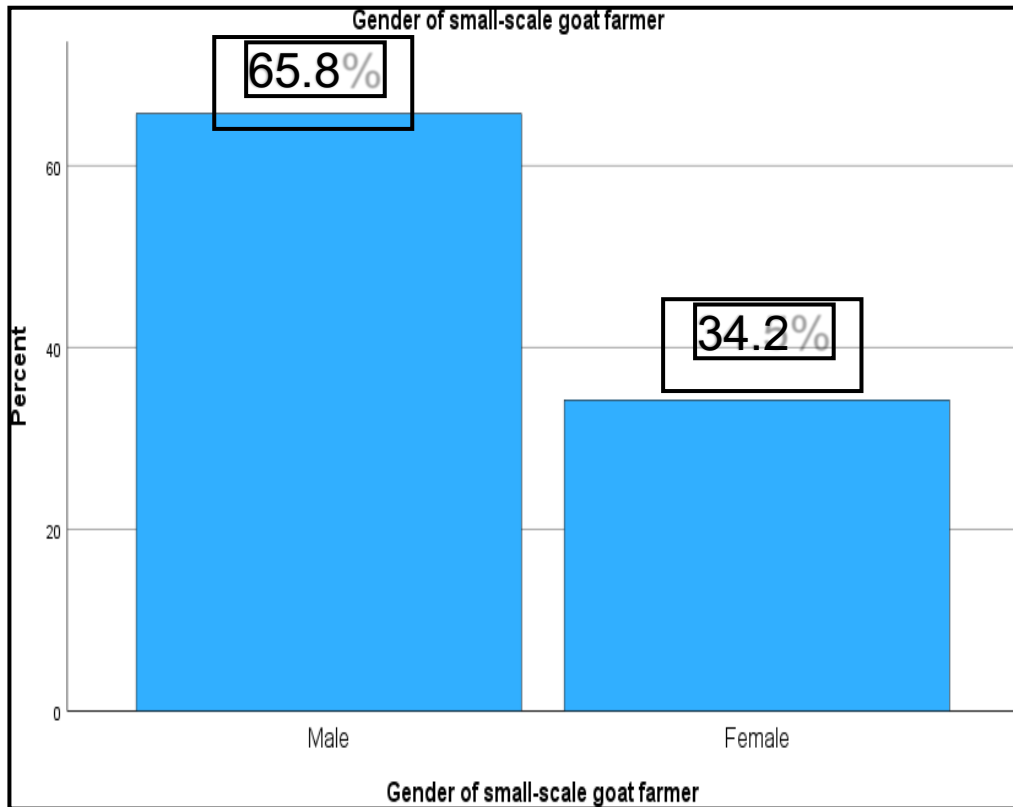
Source: Research Data (2023)

Figure 4.1: Small-scale goat farmer's gender

In the surveyed population, most respondents were males, comprising 65.8%, while females accounted for 34.2% as shown on the figure above. This gender disparity in goat farming participation can be attributed to existing social norms, as highlighted by the Nguyen *et al*., (2018), which often assign women to lighter farming or crop processing duties, leaving livestock management, including goat farming, more accessible to men. These findings align with Obinna and Onu (2021) study, emphasizing the ability of farming activities to continue irrespective of the gender of the farmers. Importantly, Obinna and Onu (2021) highlighted the significance of achieving more equal gender relations within households and communities, contributing to agricultural and rural development by enhancing productivity and nutrition.

## ii. Small-scale goat farmer's household income

The descriptive statistics presented in the figure indicate small-scale goat farmer's household income in Polokwane Municipality. The findings are presented below:
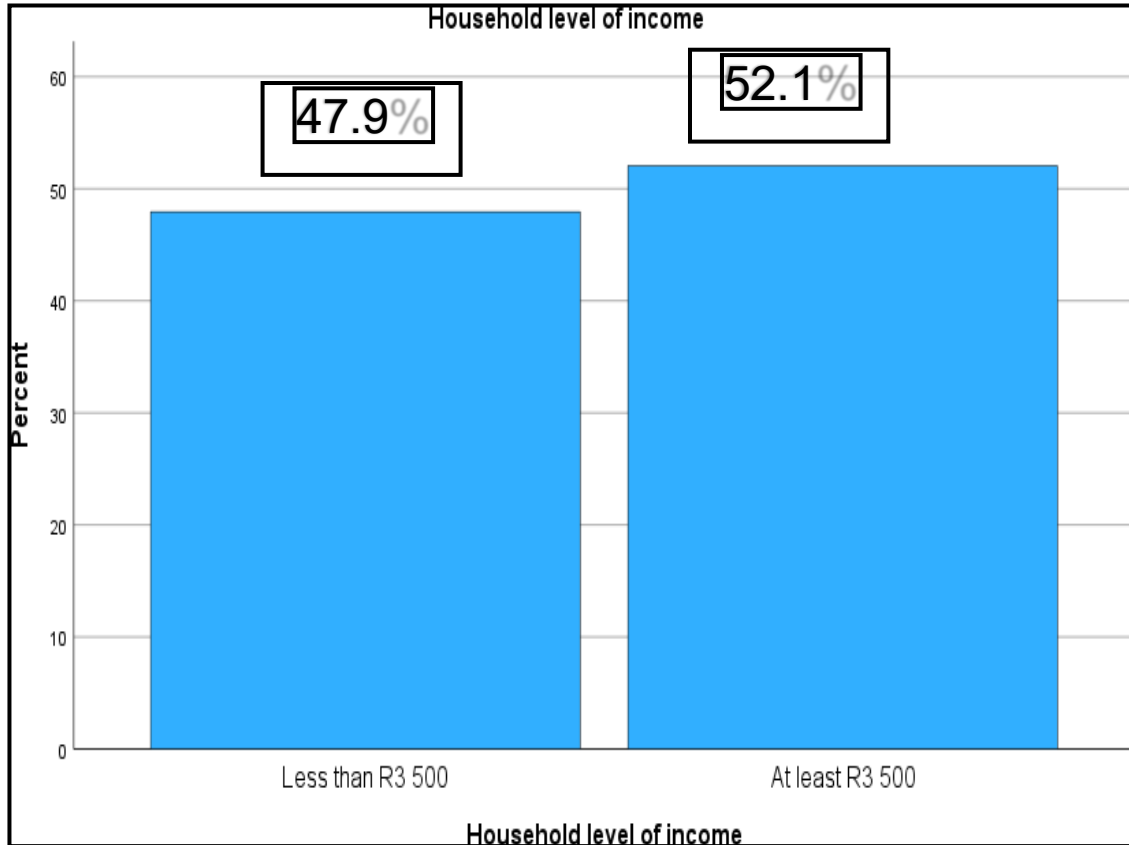


