



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

**Factors influencing cattle market participation in Mangeti Block, Oshikoto region,
Namibia**

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of

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Declaration

I, Paulus Panduleni Hangula, hereby declare that this thesis, entitled "*Factors Influencing Cattle Marketing in Mangeti Block, Oshikoto Region, Namibia*," is my own original work, carried out under the supervision of Professor David Uchesuba and Dr. Teofilus Shiimi. This thesis has not been submitted for a degree or examination at any other university. All the sources used or quoted in this work have been properly acknowledged and referenced in accordance with the prescribed academic conventions.

I further declare that I have maintained the principles of academic integrity and research ethics throughout the conduct of this study.

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Dedication

I dedicate this thesis first and foremost to Almighty God, whose grace, wisdom, and strength have guided me throughout this academic journey. Without His divine favor, this achievement would not have been possible.

To my beloved family, thank you for your unwavering love, prayers, and encouragement. Your sacrifices, patience, and belief in me have been the foundation of my perseverance and success. You have been my constant source of motivation and strength through every challenge.

Finally, this work is dedicated to the smallholder farmers of Mangeti Block and across Namibia, whose resilience, hard work, and commitment to improving their livelihoods inspired this study. May the findings of this research contribute, in some way, to improving the conditions and opportunities of all farmers striving for a better future.

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Abstract

This study investigates the socio-economic and institutional factors influencing cattle marketing decisions among smallholder farmers in Mangetti Block, Oshikoto Region, Namibia, with the objectives of (i) identifying key determinants of livestock marketing and (ii) assessing the constraints to participation in formal cattle markets. A cross-sectional descriptive design was employed using primary data collected from 46 randomly selected farmers. Descriptive statistics and correlation analysis were used to examine household characteristics and variable associations, while multiple regression analysis quantified the effects of explanatory variables on participation across auction, open market, and farm-gate channels. A multinomial logistic regression model, with auction as the base outcome, was further applied to analyse determinants of market channel choice, complemented by likelihood ratio tests to assess differences across outlets.

The results show that community auction participation and labour availability significantly increase auction sales. Open market participation is significantly influenced by community auction participation, education, gender, and farm size, while farm-gate sales are positively influenced by labour availability. The multinomial logit results indicate that education, farm size, community auction participation, and remedies significantly influence open market choice relative to auctions. For farm-gate sales, distance to auction, community auction participation, gender, farm size, and non-farm income significantly reduce participation, while labour, education, and borehole access increase it. The model demonstrates strong explanatory power, and predicted probabilities show that auctions are the dominant marketing channel, followed by open markets and farm-gate sales, with likelihood ratio tests confirming significant differences across outlets.

The findings demonstrate that market participation is characterised by an interaction of institutional access, household capacity, and infrastructural constraints; therefore, policy interventions should prioritise strengthening collective marketing institutions, improving rural transport and market infrastructure, and enhancing market literacy through

education and extension services to promote formal market participation, improve producer incomes, and support sustainable livestock commercialisation.

1.1 Background of the study

Cattle production is a central pillar of rural livelihoods in many parts of Sub-Saharan Africa and remains a key source of income, food security and social capital for smallholder households (Eyasmin, 2024; Magakwe & Olorunfemi, 2024). In Namibia, the livestock sector is a significant contributor to the agricultural economy and foreign exchange earnings, with live cattle exports and abattoir throughput being key components of national beef marketing flows (Meat Board of Namibia, 2023; FAO, 2022). Within the Oshikoto Region, the Mangeti Block is a predominantly communal area. In this area, cattle ownership serves both as a store of wealth and a potential source of income. However, producers' participation in formal marketing channels remains limited.

Scholarly and policy studies indicate that smallholder cattle marketing decisions are shaped by a constellation of socio-economic, institutional, infrastructural, and environmental factors (Eyasmin, 2024; OECD–FAO, 2022). Climatic variability (notably recurrent droughts), disease risk, poor transport infrastructure, limited access to reliable market information, and constrained veterinary services constrain the capacity of communal producers to market cattle effectively (FAO, 2022; World Bank, 2021). Namibia's national statistics and sector commentaries indicate growth in live-export volumes in some years, but persistent underutilisation of cattle marketed from communal areas compared to commercial production zones (Meat Board of Namibia, 2023; Nammic, 2023). These patterns indicate a disconnect between the existence of market opportunities at national and regional levels and actual smallholder participation in formal value chains.

A context-specific analysis of factors influencing cattle marketing in Mangeti Block is therefore necessary to identify barriers and opportunities within the local system and to

propose actionable interventions that could increase offtake, improve producer returns, and reduce livelihood vulnerability.

1.2 Problem statement

Despite the substantial cattle population in communal areas such as Mangeti Block, smallholder market participation remains low. Formal offtake rates are also limited. This situation constrains household incomes and slows regional agricultural development (Magakwe & Olorunfemi, 2024; Meat Board of Namibia, 2023). Structural constraints, including inadequate market infrastructure, long distances to auction sites or abattoirs, transport and transaction costs, and uneven access to market information, disincentivise farmers from selling cattle through formal channels and lead to reliance on informal farm-gate or local markets with lower returns (OECD–FAO, 2022; Eyasmin, 2024). Environmental pressures (drought and associated herd losses) further erode incentives and the capacity to participate in markets (FAO, 2022).

A scholarly investigation in Mangeti Block is essential due to the presence of a sizeable cattle population alongside persistently low participation of smallholder farmers in formal marketing systems and limited livestock off-take. This imbalance adversely affects household income generation and constrains broader regional agricultural development, indicating a disconnect between livestock availability and effective market integration. The current literature highlights several structural barriers, including inadequate market infrastructure, long distances to auction centres, high transport costs, and limited access to reliable market information, all of which discourage participation in formal markets. Furthermore, environmental challenges such as recurrent drought and associated livestock losses further weaken farmers' capacity to participate in structured marketing systems. Nevertheless, these constraints require context-specific empirical assessment to establish their relative significance within the Mangeti Block. Accordingly, localised academic research is necessary to generate evidence that can inform targeted policy

interventions aimed at improving market access, enhancing formal market participation, and strengthening rural livelihoods.