Source: Research Data (2023)

Figure 4.2: Small-scale goat farmer's household income

In analyzing the household income of small-scale goat farmers, it was found that 52.1% of them earn at least R3,500 per month, while 47.9% have incomes below this threshold as represented on the figure above. This indicates a significant proportion of households in the survey with relatively higher income levels. These results are in line with Sinha, (2023) study, which emphasized the importance of income streams at the start of farming production. Over time, it becomes essential for enterprises to cover production costs and generate profit, highlighting the sustainability aspect of goat farming. Interestingly, the study revealed that

households lack stable income streams as a backup plan, with 68.5% relying on sources other than a salary, and 31.5% depending primarily on a salary. The challenges in production across seasons arise from depending on varying income sources, such as the sale of goats and agricultural support from government such as The Presidential Employment Stimulus Initiative (PESI).

## iii. Goat legal identification marks

The descriptive statistics presented in the figure indicate the percentage of small-scale goat farmers who have goats with legal identification marks in Polokwane Municipality. The findings are presented below:
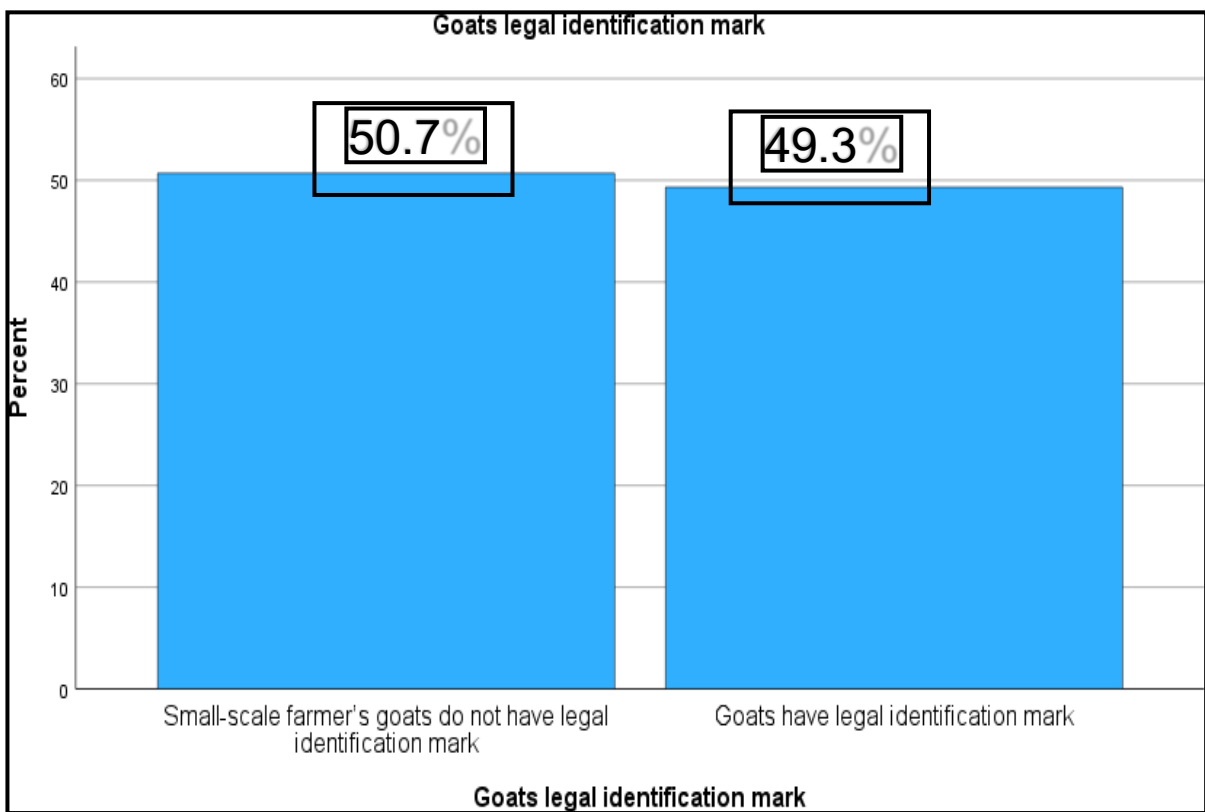


Source: Research Data (2023)

Figure 4.3: Goat legal identification marks

In evaluating the goats having legal identification, results are represented on the figure above showing that 49.3% of the goats had proper legal identification marks, while 50.7% did not. This highlights those farmers who do not have proper legal identification marks for their goats may face challenges in participating in the auction market. Compliance with the Animal Identification Act No. 6 of 2002 is crucial for goat farmers, as it ensures traceability and adherence to legal requirements in the auction market. The study of Sehar (2018) also emphasized the importance of legal identification in reducing marketing costs and ensuring proper documentation for farmers.

iv.   **Access to auction market information.**

The descriptive statistics presented in the figure indicate proportion of small-scale goat farmers' who have access to auction market information. The findings are presented below:
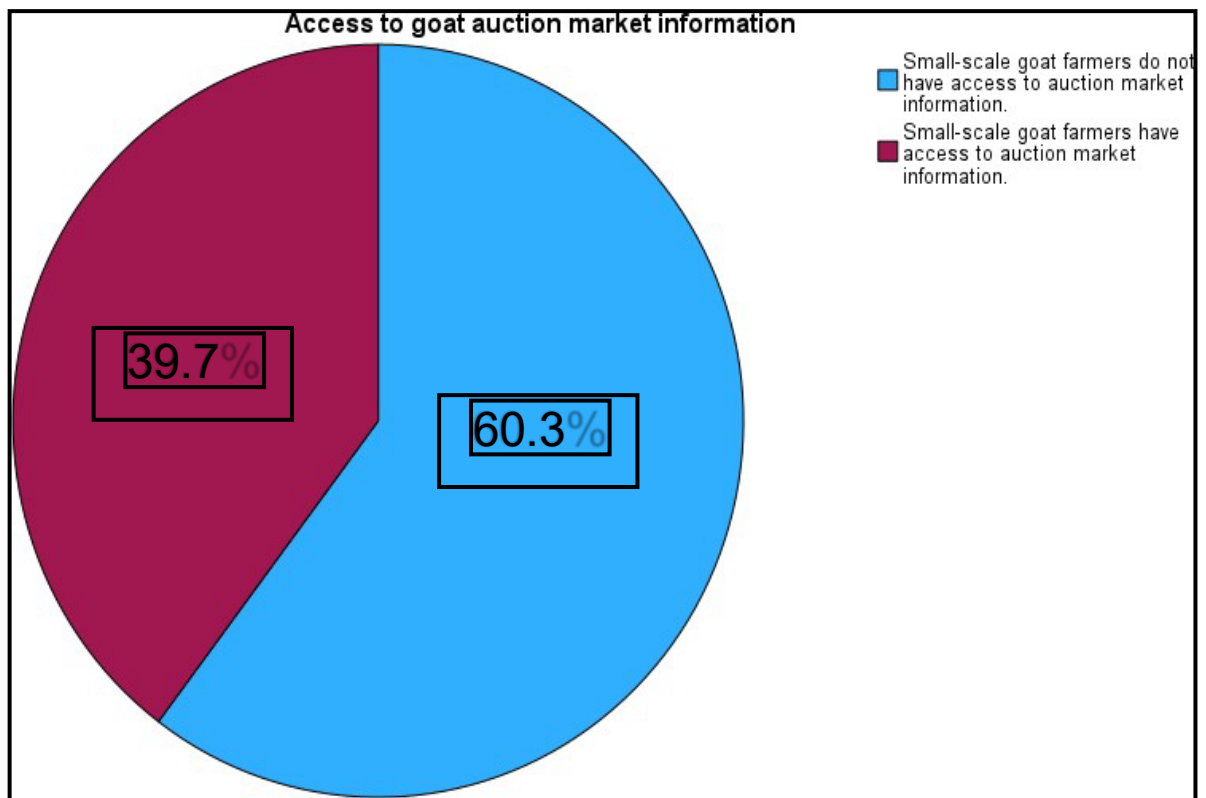


Source: Research Data (2023)

Figure 4.4: Access to auction market information

Regarding access to auction market information, 39.7% of the small-scale goat farmers have access to auction market information, while 60.3% do not as illustrated above on the figure. This demonstrates that most of the study's small-scale goat farmers do not have access to crucial information regarding the auction market. This is important for small-scale goat farmers in order to make informed decisions regarding participation in the auction market (Çukur, 2019). Furthermore, it is clear that small-scale goat farmers may find it extremely difficult to comprehend market demands and formulate wise marketing strategies in the absence of access to auction market information.

**v.    Access of extension officer**

The descriptive statistics presented in the figure indicate the access to extension officer in Polokwane Municipality. The findings are presented below:
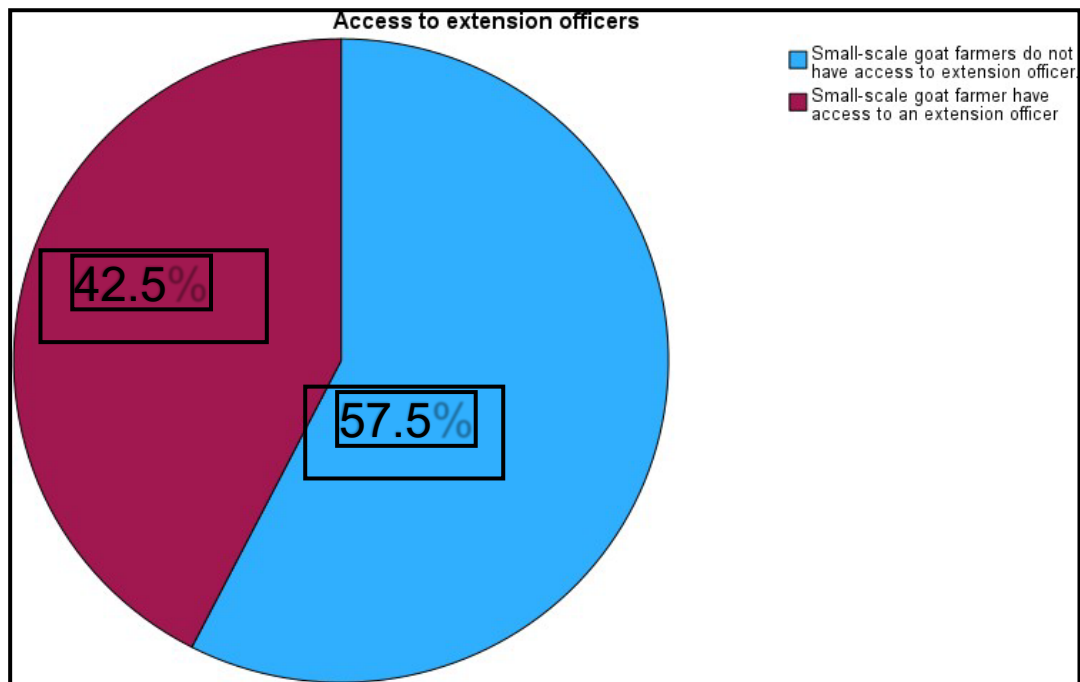


Source: Research Data (2023)

Figure 4.5: Access of extension officer

Regarding access of extension officer, it has been recorded as 42.5% of the small-scale goat farmers having access to an extension officer, while 57.5% do not as shown above. Extension officers play a crucial role in providing support and information to farmers (Alotaibi *et al.*, 2021). Since extension officers are small-scale farmers' primary source of information and advice, they are strongly related to the majority of study variables. According to the study's findings, information on auction markets is more likely to be available to small-scale goat farmers who have access to extension officers.

Development of livestock farmers' groups, pastures, veterinary services, dip tanks, and marketing facilities are under the purview of extension officers in the Polokwane Municipality. Regular interactions between extension workers and farmers lead to greater enlightenment through advisory services on new technology, which in turn encourage adoption and utilization. Maintaining regular touch with extension agents facilitates the communication of new technology's existence, applications, and advantages from manufacturers to consumers (Kwarteng *et al.*, 2019).