At the policy level, under-participation in markets among communal producers implies forgone economic opportunities and reduces the sector's capacity to contribute to poverty reduction and rural growth. The research problem addressed by this study is therefore: Which socio-economic and institutional factors influence cattle marketing decisions among smallholder farmers in Mangeti Block, Oshikoto Region, and how do these factors inhibit or enable participation in formal marketing channels? Answering this question will yield evidence to inform targeted interventions that aim to improve market participation and producer welfare.

1.3 Objectives of the study

Primary objective

To investigate the factors that influence cattle marketing among smallholder farmers in Mangeti Block, Oshikoto Region.

Specific objectives

1. To identify and assess the socio-economic and institutional influences on successful livestock marketing in Mangeti Block.
2. To determine how the identified factors inhibit smallholder farmers in Mangeti Block from participating in formal cattle markets.

1.4 Research hypotheses

H₀₁: Socio-economic characteristics of farmers have no significant effect on livestock market participation in Mangeti Block.

H_{a1}: Socio-economic characteristics of farmers have a significant effect on livestock market participation in Mangeti Block.

H₀₂: Access to livestock markets does not significantly influence livestock marketing participation in Mangeti Block.

H₀₃: There is no relationship between determinants and market choices of cattle marketing channels (auction, open market, and farm-gate) among smallholder farmers in the Mangeti block.

Ha₁: Socio-economic characteristics of smallholder farmers have a statistically significant effect on cattle marketing decisions in Mangeti Block.

Ha₂: Institutional and infrastructural factors have a statistically significant influence on cattle marketing decisions among smallholder farmers in Mangeti Block.

Ha₃: Socio-economic, institutional, and infrastructural factors significantly influence the choice of cattle marketing channels (auction, open market, and farm-gate) among smallholder farmers in Mangeti Block.

1.5 Literature review

1.5.1 Market channels and smallholder choices

Cattle producers typically choose among farm-gate sales, open/local markets, and auction or formal abattoir channels. Farm-gate sales offer convenience and low transaction costs, but typically yield lower prices and weaker bargaining positions. In contrast, auctions and formal abattoirs can achieve higher prices, but require a sufficient herd size, reliable transportation, and timely market information (Magakwe & Olorunfemi, 2024; Eyasmin, 2024). In Namibia, the national market is characterised by a substantial live-export component, which shapes price signals for producers; however, communal producers often face obstacles in accessing these channels (Meat Board of Namibia, 2023; Nammic, 2023).

1.5.2 Determinants of market participation

Empirical studies across Sub Saharan Africa (SSA) and other developing regions regularly identify the following determinants of livestock market participation: household socio-demographics (age, gender, education), herd size and composition, off-farm income, access to extension and veterinary services, distance to markets and transport costs, availability of water (boreholes) and feed, and presence or absence of effective producer

organisations (Eyasmin, 2024; Magakwe & Olorunfemi, 2024; OECD–FAO, 2022). The literature also emphasises the role of information asymmetries and weak value-chain linkages, which limit farmers’ ability to access higher-value markets (World Bank, 2021).

1.5.3 Interventions and strategies

Recommended strategies to increase smallholder market participation include strengthening rural infrastructure (roads, transport, abattoir capacity), improving access to market information and price determination, facilitating producer aggregation and cooperative marketing, expanding extension and veterinary services, and increasing access to finance and insurance to enable risk management (FAO, 2022; World Bank, 2021; Magakwe & Olorunfemi, 2024). Collective marketing and improved market linkages have been shown to reduce transaction costs and increase bargaining power for smallholders (Magakwe & Olorunfemi, 2024).

1.6 Proposed research design

1.6.1 Research approach and design

This study adopted a cross-sectional, descriptive quantitative design to capture the current determinants of cattle marketing in Mangeti Block. A structured questionnaire combining closed and a limited number of open-ended items was administered to smallholder cattle farmers. The cross-sectional approach is suitable given resource and time constraints, providing a representative snapshot of farmer behaviour and constraints at the time of data collection (Eyasmin, 2024).

1.6.2 Population and sampling

The target population comprises all smallholder cattle producers within Mangeti Block. Based on local agricultural extension records, the estimated number of farming households is approximately 100. A probability sampling strategy (simple random sampling or systematic random sampling, depending on household listings) will target a

sample of 45 households (45% of the population) to balance representativeness with logistical feasibility. The final sample size will be reported, along with the sampling frame and response rate.

1.6.3 Data collection instrument and variables

The survey instrument was used to collect data on:

The Primary marketing channel (dependent variable) used in the most recent sale (categorical: auction, open market, farm-gate). The socio-demographic characteristics (age, gender, education, household size), farm attributes (farm size, herd size, ownership/tenure), economic variables (off-farm income, input costs: feed, licks, remedies), institutional access (extension contact, veterinary services), infrastructural factors (distance to nearest auction/abattoir, transport availability, borehole/water access), and market information access – independent variables. Questionnaire items were drawn on established measures used in recent livestock commercialisation research (Eyasmin, 2024; Magakwe & Olorunfemi, 2024). Pre-testing with a small subset of farmers (5–10 households) ensured clarity and contextual relevance.

1.6.4 Data analysis

The data was analysed using STATA statistical software. The planned analyses include:

1. Correlation analysis to examine bivariate associations among variables.
2. Regression analysis to help the researcher understand and quantify relationships among variables and predict the research outcome. It allows the researcher to control confounding factors, drawing accurate and meaningful conclusions about the phenomena under study.
3. Multinomial logistic regression to model determinants of market channel choice (auction as the base category), estimating the relative influence of socio-economic and infrastructural predictors on the likelihood of choosing farm-gate or open market channels relative to auctions. Multicollinearity diagnostics and model fit statistics were reported.

4. Chi-square tests to examine associations between categorical predictors (e.g., gender, access to extension) and market choice.
5. Robustness checks (e.g., re-estimating models with alternative base categories, interaction terms) where sample size permits.

Significance was assessed at conventional levels ($p < .05$), and effect sizes and confidence intervals were reported to complement p-values.

1.6.5 Ethical considerations

Ethical clearance was sought from the university's ethics committee. Participation was voluntary. All respondents were provided informed consent after receiving information about the study's purpose, anonymity, confidentiality, and the voluntary nature of participation. Data will be stored securely and reported in aggregate form to prevent individual identification.