4.2.3 Descriptive statistics results for participation rate of small-scale goat farmers in auction market

The descriptive statistics presented in the figure indicate the participation rate of small-scale goat farmers in the auction market within the Polokwane Municipality. The findings are present The lens of smallholder commercialization, as explored by Mkuna and Wale (2022), indicates that while small-scale farmers in South Africa's homelands have engaged in some level of commercialization, their market participation is primarily limited to informal rather than formal markets. In the context of South African commercial farming, it is noteworthy, nevertheless, that participation in auction markets, a sort of formal market, is essential to the development of small-scale goat producers. Auction Market participation rate of small-scale goat farmers in Polokwane Municipality
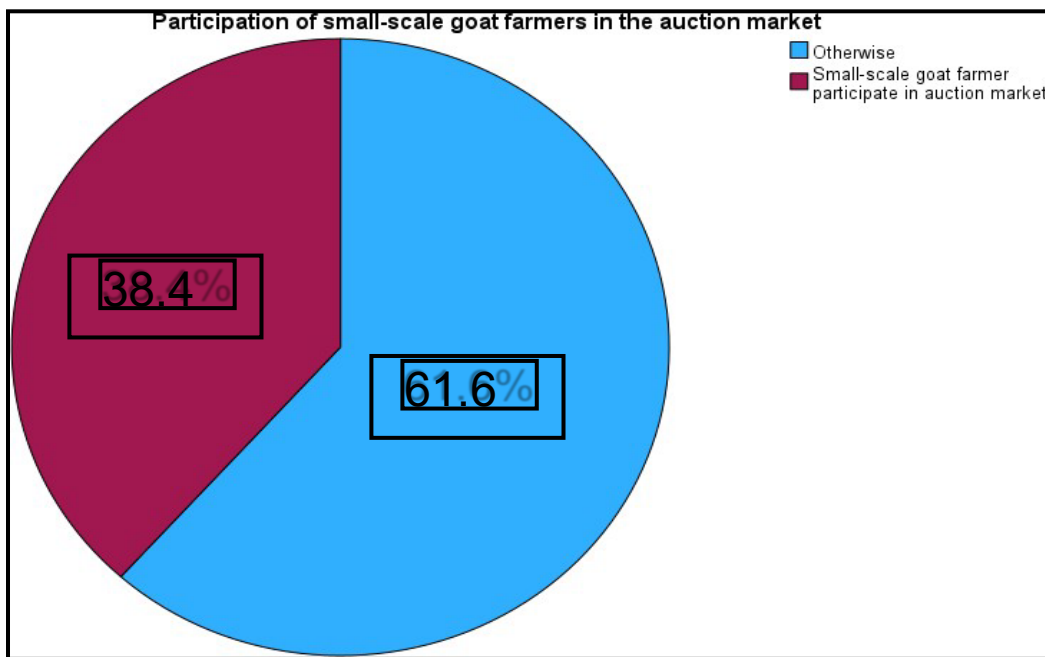
Source: Research Data (2023)

Figure 4.7: Participation of Polokwane Municipality's small-scale goat farmers in the auction market

The above figure represents the descriptive statistical results for participation of Polokwane Municipality's small-scale goat farmers in auction market. The findings in the above figure indicate that a significant majority, 61.6% of small-scale goat farmers within the Polokwane Municipality are participating in the auction market while a relatively small proportion of 38.4% are participating. This aligns with the results of the research that has been done on smallholder farmers in South Africa, which have shown that market participation among this group is generally limited to informal markets within their communities and surrounding areas (Zantsi *et al*., 2020). These farmers primarily engage in informal market transactions, rather than participating in formal markets particularly during festive periods like December and Good Friday (Nyakwawa *et al*., 2022).

**4.3 Double-hurdle model: Determining the participation rate of small-scale goat farmers in the auction market in Polokwane Municipality.**

The double-hurdle model was fitted with 17 explanatory variables as presented in Tables 4.3 and 4.4 to determine the participation rate of small-scale goat farmers in the auction market in Polokwane Municipality. Objective two involves employing a Double-Hurdle model, which incorporates both probit and tobit models. Age and the body condition score of the goats were significant for Probit model while for Tobit model, marital status, household size, household level of income, body condition score of the goats, availability of transport, and access to an extension officer were significant.

4.3.1 Factors influencing the decision of small-scale goat farmers to participate in the auction market (first hurdle)

The results in figure 4.7 indicate the participation of small-scale goat farmers in auction market where Table 4.3 revealed factors of auction market participation among small-scale goat farmers in Polokwane Municipality. This assisted in predicting the likelihood that a small- scale goat farmer will participate in the auction market. The results found that small-scale goat farmer's age and body condition score of the goats were significant at the 10% and 5% level respectively. Surprisingly, access to auction market information and distance to auction market did not have a significant impact on the decision of small-scale goat farmers to participate in the auction market. Furthermore, these variables had unexpected coefficient signs (negative for access to goat auction market information and positive for distance to auction market).

Table 4.3: Probit results for factors affecting auction market participation decision of goat small-scale farmers (first hurdle).

| Variables | B | SE | Sig. |
|---|---|---|---|
| Constant | -1.414 | 1.2606 | 0.262 |
| Age of small-scale goat farmer | -0.661 | 0.3694 | 0.073*** |
| Gender of small-scale goat farmer | 0.475 | 0.3745 | 0.205 |
| Marital status of small-scale famer | -0.254 | 0.4994 | 0.610 |
| Household size | -0.056 | 0.3366 | 0.868 |
| Education level | 0.013 | 0.0172 | 0.437 |
| Household level of income | 0.539 | 0.4885 | 0.270 |
| Household income source | -0.020 | 0.0220 | 0.364 |
| Number of goats owned by small-scale goat farmer in 2022 | 0.131 | 0.1213 | 0.281 |
| A body condition score of the goats | 0.802 | 0.4041 | 0.047** |
| Goats' legal identification mark | 0.027 | 0.0494 | 0.586 |
| Number of goats sold by small-scale goat farmer at auction market in 2022 | -0.157 | 0.4291 | 0.714 |
| Access to goat auction market information | -0.044 | 0.3818 | 0.908 |
| Distant to the auction market | 0.009 | 0.0095 | 0.370 |
| Status of the road to auction market | -0.006 | 0.0070 | 0.364 |
| Availability of transport to the auction market | 0.041 | 0.3565 | 0.908 |
| Access to an extension* officer | -0.223 | 0.3691 | 0.546 |
| Access to the certificate of removal at local stock theft unit | 0.307 | 0.3888 | 0.430 |
| **Omnibus Test[a]** | | | |
| Likelihood Ratio Chi-Square | df | Sig. | Pseudo R-squared |
| 13,089 | 17 | .730 | 0.730 |

Note:  *, **, and *** indicate significance at 1%, 5%, and 10% level, respectively.

Source: Research Data (2023)

The Probit model result of the Omnibus Test, with a Likelihood Ratio Chi-Square value of 13.089 indicates that there is a statistically significant relationship between the factors analyzed and small-scale goat farmers' participation in the auction market in Polokwane Municipality. Therefore, the factors analyzed in the Probit model have an impact on the decision of small-scale goat farmers to participate in the auction market (Kalema *et al*., 2022). The following explanatory variables below were found to be significant in the model:

### i.  Age of small-scale goat farmers

The probit model analysis revealed that the age of small-scale goat farmers has a significant impact on their participation in the goat auction market. The coefficient of -0.661 suggests that as the age of small-scale goat farmers increases, their likelihood of participating in the auction market decreases. This finding implies that younger farmers are more likely to participate in the auction market, possibly due to their greater enthusiasm and willingness to explore new markets. Additionally, the significant level of 10% (0.073) indicates that this relationship between age and participation rate is statistically significant, further emphasizing the importance of age as a factor influencing small-scale goat farmers' decision to participate in the auction market. These findings are contrary to other studies, which found a positive relationship between age and farmers' market participation such as a study by Ngwako *et al*., (2021) who found that older farmers are more likely to be experienced and informed about marketing and livestock husbandry practices.

### ii.  Body condition score of the goats

The probit model showed that the body condition score of goats significantly affects the participation rate of small-scale goat farmers in the auction market. This is evidenced by a positive coefficient of 0.802 with a significance level of 5% (0.047). This finding suggests that as the body condition score of the goats improves, the likelihood of those who participate in the auction market increases. This finding indicates that farmers who have goats with better body condition scores are more motivated to participate in the auction market, possibly due to the potential for achieving higher prices for their healthier goats. These findings concur with the study of Muriuki and Wambugu, who found that the body condition score of goats influenced the decision of small-scale farmers to participate in the auction market (Nenadović

*et al*., 2021).

## 4.3.2 Factors of participation rate of Polokwane Municipality small-scale goat farmers in auction market (second hurdle)

The results in Table 4.4 highlight the factors of auction market participation among small-scale goat farmers in Polokwane Municipality. This assisted in determining the participation rate of small-scale goat farmers in the auction market in Polokwane Municipality. The results showed that marital status of small-scale farmer, household size, household level of income, body condition score of the goats, and access to an extension officer were significant at the 10% level while availability of transport for goats to the auction market were significant at 5% level respectively.

Table 4.4: Tobit results of Determinants of auction market participation among small-scale goat farmers in the Polokwane Municipality

| Variables | Second hurdle | | |
|---|---|---|---|
| | B | SE | Sig. |
| (Intercept) | -6.2291 | 5.104 | 0.222 |
| Age of small-scale goat farmer | -1.2375 | 2.349 | 0.598 |
| Gender of small-scale goat farmer | -0.4131 | 0.439 | 0.346 |
| Marital status of small-scale farmer | -0.4520 | 0.160 | 0.005*** |
| Household size | -1.1685 | 0.447 | 0.009*** |
| Education level | -0.4469 | 0.305 | 0.142 |
| Household level of Income | 6.5197 | 2.287 | 0.004*** |
| Household income source | 0.3783 | 0.343 | 0.271 |
| Number of goats owned by small-scale goat farmer in 2022 | -0.3047 | 0.250 | 0.224 |
| Body condition score | -1.3437 | 0.474 | 0.005*** |
| Goats' legal identification mark | -0.4044 | 0.650 | 0.534 |
| Number of goats sold by small-scale goat farmer at auction market in 2022 | 0.2061 | 0.339 | 0.543 |
| Access to goat auction market information | 0.0098 | 0.016 | 0.537 |
| Distant to the auction market | 0.0030 | 0.038 | 0.938 |
| Status of the road | -0.2583 | 0.340 | 0.448 |
| Availability of transport for goats to the auction market | 0.9733 | 0.446 | 0.029** |
| Access to an extension officer | -0.0396 | 0.015 | 0.008*** |
| Access to the certificate of removal at stock theft unit | -0.0559 | 0.059 | 0.340 |
| Likelihood Ratio Chi-Square | df = 16 | Pseudo R-squared | |
| -40.107 | | 0.6084 | |

Note: *, **, and *** indicate significance at 1%, 5%, and 10% level, respectively.

Source: Research Data (2023)

The Tobit results of the study showed a Likelihood Ratio Chi-Square of -40.107 with degrees of freedom of 16, indicating a significant relationship between the determinants and auction market participation among small-scale goat farmers in the Polokwane Municipality. The Pseudo R-squared of 60.84% indicates that the Tobit model used in the study can explain a significant portion of the variation in auction market participation among small-scale goat farmers in the Polokwane Municipality. The results of the study indicate that several determinants influence the participation of small-scale goat farmers in the auction market within the Polokwane Municipality. The following explanatory variables below were found to be significant in the model:

### i. Marital status

Marital status had a negative influence of -0.4520 over the participation of Polokwane Municipality's goat small-scale farmers who participated in auction market at a significant level of 10% (0.005). This suggests that, among individuals who participated in the auction market (first stage), marital status had a significant impact on the intensity of their activity in the market. This finding contradicts with the findings of Andaregie *et al*., (2021) who reported that in Nigeria, 80% of married farmers engage in agricultural market activities, while the remaining 20% did not. The high level of statistical significance (10%) suggests that this relationship is not likely to have occurred by chance, reinforcing the importance of marital status as a factor affecting auction market participation among the small-scale goat farmers in the Polokwane Municipality. This concurs with the findings of other studies, such as the research conducted by Hlatshwayo (2022), which found that marital status had a significant effect on smallholder farmers' market participation on rural households' food and nutrition security status.

### ii. Household size

Household size had a negative influence of -1.1685 over the participation of Polokwane Municipality goat small-scale farmers who participated in auction market at a significant level of 10% (0.009). This indicates that those who participated in the auction market, the size of the household influences the intensity or quantity of their participation. Larger household sizes are less likely to participate in the auction market, while smaller households are more inclined to do so. This means that household size and participation of those who participated in the auction

market have an inverse relationship where when household size increases, the participation of decrease. This concurs with the findings of a study conducted by Nwafor (2020), who found that household size was negatively correlated with small-scale farmers' participation in the auction market. These findings contradict the findings of a study by Belay (2018), which found that there is no significant relationship between household size and market participation.

### iii. Household level of income

Household level of income had a positive influence of 6.5197 over the participation of Polokwane Municipality's goat small-scale farmers in the auction market at a significant level of 10% (0.004). This suggests that those who participated in the auction market, their household income has a significant impact on the intensity or quantity of their participation where Higher household income are likely to participate in auction markets. This finding highlights the economic aspect of goat farming and how a higher household income can contribute to an increased participation in the auction market aligning with Tsvuura *et al*., (2021). Therefore, those with higher income are more likely to participate in auction markets as they have the financial means to invest in improving the health and well-being of their goats, which in turn enhances their market value.