1.7 Significance of the study

This study offers both theoretical and practical contributions. Theoretically, it extends the empirical literature on smallholder livestock marketing by providing a context-specific analysis for Mangeti Block and adding evidence on how socio-economic and institutional factors interact to shape marketing decisions (Eyasmin, 2024; Magakwe & Olorunfemi, 2024). Practically, the findings will inform local extension services, cooperatives, and policymakers about priority interventions—such as transport subsidies, market information systems, cooperative strengthening, or targeted extension—to increase formal market participation, improve producer returns, and reduce vulnerability to shocks. Ultimately, improved market participation can contribute to poverty reduction, rural employment, and more sustainable livestock systems at the regional level (FAO, 2022; World Bank, 2021).

1.8 Limitations of the study

Several limitations warrant acknowledgement. The cross-sectional design provides a snapshot in time and cannot capture temporal dynamics or causal ordering; longitudinal studies would be needed to assess change over time. The relatively small sampling frame (approx. 100 households) constrains statistical power and limits generalisability beyond Mangeti Block. Self-reported data are subject to recall and social desirability biases; triangulation with extension records and, where possible, market data will be used to validate key variables. Despite these limitations, the study is designed to yield robust, policy-relevant insights into local determinants of cattle marketing.

1.9 Delimitations of the study

This study deliberately delimits its scope to cattle marketing among smallholder producers in Mangeti Block, Oshikoto Region. It excludes other livestock categories (e.g., goats, sheep) and crop production systems. Geographically, the findings are bound to the communal context of Mangeti Block and may not be directly transferable to commercial cattle systems or to other communal areas with substantially different institutional or ecological conditions.

1.10 Structure of the thesis

The thesis is organised as follows:

- **Chapter 1:** Introduction and background, problem statement, objectives, hypotheses, significance, limitations, and delimitations.
- **Chapter 2:** Literature review, theoretical frameworks, and empirical studies on livestock marketing, determinants of market participation, and interventions to improve participation.
- **Chapter 3:** Methodology research design, sampling, instruments, data collection procedures, analytical approaches, and ethical considerations.
- **Chapter 4:** Results, descriptive and multivariate findings, including multinomial logistic regression and hypothesis tests.

- **Chapter 5:** Discussion, conclusions, and recommendations interpretation of results in relation to literature, policy implications, limitations, and suggestions for further research.

Chapter Two

Literature review

2.1 Introduction

This chapter provides a comprehensive review of the literature on livestock marketing in the Oshikoto region. It aims to critically examine relevant studies, theories, and concepts that inform our understanding of the factors influencing livestock marketing, the challenges faced by small-scale farmers, and strategies to improve market participation. By reviewing and synthesising the available literature, the chapter will contribute to the theoretical framework of the studies and provide a foundation for the subsequent analysis and discussion of the research findings. The literature review will examine relevant scholarly works, reports, and empirical studies that illuminate key themes and issues related to livestock marketing in the context of Mangeti Block. It will examine the factors that influence livestock marketing, such as market access, infrastructure, information availability, and support services. Additionally, the review will explore the constraints and challenges faced by small-scale farmers in participating effectively in livestock marketing, including limited resources, institutional barriers, and market dynamics. Furthermore, the literature review will highlight strategies and interventions proposed in previous studies to enhance small-scale farmers' market participation, including capacity-building programs, market linkages, and policy recommendations. By synthesising and analysing the literature, this chapter will provide a comprehensive understanding of the current knowledge landscape and set the stage for the subsequent chapters.

The conceptualisation of factors influencing cattle marketing involves understanding the complex interplay among elements that shape the region's marketing dynamics. Cattle marketing is influenced by a combination of economic, social, environmental, and institutional factors that determine the success and participation of small-scale farmers in the market (Barrett, 2008; Jabbar, Ehui, & von Kaufmann, 2000). At an economic level, factors such as market access, pricing mechanisms, and demand patterns play a crucial role (Krugman & Obstfeld, 2018; Mankiw, 2020). The availability and proximity of markets, transportation infrastructure, and market information channels affect farmers' ability to connect with buyers and sell their livestock (Ouma et al., 2019). Additionally, understanding price fluctuations, market trends, and consumer preferences is vital for small-scale farmers to make informed decisions and maximise their returns from livestock sales (Kruger, H., & Lammerts-Imbuwa, 2015).

Traditional practices, cultural norms, and social networks can shape farmers' market behaviours and choices (Makhura, 2001). Access to social capital, including informal networks and cooperative structures, can provide small-scale farmers with support, knowledge sharing, and market linkages (Kruger & Lammerts-Imbusa, 2015). Furthermore, social factors, such as gender and household dynamics, can affect the participation of different groups in cattle marketing and influence decision-making processes (Obisesan et al., 2020).

Institutional factors, including policies, regulations, and support services, also significantly influence cattle marketing. The presence of supportive policies and institutions that facilitate access to credit, market information, veterinary services, and extension support can enhance the market participation of small-scale farmers (FAO, 2018). Conversely, bureaucratic procedures, inadequate infrastructure, and limited access to resources can pose barriers to effective marketing of livestock (Obisesan et al., 2020).

Understanding these factors and their interactions is essential for developing strategies and interventions to enhance cattle marketing. By addressing the challenges and leveraging the opportunities presented by economic, social, and environmental factors, small farmers can improve their market participation, increase their income, and contribute to the overall development of the livestock sector in the region.

2.3. Theoretical Framework

This study was informed by the Sustainable Livelihood Framework (SLF) approach. The Sustainable Livelihoods Framework is a widely used theoretical approach for analysing the diverse resources and strategies households rely on to improve and sustain their livelihoods. In the context of smallholder cattle farming in Mangeti Block, Oshikoto Region, the SLF provides a comprehensive lens for examining how various assets, external factors, and institutional influences shape farmers' capacity to participate in cattle markets.

The SLF was developed by the Department for International Development (DFID) in 1999 as a tool to understand how people utilise various types of assets to pursue their livelihood goals. The framework highlights five core assets (human, financial, physical, natural, and social capital) and emphasises the importance of understanding the vulnerability context in which people operate. The SLF also explores the role of institutions and policies in shaping individuals' and communities' choices and actions (DFID, 1999). The framework emphasises that livelihood outcomes, including income, well-being, and sustainability, are influenced by the interaction between the assets available to households and the contextual factors they encounter. The study of smallholder farmers' participation in cattle markets in Mangeti Block aligns well with this framework, as it focuses on understanding how farmers' access to resources and the challenges they face affect their full participation in the livestock market.

Human capital refers to the skills, knowledge, and health that individuals or households possess, which directly impact their productivity and livelihood outcomes. In the context of the Mangeti block, farmers' knowledge and skills in cattle farming practices (e.g., breeding, animal health, marketing strategies) are crucial for their participation in the livestock market. However, limited access to agricultural training and education could constrain their ability to optimise cattle farming for market success (Godde, Mason, & Mayberry, 2021). Financial capital includes the money, savings, and access to credit or loans that individuals can use to invest in their livelihoods. In Mangeti-block, limited access to financial services is a significant constraint to farmers' ability to invest in cattle marketing infrastructure, such as transportation or market participation costs (Togarepi, 2016).

The lack of financial capital further limits farmers' ability to manage the risks posed by droughts and other shocks. Physical capital encompasses the tools, infrastructure, and equipment that enable farmers to engage in productive activities. In this case, physical capital includes transport infrastructure, markets, and livestock handling facilities. Inadequate roads, lack of access to formal markets like Meatco, and poor-quality cattle pens can severely limit market participation by farmers (Nakale, 2019). Natural capital refers to the land, water, and biodiversity that support agricultural activities. In the Mangeti block, limited access to grazing land, poor-quality pastures due to overgrazing, and the impact of frequent droughts can negatively affect cattle health and marketability. The loss of livestock due to environmental stress further undermines the economic viability of farming in the region (AgriNamibia, 2019). Social capital involves the relationships, networks, and social structures that enable individuals to access resources and opportunities. In the Mangeti block, social networks such as local farmer groups and cooperatives may facilitate the sharing of market information and the development of collective marketing strategies. Trust between farmers and market participants (e.g., traders, abattoirs, buyers) is essential for overcoming market uncertainties and reducing transaction costs (Kamal, Martens, & Mechisowin, 2023).

The Sustainable Livelihoods Framework will guide this study by examining how smallholder farmers' access to assets (human, financial, physical, natural, and social capital) influences their participation in the cattle market in Mangeti Block. This framework provides insight into the opportunities and constraints that affect farmers' decision-making and behaviour. The SLF also enables the identification of interventions and policy recommendations to improve market access, address environmental risks, and enhance the overall sustainability of cattle farming in the region.

2.4. Factors influencing the marketing of livestock

2.4.1 Market Access

The availability and proximity of markets, as well as the accessibility of transportation infrastructure, affect farmers' ability to connect with buyers and sell their livestock (Mwacharo et al., 2018). Market access is a crucial factor influencing the successful marketing of livestock. It refers to farmers' ability to reach and connect with potential buyers and markets for their livestock products. Recent studies emphasise the importance of market access for smallholder farmers in achieving better market outcomes (Mwacharo et al., 2018; Ayuya et al., 2017; Djurfeldt et al., 2020; Bahta & Bauer, 2007; Nyikahadsoi et al., 2018). Improved market access enables farmers to expand their customer base, sell their livestock at competitive prices, and increase their income (Mwacharo et al., 2018). Limited market access, on the other hand, can result in reduced sales opportunities and lower prices for farmers, negatively impacting their profitability and livelihoods (Ayuya et al., 2017). Easy access to markets increases small-scale farmers' bargaining power, facilitates price discovery, and enables them to explore diverse market channels, thereby improving marketing outcomes (Djurfeldt et al., 2020). Restricted market access limits farmers' ability to sell their livestock, resulting in lower market participation and reduced economic returns (Bahta & Bauer, 2007). Moreover, market access is crucial for small farmers to participate in livestock health programs and comply with market requirements, thereby enhancing the marketability of their livestock

(Nyikahadsoi et al., 2018). In summary, addressing barriers and improving market access are essential for small-scale farmers to participate effectively in livestock markets, increase their market share, and achieve better marketing outcomes.

Market access is a critical determinant of economic viability for livestock producers in Namibia's Northern Communal Areas (NCAs), particularly in remote regions such as Mangeti Block. Market access refers to producers' ability to reach and participate in formal and informal markets where livestock and related products are exchanged. In the context of the NCAs, and specifically Mangeti Block, market access is shaped by a combination of infrastructural, institutional, environmental, and policy-related factors that either enable or constrain producers' ability to generate income from livestock production (MAWLR, 2021; Mujetenga, Shifiona, & Hango, 2020).

Mangeti Block, located in the Oshikoto region near the veterinary cordon fence, is characterised by a communal farming system with limited infrastructure and formal marketing channels. Livestock farmers in this area primarily rear cattle, goats, and sheep under extensive production systems. However, their ability to access high-value markets is restricted due to the region's classification as part of the NCAs—a zone subjected to strict animal disease control measures, especially for Foot-and-Mouth Disease (FMD). This zoning prohibits the export of live animals or meat from Mangeti to premium markets such as the European Union or South Africa, thereby confining producers to low-margin domestic and regional markets (LLPB, 2023; MeatCo, 2018).

One of the key institutional mechanisms that facilitates market access in Mangeti Block is the support provided by the Livestock and Livestock Products Board (LLPB). Through systems such as NamLITS (Namibian Livestock Identification and Traceability System) and FAN Meat (Farm Assured Namibian Meat), the LLPB assists communal farmers in complying with the traceability and quality requirements necessary to enter formal markets within the NCAs. These programs are crucial for maintaining basic health and

food safety standards and for facilitating access to formal auctions and abattoirs (LLPB, 2023). However, despite these efforts, the majority of livestock sales in Mangeti occur through informal channels, including farm-gate sales and local traders, where prices are often lower and unregulated (MCA-Namibia, 2015).

Transportation and infrastructure are significant barriers to market access in Mangeti Block. Poor road networks, limited availability of quarantine stations, and inadequate loading facilities make it costly and logistically challenging for producers to deliver animals to markets. Additionally, the nearest formal abattoirs are located far from the community, discouraging participation in regulated markets and leading to high transaction costs (MAWLR, 2021; MeatCo, 2018). The lack of reliable veterinary services and market information systems further compounds these challenges, leaving farmers without the necessary support to improve market readiness or respond to market signals (LLPB, 2023).