### iv. A body condition score of the goats

The body condition score of the goats had a negative influence over the participation of Polokwane Municipality's goat small-scale farmers in the auction market at a significant level of 10% (0.005). A one-unit increase in the body condition score is associated with a decrease in the expected intensity or quantity of auction market activity by -1.3437 units. These findings highlight among participants, those with goats having a higher body condition score may be less likely to participate with high intensity or quantity in the auction marketThis is aligned with Ramukhithi *et al*., (2019) who highlighted that nutrients supplements improve the quality of goat's production. With this, farmers may benefit from practices that focus on proper nutrition, healthcare, and management to ensure their goats are in good physical condition, thereby improving their chances of success in the auction market.

### v. Availability of transport for goats to the auction market

Availability of transport for goats to the auction market had a positive influence over the participation of Polokwane Municipality's small-scale goat farmers in the auction market at a significant level of 10% (0.029). This finding suggests that those who participated in the auction market, the availability of transport significantly influences the intensity or quantity of their participation. Having adequate transport which is reliable and accessible transport options plays a crucial role in small-scale farmers' ability to participate in the auction market. These findings corroborate the findings of Ouedraogo (2018), which highlighted that small-scale farmer who are not owning their own vehicles result in cost of transport crop commercialization to remain limited.

### vi.   Access to an extension officer

Access to an extension officer had a negative influence of 0.0396 over the participation of Polokwane Municipality's small-scale goat farmers in the auction market at a significant level of 10% (0.008). A one-unit increase in access to an extension officer is associated with a decrease in the expected intensity or quantity of auction market activity by -0.0396 units. This indicates that among participants, those with greater access to extension officers may be less likely to participate with high intensity or quantity in the auction market. This concurs with the findings of Andaregie *et al*., (2021) which showed that access to extension officer was a significant variable affecting the market participation of smallholder farmers. Contrarily, the study conducted by Mmbando showed that contact with agricultural extension services had a positive impact on market participation (Mdoda and Obi, 2019).

### 4.4 Factors affecting the small-scale goat farmers' participation in the auction market in Polokwane Municipality

This section presents and discusses identified factors affecting the small-scale goat farmers' participation in the auction market in Polokwane Municipality, a Binary Logistic Regression Model was used. The results of the Binary Logistic Regression Model presented on Table 4.5 below obtained from Statistical Packaging for the Social Sciences (SPSS) revealed several significant factors that influence small-scale goat farmers' participation in the auction market. These factors include household size, the body condition score of the goats, the presence of a goat's legal identification mark, and access to goat auction market information.

Table 4.5: Binary logistic regression model results of factors affecting the small-scale goat farmers' participation in the auction market in Polokwane Municipality.

| Variables | B | S.E. | Sig. |
|---|---|---|---|
| Constant | 9.986 | 7.359 | 0.175 |
| Age of small-scale goat farmer | 0.024 | 0.085 | 0.776 |
| Gender of small-scale goat farmer | -1.091 | 1.528 | 0.475 |
| Marital status of small-scale famer | 0.947 | 1.302 | 0.467 |
| Household size | -5.133 | 2.949 | 0.082*** |
| Education level | -1.401 | 0.936 | 0.134 |
| Household level of income | 1.131 | 1.914 | 0.555 |
| Household income source | 2.312 | 1.940 | 0.233 |
| Number of goats by small-scale goat farmer in 2022 | 1.420 | 1.650 | 0.389 |
| A body condition score of the goats | 28.422 | 15.135 | 0.060*** |
| Goats' legal identification mark | -3.709 | 2.062 | 0.072*** |
| Number of goats sold by small-scale goat farmer at auction market in 2022 | -4.953 | 3.441 | 0.150 |
| Access to goat auction market information | -5.161 | 2.766 | 0.062*** |
| Distant to the auction market | 0.039 | 0.033 | 0.242 |
| Status of the road to auction market | -0.136 | 0.101 | 0.181 |
| Availability of transport for goats to the auction market | 2.151 | 1.660 | 0.195 |
| Access to an extension officer | 2.969 | 1.930 | 0.124 |
| Access to the certificate of removal at stock theft unit | 1.355 | 1.603 | 0.398 |
| MODEL SUMMARY | | | |
| (-2) Log-likelihood | 18.847 | | |
| Accuracy of prediction: Overall (%) | 86.8 | | |
| Cox and Snell R Square | 0.600 | | |
| Nagelkerke R Square | 0.868 | | |

Note: *, **, and *** indicate significance at 1%, 5%, and 10% level, respectively. Source: Research Data (2023)

The binary logistic model's high prediction accuracy of 86.8% demonstrates its effectiveness in foreseeing small-scale goat farmers' participation in the Polokwane Municipality's auction market. This means that out of 100 instances, the model accurately predicts their involvement 86 times. The Cox and Snell R Square value of 0.600 signifies that the model accounts for approximately 60% of the variation in the farmers' participation, indicating a substantial explanatory power. Furthermore, the Nagelkerke R Square value of 0.868 illustrates an even more comprehensive explanation, capturing around 86.8% of the variation in their market participation. The following explanatory variables below were found to be significant in the model:

**i.    Household size**

Household size had a negative influence over the participation of Polokwane Municipality goat small-scale farmers in the auction market and it is significant at 10% level (0.082) with a coefficient of -5.133. The findings indicate that as household size increases, the likelihood of farmers participating in auctions diminishes as the coefficient of -5.133 reveal that as this factor increases, the odds of participating in the auction market decrease by a factor of 5.133 units. These findings contradict Belewu *et al*., (2020) findings which reported a positive relationship between household size and market participation among small-scale farmers.

**ii.    Body condition score of the goats**

Body condition score of the goats had a positive influence with a coefficient of 28.422 over the participation of Polokwane Municipality goat small-scale farmers in the auction market and it had a highly significant at 10% level (0.060). This finding implies that as the body condition score of the goats increases, the odds of those who participate in the auction market increase by a factor of 28.422 units. These findings coincide with the findings of Ali and Ibrahim (2019) which highlighted that body condition score of the goats having a huge contribution to an overall quality, as this variable is linked with the genes of reproductive performance of the animals.