Financial services are another critical factor affecting market access in Mangeti Block. While Agribank offers specialised loan products for communal farmers, including the Emerging Retail Financing Product and the Youth Agri-entrepreneur Scheme, uptake remains low due to stringent requirements such as formal livestock ownership documentation and collateral—both of which are complicated by the communal tenure system (Agribank, 2022). This hinders farmers' ability to invest in production improvements that would enhance their competitiveness in formal markets.

Livestock market access in Mangeti Block remains constrained by structural and systemic challenges, including veterinary zoning restrictions, infrastructural limitations, inadequate financial services, and low levels of market integration. Institutional efforts by the LLPB and Agribank provide important foundational support, but further investment in infrastructure, veterinary extension, and localised marketing facilities is essential to improving producers' ability to access and benefit from formal livestock markets.

2.4.2 Market Information

Access to accurate, timely market information on prices, demand trends, and consumer preferences is crucial for small-scale farmers to participate successfully in livestock marketing. Market information enables farmers to make informed decisions about livestock sales, adjust their marketing strategies, and maximise their returns. Several recent studies support the relevance of market information in livestock marketing. Teshome *et al.* (2020) emphasise the importance of reliable market information for smallholder farmers' decision-making in livestock marketing. Their study reveals that access to market information enables farmers to make informed choices about selling their livestock, thereby improving marketing outcomes. Bekele *et al.* (2019) identify market information as a key determinant of the marketing success of small-scale farmers. They highlight that timely, accurate market information enables farmers to align their production and marketing strategies with market demand, resulting in better prices and increased profitability. Djurfeldt *et al.*, (2020) discuss the significance of market information in their research on smallholder livestock producers. They emphasise that access to market information enhances farmers' ability to negotiate prices, identify market opportunities, and respond to shifting consumer preferences, thereby leading to more successful marketing outcomes. Ochieng *et al.* (2017) highlight the role of market information in reducing market uncertainties and risks for small-scale farmers. Their study demonstrates that farmers with access to market information are better equipped to anticipate market changes, plan their marketing activities effectively, and mitigate potential losses.

Sarker *et al.* (2019) emphasise the crucial role of market information in facilitating small-scale farmers' market participation and integration. They argue that access to market information enables farmers to engage in value-added activities, meet quality standards, and target specific market segments, enhancing their competitiveness and market success. These studies collectively emphasise the relevance of market information as a

key factor influencing successful livestock marketing. Access to accurate and timely market information empowers small-scale farmers to make informed decisions, adapt their marketing strategies, and respond effectively to market dynamics. It enables farmers to identify market opportunities, optimise pricing, and meet consumer demands, leading to improved market outcomes, increased sales, and enhanced profitability. Therefore, ensuring the availability and accessibility of market information is crucial for small-scale farmers to participate effectively in livestock markets and achieve better marketing outcomes.

Market information plays a pivotal role in the functioning and development of livestock markets, particularly in underdeveloped regions such as Namibia's Northern Communal Areas (NCAs). Defined broadly, market information encompasses data on livestock prices, market demand, supply trends, and quality requirements, enabling producers to make informed decisions about the sale and management of their animals (FAO, 2017). In the NCAs, however, access to accurate and timely market information remains a significant constraint for communal farmers, contributing to market inefficiencies and reduced producer bargaining power (Mujetenga, Shifiona, & Hango, 2020).

The Livestock and Livestock Products Board (LLPB) of Namibia serves as the primary institution responsible for disseminating market information to producers in both commercial and communal areas. Through weekly bulletins, auction reports, and extension services, the LLPB provides data on livestock prices, sales volumes, and market trends (LLPB, 2023). These reports aim to enhance market transparency and empower farmers, particularly those in remote areas, to make strategic marketing decisions. In the NCAs, where producers are often geographically isolated and have limited access to mass communication infrastructure, such information is crucial for overcoming spatial market asymmetries (Ministry of Agriculture, Water and Land Reform, 2021).

Despite these efforts, the effectiveness of market information dissemination in the NCAs remains limited by infrastructural and socio-economic barriers. Many communal farmers

have limited access to the internet or mobile networks, restricting their ability to access digital market reports. Additionally, low levels of formal education and limited market literacy hinder farmers' ability to interpret and apply market data effectively (Millennium Challenge Account, MCA-Namibia, 2015). As a result, producers frequently rely on informal networks or local intermediaries (so-called “middlemen”) for pricing and sales decisions, which often leads to price manipulation and information asymmetry that disadvantage farmers (Mujetenga et al., 2020).

Furthermore, market information systems in the NCAs often fail to account for local socio-economic dynamics and livestock production cycles. For instance, the seasonal nature of livestock off-take, influenced by rainfall patterns, disease outbreaks, and communal events (e.g., festivals and funerals), is not always reflected in formal pricing reports. This mismatch between formal market signals and localised realities further limits the utility of available information for communal producers (MeatCo, 2018).

To address these challenges, multi-stakeholder initiatives have emerged to improve information dissemination. These include mobile-based livestock advisory platforms, farmer radio programs, and SMS alerts for auction prices. Such interventions, if scaled and integrated with extension services, could bridge the information gap and strengthen market participation in the NCAs. Additionally, increased investment in infrastructure, particularly mobile and internet connectivity, would significantly enhance the reach and relevance of market information systems (FAO, 2017; MAWLR, 2021).

While institutional mechanisms for disseminating market information exist within the NCAs, their impact is curtailed by infrastructural, educational, and socio-economic barriers. Addressing these issues through targeted investment, inclusive communication strategies, and farmer capacity-building initiatives is crucial for enhancing livestock marketing efficiency and improving producer welfare in the region.

2.4.3 Pricing Mechanisms

The mechanisms used to determine livestock prices, such as auctions and peer-to-peer negotiations, significantly impact the profitability of the livestock market for farmers. Pricing mechanisms play a crucial role in the successful marketing of livestock. Recent literature supports the relevance of pricing mechanisms in livestock marketing. Oguttu et al. (2020) identify pricing mechanisms as a critical factor affecting the marketing success of smallholder farmers. They emphasise that fair and transparent pricing mechanisms instil confidence in farmers and incentivise their active participation in livestock markets.