### iii. Goats' legal identification mark

Goats' legal identification mark had a negative influence with a coefficient of -3.709 over the participation of Polokwane Municipality goat small-scale farmers in the auction market and it is significant at 10% level (0.067). The findings indicate that having a legal identification mark for goats negatively influences the participation of small-scale goat farmers from Polokwane Municipality in the auction market. This implies that those farmers who have registered their goats with legal identification marks are less likely to participate in the auction market. These findings contradict with the findings of Ali and Ibrahim (2019) who stated that having a legal identification mark is an important factor in ensuring the traceability and quality of goats in the auction market. Sari and Munajat, (2023) found that having a legal identification mark had a negative as a factor influencing farmers' decisions to sell livestock in auction markets in Bungo Regency, this was consistent with this study.


### iv. Access to goat auction market information

Access to goat auction market information had a negative influence (-5.161) over the participation of Polokwane Municipality goat small-scale farmers in the auction market and it had a highly significant at 10% level (0.062). These findings indicate those who have better access to goat auction market information are less likely to participate in the auction market. They may prefer to sell their goats through non-auction markets where they have better access to information and can negotiate prices directly with traders. The results of this study are consistent with the findings of Ali and Ibrahim (2019), who also found that access to market information had a negative influence on farmers' participation in the auction market.


### 4.5 Insignificant variables

Several variables were examined for their impact on market participation in this study and certain variables did not demonstrate significant associations with the outcomes. Specifically, variables such as age of small-scale goat farmer, gender of small-scale goat farmer, and marital status of small-scale farmer were found to be statistically insignificant, indicating that these demographic factors were not significant among the studied farmers.

Additionally, factors like education level, household level of income, number of goats owned by small-scale goat farmer in 2022, number of goats sold by small-scale goat farmer at auction market in 2022, and various others did not reach the conventional significance level ($p > 0.05$), suggesting that these variables did not have a discernible impact on the farmer's participation in the auction market. These findings highlight the nuanced nature of market participation, indicating that while certain variables were significant, others did not exhibit substantial influence, underscoring the complexity of the factors at play in the context of small-scale goat farming in Polokwane Municipality.

## 4.6 Chapter summary

This chapter has given an overview of descriptive statistics of the socio-economic characteristics of small-scale goat farmers in Polokwane Municipality. Double-hurdle model was employed to estimate auction market participation rates, revealing significant factors influencing small-scale goat farmer's decisions to participate in auction market. Additionally, a binary response model identified determinants of participation, offering valuable insights into their auction market involvement dynamics through identifying challenges experienced by small-scale goat famers in the auction market in Polokwane Municipality

# CHAPTER 5: RESEARCH SUMMARY, CONCLUSION, AND RECOMMENDATIONS

## 5.1 Introduction

In this chapter, the results findings of the study are summarized then conclusion, recommendations and further research ideas are provided. However, the chapter outlines the extent to which the objectives and hypothesis posed at the beginning of the study, specifically chapter one, has been addressed in the analysis. The study has evaluated small-scale goat farmers' participation in the auction market in the Polokwane Municipality.

## 5.2 Research summary

The study aims to evaluate a small-scale goat farmer's participation in the auction market in the Polokwane Municipality. The results were analyzed in line with the set objectives and aim of the study. The study used descriptive statistics, Double-hurdle model, and Binary logistic regression to analyze data using the IBM SPSS program version 29. A simple random sampling technique was used to select a sample size of 73 small-scale goat farmers in Polokwane Municipality where face to face was administered with the aid of a questionnaire. The study found that 61.6% of small-scale goat farmers within the Polokwane Municipality are participating in the auction market, while the remaining 38.4% are not involved in the auction market.

The socio-economic factors of the respondents were explained using descriptive statistics and results were analyzed. The study revealed a wide range of demographics and challenges among small-scale goat farmers. Farmers' ages spanned from 21 to 79 years, with an average age of 49.6027 years. Household sizes varied from 1 to 11 members, averaging 5.4932. In 2022, farmers owned between 7 and 46 goats, with an average of 21.2055 goats. At auctions, farmers sold an average of 3.0548 goats, with sales ranging from 0 to 26 goats. The distance to the auction market ranged from 12 to 60 units, averaging 33.6301. Despite this diversity, challenges such as limited access to essential auction market information for 40% of participants and inadequate transport facilities for over 38% of them were evident. Furthermore, access to extension officers and certificates of removal at local stock theft units was constrained for a substantial portion of the farmers, highlighting the hurdles faced by this

community.

In the first stage of the Double-Hurdle model (Probit), the study found that the age of small-scale goat farmers and the body condition score of the goats significantly affect decisions to participate in the auction market, with significance levels of 10% and 5%, respectively. Furthermore, Tobit model of double hurdle (second stage) was used were, Marital Status of Small-scale Farmer, Household Size, Household Level of Income, Body Condition Score of the Goats, Availability of Transport for Goats to the Auction Market, and Access to an Extension Officer were found significantly affecting auction market participation rate of small-scale goat farmers.

Analysis of factors affecting goat small-scale farmer's participation in the auction market was estimated using a Binary Logistic regression model and significant variables were discussed in detail. The results revealed that marital status has a positive influence over the participation of small-scale goat farmers in the informal market and statistically significant at 10% (0.069). These results suggested a higher likelihood of married respondents participating in the goat informal market. Household sizes were found positive and statistically significant at 5% level (0.045). This implies that the higher the household size, the more the households will participate in the goat informal market. The results further revealed that household level of income has a positive influence over the participation of small-scale goat farmers in the informal market and was statistically significant at 5% (0.023). According to this, small-scale goat farmers have a better possibility of participating in the goat auction market if their household income is larger allowing them to cover their production expenses.

### 5.3 Conclusions

The study had three objectives which were analyzed using seventeen explanatory variables which were fitted in descriptive statistics, Double-hurdle model, and binary logistic regression model analytical technique. This effort was conducted to evaluate a small-scale goat farmer's participation in the auction market in the Polokwane Municipality.

The study had two hypotheses namely, small-scale goat farmers are not participating in the auction market in Polokwane Municipality, and there is no relation between identified factors of small-scale goat farmers and their participation in the auction market in Polokwane Municipality. For the first research hypothesis the results of Double-hurdle model showed that small-scale goat farmers are participating in the auction market in Polokwane Municipality as participation rate in auction market was found to be 38.4% of the small-scale goat farmers. Lastly, for the second hypothesis, the study found several factors significantly affecting the small-scale goat farmers' participation in the auction market in Polokwane Municipality. The study employed both the Double-Hurdle and binary logistic regression models to explore the relationship between various variables and the participation of small-scale goat farmers in the auction market. Several variables exhibited a significant connection with market participation in the analysis.

Therefore, the study rejects all hypotheses of the research. This means that small-scale goat farmers are participating in the auction market in Polokwane Municipality, and there is a relation between identified factors of small-scale goat farmers and their participation in the auction market in Polokwane Municipality.