Sarker et al. (2019) discuss the significance of pricing mechanisms in their research on smallholder livestock producers. They argue that effective pricing mechanisms, including price discovery mechanisms and price transparency, enable farmers to receive fair prices for their livestock, thereby enhancing their profitability and market success. Ouma et al. (2018) highlight the crucial role of pricing mechanisms in determining the value and marketability of livestock. Their study reveals that transparent and competitive pricing mechanisms contribute to market efficiency, ensuring that both buyers and sellers receive fair prices based on the quality and characteristics of the livestock.

Akpalu et al. (2017) emphasise the influence of pricing mechanisms on small farmers' decision-making in livestock marketing. The authors emphasise that farmers' perception of fair pricing significantly affects their willingness to participate in the market, sell their livestock, and engage in long-term market relationships. Nyikahadsoi et al. (2018) emphasise the importance of pricing mechanisms in their study on the marketing behaviour of smallholder farmers. They argue that reliable, transparent pricing mechanisms reduce market uncertainty for farmers, allowing them to make informed decisions about the timing, volume, and pricing of their livestock.

These studies collectively highlight the relevance of pricing mechanisms as crucial factors influencing successful livestock marketing. Fair and transparent pricing mechanisms instil confidence in farmers, incentivise their participation, and ensure they receive fair prices

for their livestock. Transparent pricing mechanisms contribute to market efficiency and reduce uncertainties for farmers, enabling them to make informed marketing decisions. Therefore, implementing effective pricing mechanisms is essential for small-scale farmers to achieve better market outcomes and enhance their overall marketing success.

The pricing mechanism in Namibia's Northern Communal Areas (NCAs) livestock industry is shaped by a complex interplay of market access limitations, animal health restrictions, supply chain inefficiencies, and institutional interventions. Unlike Namibia's commercial farming sector, where livestock producers have access to export markets and more predictable pricing structures, producers in the NCAs face systemic constraints that lead to highly variable and often suppressed livestock prices (MAWLR, 2021; Mujetenga et al., 2020).

One of the key factors influencing livestock pricing in the NCAs is the region's classification under a veterinary cordon fence, which designates it as a Foot-and-Mouth Disease (FMD) protection zone. As a result, livestock from these areas is excluded from international export markets, particularly those in the European Union and South Africa, which demand stringent animal health and traceability standards. This limitation effectively reduces competition and price incentives, as producers in the NCAs are confined to domestic and regional markets with lower purchasing power (LLPB, 2023).

Livestock prices in the NCAs are primarily determined through local auctions and direct sales, where pricing is influenced by factors such as breed type, animal condition, age, and seasonal fluctuations in demand. However, the absence of a robust formalised grading system often leads to inconsistent pricing, with communal farmers at a disadvantage due to limited market information and negotiation power (MCA-Namibia, 2015). The Livestock and Livestock Products Board (LLPB) aims to address this asymmetry by publishing weekly market reports and auction results, thereby increasing price transparency and enabling farmers to make informed marketing decisions (LLPB, n.d.-b).

Moreover, the Livestock Marketing Incentive Scheme, supported by the Meat Corporation of Namibia (MeatCo), provides price subsidies to NCA farmers who deliver livestock to approved abattoirs. This program is designed to promote formal sector participation and stabilise producer prices in regions with limited marketing infrastructure. Despite its potential, uptake has been limited by logistical constraints, including poor road access, inadequate transport facilities, and the high cost of delivering animals to centralised markets (MeatCo, 2018).

Another dimension affecting pricing in the NCAs is the lack of access to financial services, which restricts farmers' ability to feed, vaccinate, and manage their animals to achieve higher market value. Without the capital to invest in animal quality and health, communal farmers often accept lower prices out of necessity or are forced to sell livestock during periods of distress, further depressing local market prices (Agribank, 2022).

In summary, the livestock pricing mechanism in the NCAs is influenced by restricted market access due to veterinary zoning, limited transparency in price formation, infrastructural weaknesses, and inadequate access to financial and technical resources. While institutional interventions such as auction price dissemination and marketing subsidies aim to mitigate some of these challenges, structural reforms are necessary to ensure fair and competitive pricing for communal livestock producers.

2.4.4 Quality Assurance

Ensuring high-quality livestock through proper breeding, feeding, and healthcare practices is crucial for successful livestock marketing. Quality assurance plays a significant role in influencing market success. Getachew et al. (2019) emphasise the importance of quality assurance in their study on smallholder dairy farmers in Ethiopia. They highlight that adhering to quality standards, including good hygiene practices, proper animal

handling, and compliance with health regulations, enhances the marketability of livestock products and increases farmers' competitiveness.

They argue that ensuring the quality and safety of beef products through proper animal management, veterinary care, and meat processing practices is crucial for gaining consumer trust and accessing premium markets. Ochieng et al. (2017) emphasise the crucial role of quality assurance in the success of small-scale farmers' markets. Their study reveals that farmers who prioritise quality assurance measures, such as proper feeding, disease control, and product traceability, are better positioned to meet market demands, command higher prices, and establish long-term market relationships.

Makanya et al. (2018) emphasise the importance of quality assurance systems in their study of beef farmers in South Africa. They argue that implementing quality control measures, such as grading systems, product certification, and carcass traceability, enhances market transparency, assures product safety, and improves marketing outcomes for farmers.

These studies collectively emphasise the relevance of quality assurance as a crucial factor influencing successful livestock marketing. Adhering to quality standards and implementing quality assurance measures enhances the marketability of livestock products, builds consumer trust, and provides access to premium markets. Compliance with quality assurance practices improves farmers' competitiveness, market access, and profitability. Therefore, incorporating and promoting quality assurance practices is essential for small-scale farmers to achieve better market outcomes and succeed in livestock marketing.

The Northern Communal Areas (NCAs) of Namibia constitute a unique livestock production zone, governed by specific animal health and trade protocols due to their classification as Foot-and-Mouth Disease (FMD) protection zones. Quality assurance in

this context is fundamental not only for ensuring food safety and animal health but also for facilitating access to domestic and regional markets. However, structural challenges, including communal land tenure systems, poor infrastructure, and constraints on disease control, pose persistent limitations to achieving comprehensive quality assurance (MAWLR, 2021; MCC, 2013).

The Livestock and Livestock Products Board (LLPB) serves as the primary regulatory body for quality assurance in Namibia's livestock industry. In the NCAs, the LLPB enforces veterinary and sanitary standards aligned with national policies and the World Organisation for Animal Health (WOAH) guidelines. Quality assurance mechanisms such as the Namibian Livestock Identification and Traceability System (NamLITS) and the Farm Assured Namibian Meat (FAN Meat) scheme play pivotal roles in this effort. NamLITS enables the real-time tracking of livestock movements, helping to manage disease outbreaks and maintain biosecurity. Meanwhile, FAN Meat provides a certification framework that ensures livestock meet minimum animal welfare, environmental, and production standards (LLPB, 2023).

Despite these efforts, livestock from the NCAs remains excluded from premium export markets due to the persistent classification of the area under animal disease control zoning. This exclusion limits producers' ability to capitalise on high-value markets that reward rigorous quality standards. Nevertheless, quality assurance measures still serve critical functions within domestic and regional markets, particularly by enhancing producer credibility, reducing transaction costs, and facilitating participation in formal marketing channels, such as auctions and abattoirs (Mujetenga et al., 2020).

Additionally, the LLPB's dissemination of market information, such as price updates and market trends, contributes to quality assurance by fostering transparency and informed decision-making among communal farmers. These systems support farmers in aligning

their production strategies with market demands, indirectly reinforcing quality through responsive production behaviour (LLPB, 2023).

Institutional and infrastructural support remains vital to enhancing quality assurance in the NCAs. For example, Agribank's financing schemes, which often cover veterinary inputs and kraal construction, indirectly promote adherence to quality standards by improving livestock health and management systems (Agribank, 2022). However, persistent constraints, such as limited veterinary outreach, lack of cold chain infrastructure, and informal livestock ownership patterns, undermine the full realisation of quality assurance in these communal settings (MAWLR, 2021).

While the NCAs face significant challenges in aligning with global quality standards due to their epidemiological status and systemic limitations, ongoing institutional efforts, particularly through traceability and certification systems, form the backbone of quality assurance in this region. Further investment in infrastructure, veterinary services, and farmer training will be essential to improving the credibility, safety, and marketability of NCA livestock.

2.4.5 Animal Health

The health status of livestock, including disease prevention and control measures, is crucial for the successful marketing of livestock. Nyokabi et al. (2018) emphasise the importance of animal health in their study on smallholder dairy farmers in Kenya. They highlight that maintaining good animal health through vaccination programs, disease prevention, and proper management practices enhances the marketability of livestock and increases farmers' profitability. Gashaw et al. (2019) discuss the significance of animal health in their research on small ruminant value chains in Ethiopia. They argue that ensuring the health and well-being of animals through regular veterinary care, deworming, and disease control measures is crucial for producing healthy livestock products, meeting market requirements, and accessing higher-value markets. Ayuya et

al. (2017) emphasise the crucial role of animal health in the marketing success of small-scale farmers. Their study reveals that farmers who prioritise animal health practices, such as routine vaccinations, proper nutrition, and parasite control, are better able to produce healthy livestock, reduce mortality rates, and improve market outcomes. Mahajan et al. (2019) emphasise the significance of animal health management in their study of cattle farmers in India. They argue that maintaining good animal health through proper nutrition, vaccination programs, and disease prevention measures improves the marketability of cattle, reduces health-related risks, and enhances farmers' marketing outcomes.

Proper animal health management practices contribute to producing healthy livestock, meeting market requirements, and accessing higher-value markets. Maintaining good animal health also reduces mortality rates, improves productivity, and enhances farmers' profitability in the market. Therefore, prioritising animal health and implementing appropriate veterinary care measures is essential for small-scale farmers to achieve better market outcomes and succeed in livestock marketing.

Animal health care forms a foundational element of livestock production systems in Namibia, particularly within the Northern Communal Areas (NCAs), where smallholder farming is predominant. Effective disease control, animal nutrition, and preventive care practices are central to sustaining livestock productivity and ensuring food security in these regions. The provision of veterinary services, disease surveillance, and structured seasonal management plans has been critical in strengthening the resilience of small-scale farmers to climate variability, livestock diseases, and market demands (MAWLR, 2021; FAO, 2022).

Table 1. Seasonal Livestock Management Calendar-NCAS

Season	Months	Key Activities
Rainy Season (Main Growing Season)	November – March	- Planting of fodder crops (e.g., lablab, cowpeas) - High pasture availability – rotational grazing starts - Tick and fly control (dip/spray livestock) - Monitor animals for internal parasites (deworming) - Calving/kidding season – monitor births and provide support - Vaccinate against anthrax, black quarter, lumpy skin (Nov–Dec) - Supplement with minerals (e.g., salt licks, phosphorus) - Maintain water sources – clean and repair troughs/tanks
Post-Rainy Season (Cooling Off)	April – June	- Weaning of young stock - Begin early haymaking and fodder harvesting - Continue rotational grazing (pastures still adequate) - Culling unproductive or sick animals - Vaccinate against CBPP and pasteurellosis - Castration and branding of young animals - Livestock marketing/sales – take advantage of healthy body condition - Repair kraals, fences, and water points
Dry Season (Stress Period)	July – September	- Feed supplementation (hay, crop residues, commercial feed) - Ensure access to clean water – water stress high - Treat for internal/external parasites - Monitor for signs of nutritional deficiencies - Implement strict grazing control – prevent overgrazing - Firebreak construction and maintenance - Preg-check (if AI or controlled breeding done) - Vaccinate small stock for pulpy kidney disease (July)
Hot Dry Season (Pre-Rain)	October – early November	- Finalise firebreaks before lightning season - Clean and repair water infrastructure - Prepare fields for fodder/cover crop planting - Deworm livestock before rainy season begins

Season	Months	Key Activities
		- Monitor and treat tick infestations - Keep breeding records and plan for upcoming calving - Prepare for rainy season vaccinations

Source: Namibia Ministry of Agriculture, Water and Forestry (MAWF), Extension Materials (2016–2021)

The Directorate of Veterinary Services (DVS), under the Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR), plays a leading role in safeguarding animal health in the NCAs. Through national vaccination campaigns, the DVS provides essential disease control services targeting high-risk areas, especially where informal farming practices and limited access to commercial veterinary care increase vulnerability to disease outbreaks (FAO, 2024).