## 5.4 Recommendations

The results of this study suggest several ways in which small-scale goat farmers can actively market goats at auctions. The study's findings offer valuable insights into enhancing small-scale goat farmers' participation in auction markets in Polokwane Municipality. Collective action emerges as a crucial factor, particularly in light of the economic challenges associated with individual participation, including issues such as the availability of transport for goats to the auction market. Thus, initiatives promoting the formation of cooperatives and group marketing arrangements can significantly alleviate these challenges. By pooling resources and expertise, such collective efforts can effectively lower marketing expenses, enhance market accessibility, and provide much-needed support to small-scale goat farmers experiencing low levels of income. Additionally, tailored support programs should be developed to address the negative impact of household size on participation. These programs could involve specialized

training in effective marketing techniques, providing financial incentives or subsidies to mitigate higher costs linked to larger households, and ensuring access to vital market information and resources.

Extension officers can play a pivotal role not only in providing auction market insights and information but also in assisting small-scale goat farmers with the legal identification mark application process. By working hand in hand with farmers, extension officers can streamline the procedure and ensure of all goats have corresponding certificate to the goat mark. This collaboration can expedite the process and alleviate concerns not being able to participate in the auction market. Additionally, extension officers can educate farmers about the importance of animal identification marks in ensuring traceability and ownership verification, especially in cases of loss or theft. It is compulsory for owners to mark their goats and apply for a registered identification mark at the Department of Agriculture, Land Reform, and Rural Development. By facilitating the application process, promoting awareness of its significance, and offering assistance locally, extension officers not only empower small-scale goat farmers but also reduce the costs associated with traveling to Pretoria offices for assistance.

Lastly, addressing the health and nutrition aspects of goats is crucial. Providing small-scale goat farmers with guidance on balanced diets, vaccinations, deworming, and proper shelter ensures healthier livestock, enhancing market value and appeal to buyers in order to achieve a better body condition score of the goats which can be acceptable at the auction market. By implementing these comprehensive recommendations, Polokwane Municipality can create a conducive environment for small-scale goat farmers, fostering their active participation in auction markets and ensuring sustainable growth in the sector.

## 5.1 Further research

Further research on the evaluation of small-scale goat farmer's participation in the auction market which can provide valuable insights into improving and promoting goat farming in Polokwane Municipality, Limpopo Province, South Africa are provided below:

i.    Impact of digital technologies on market access for small-scale goat farmers: Investigating the role of digital platforms, mobile apps, and online marketplaces in enhancing market access and trade efficiency for small-scale goat farmers, with a focus

on the Polokwane Municipality.

ii. Market information systems for livestock farmers: Studying the effectiveness of market information systems, including real-time pricing data, market trends, and demand forecasts, in empowering small-scale goat farmers to make informed decisions, optimize their production, and strategically participate in auctions.

Each of these research areas can provide valuable insights into the complexities of small-scale livestock farming, offering practical solutions and innovative approaches to increase auction market participation and overall sustainability.

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**APPENDICES.**

**Appendix 1: Questionnaire**



FACULTY OF SCIENCE AND AGRICULTURE

SCHOOL OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF AGRICULTURAL ECONOMICS AND ANIMAL PRODUCTION

Dear participant

My name is Lerato Malebati ,a masters student from the University of Limpopo in the Department of Agricultural Economics and Animal Production. I am conducting a questionnaire on "Evaluation of small-scale goat farmer's participation in the auction market: A case study of Polokwane Municipality, Limpopo Province, South Africa".

Ethical statement: The study will abide by ethical standards -stipulated by the University of Limpopo such as respecting the dignity of respondents, ensuring the protection of the privacy of the farmers, ensuring that participants participate voluntarily, and acknowledging the works of other authors. Hence, information obtained from participants will be kept in strict confidentiality, and small-scale goat farmers of the Polokwane Municipality will not be forced to take part in the questionnaire.

## A. Socio-demographic information

1. Name of small-scale farmer _____

2. Age of small-scale farmer _____

3. Gender of small-scale farmer: **Tick the applicable answer**

| 0 | 1 |
|---|---|
| Male | Female |

4. Marital status of small-scale farmer: **Tick the applicable answer**

| 1 | 0 |
|---|---|
| Married | Otherwise |

5. How many are you in household excluding you (the interviewee)?

6. Level of education: **Tick the applicable answer**

| 1 | 0 |
|---|---|
| Formal educati | Otherwise |

7. What is the level of household income? **Tick the applicable answer**

| 1 | 0 |
|---|---|
| At least R3 500 | Otherwise |

8. Source of household income? **Tick the applicable answer**

| 1 | 0 |
|---|---|
| Salary | Other |

If other, please kindly specify here. _____

9. Total number of goats you own in 2022?

## B. Technical factors of auction market

10. Are you selling goats at the auction market? **Tick the applicable answer**

| 1 | 0 |
|---|---|
| Yes | Otherwise |

11. What is the goat body condition score? **Tick the applicable answer**

| 1 | 0 |
|---|---|
| 2.5-4.0 | Otherwise |

12. Do you know the weight of the goats? Ti**ck the applicable answer**

| 1 | 0 |
|---|---|

| Yes | Otherwise |
|-----|-----------|

If yes, please kindly specify the average weight of goats in kilograms here._____

13.     Do the goats have legal identification mark from the office of registrar of animal identification? **Tick the applicable answer**

| 1 | 0 |
|-----|-----------|
| Yes | Otherwise |

14.     What is the total number of goats sold at the auction market in 2022?

## C. Institutional factors

15.     Do you have access to the auction market information? **Tick the applicable answer**

| 1 | 0 |
|-----|-----------|
| Yes | Otherwise |

16.     What is the distance to the auction market in kilometres?

17.     What is the status of the road? **Tick the applicable answer**

| 1 | 0 |
|------|-------|
| Good | Other |

If other, please kindly specify here._____

18.     Do you have the available suitable transportation to transport goats? **Tick the applicable answer**

| 1 | 0 |
|-----|-----------|
| Yes | Otherwise |

19. Do you have access to the extension officer? **Tick the applicable answer**

| 1 | 0 |
|-----|-----------|
| Yes | Otherwise |

20.     Do you have access to the local stock theft unit for certificate of removal from local police station? **Tick the applicable answer**

| 1 | 0 |
|-----|-----------|
| Yes | Otherwise |

**This is the end of the questionnaire, thank you very much for your time and cooperation. God bless you**.