In 2024, the DVS, in collaboration with the Food and Agriculture Organisation (FAO), implemented a widespread vaccination campaign in response to a Lumpy Skin Disease (LSD) outbreak that affected multiple regions, including Otjosondjupa, Kavango East, Sambesi, and Ohangwena. The campaign successfully vaccinated over 1.28 million cattle and was complemented by disease surveillance, farmer awareness programs, and movement control protocols to prevent further spread (Namibian Sun, 2024). Similar national campaigns are routinely conducted to control other transboundary animal diseases (TADs) such as Foot-and-Mouth Disease (FMD), Contagious Bovine Pleuropneumonia (CBPP), and anthrax (FAO, 2024).

The integration of the National Livestock Identification and Traceability System (NAMLITS) further enhances disease response efficiency and supports livestock market access. Farmers are required to adhere to official identification protocols, which link animal health status to market eligibility and contribute to national disease reporting efforts (FAO, 2024).

Animal health declarations, required biannually by the DVS, are an integral part of the country's health monitoring system. These declarations allow the government to track disease prevalence, enforce quarantine regulations, and report animal health data to international bodies such as the World Organisation for Animal Health (OIE). Failure to submit these declarations may result in a temporary suspension of branding privileges or restrictions on livestock movement (Namibia Trade Network, 2025).

Furthermore, educational outreach remains a core strategy for improving veterinary compliance among communal farmers. In 2023, a major awareness campaign conducted across the NCAs reached over 2,800 farmers, focusing on improved animal husbandry practices, vaccination awareness, and the early detection of diseases such as FMD and CBPP. These programs aim to increase participation in national veterinary programs and to build adaptive capacity among small-scale livestock producers (WOAH, 2023).

Notifiable diseases are defined as animal diseases that must, by law, be reported immediately to veterinary authorities due to their potential for rapid spread and serious socio-economic consequences (WOAH, 2023). In Namibia, the Directorate of Veterinary Services (DVS) is responsible for monitoring, reporting, and controlling these diseases to protect animal health and support trade compliance (FAO, 2024).

Common notifiable diseases in Namibia include Foot-and-Mouth Disease (FMD), Contagious Bovine Pleuropneumonia (CBPP), Lumpy Skin Disease (LSD), Anthrax, and Rabies. Livestock owners, veterinary officers, and extension workers are legally obliged to report suspected cases immediately to the nearest DVS office. This prompt reporting facilitates rapid mobilisation of control measures, including quarantine, movement restrictions, vaccination campaigns, and, in extreme cases, culling of infected or exposed animals (Namibia Trade Network, 2025; FAO, 2024). Outbreak responses involve comprehensive actions such as: Quarantine and Movement Control: Restricting the

movement of animals from infected and surrounding zones to contain disease spread. Vaccination Campaigns: Mass immunisation of susceptible livestock, often in partnership with international bodies like the FAO. Culling and Disposal: Humane destruction and safe disposal of infected animals to eliminate disease reservoirs. Farmer Education and Awareness: Increasing community knowledge on disease recognition, biosecurity, and compliance with veterinary directives. Laboratory Confirmation: Diagnostic testing to confirm disease presence and guide response strategies.

Despite these structured protocols, challenges persist, including limited veterinary coverage in remote areas, logistical difficulties in vaccine distribution, and occasional delays in disease reporting. Continued investment in veterinary services, farmers' training, and digital reporting platforms remains crucial for effective disease control in Namibia's livestock sector (WOAH, 2023; FAO, 2024).

The coordinated approach to animal healthcare in Namibia, particularly in the NCAs, exemplifies a robust system that integrates vaccination, seasonal management, traceability, and farmer education. These interventions have significantly reduced disease prevalence, enhanced livestock productivity, and increased the resilience of smallholder systems. However, ongoing challenges such as limited veterinary coverage in remote areas, climate-related stress, and low farmer compliance underscore the need for continued investment in animal health services and infrastructure.

2.4.6 Supply Chain Coordination

Efficient coordination and collaboration among market actors, including farmers, traders, processors, and service providers, are essential for the successful marketing of livestock. Asamoah et al. (2019) emphasise the importance of supply chain coordination in their study on smallholder poultry farmers in Ghana. They highlight that effective coordination among farmers, input suppliers, processors, and marketers improves market efficiency, reduces transaction costs, and enhances farmers' access to markets and services.

Mugunieri et al. (2019) discuss the significance of supply chain coordination in their research on small-scale beef producers in Kenya. They argue that coordinated efforts among farmers, traders, processors, and retailers enable the smooth flow of livestock products, ensure product quality, and enhance market performance.

Gebremariam et al. (2017) highlight the crucial role of supply chain coordination in small farmers' marketing success. Their study reveals that effective coordination in the dairy value chain, including timely collection and transportation of milk, proper storage facilities, and collaboration among stakeholders, enhances market access and improves farmers' profitability.

Ferrer et al. (2018) found that supply chain coordination positively influences the marketing outcomes of smallholder goat farmers in the Philippines. The authors emphasise the importance of coordination among farmers, traders, and processors to ensure efficient product flow, minimise post-harvest losses, and access higher-value markets. They argue that effective coordination among farmers, input suppliers, processors, and traders enhances market linkages, facilitates access to resources and inputs, and improves market outcomes for small-scale farmers.

Market linkages play a vital role in the successful marketing of livestock, and recent literature supports their relevance. Nkonya et al. (2017) conducted a study on smallholder dairy farmers in Uganda, emphasising the importance of market linkages in livestock marketing. They highlighted that establishing strong, reliable relationships with market actors, such as processors and retailers, enhances farmers' market access. This improved access allowed farmers to negotiate better prices and increase their market share. Kiregyera et al. (2019) discussed the significance of market linkages in their research on small-scale beef producers in Uganda. They argued that forming strategic partnerships and alliances with market intermediaries, such as traders and processors, enabled

farmers to access diverse markets and negotiate better prices. These linkages increased farmers' market competitiveness.

Ochieng et al. (2019) conducted a study that revealed the critical role of market linkages in the marketing success of small farmers. They found that building direct connections with end consumers, such as restaurants and hotels, through direct marketing initiatives or farmer-producer organisations, improved farmers' market access and reduced transaction costs. This, in turn, enhanced their profitability. Ayalew et al. (2020) examined the poultry sector in Ethiopia and found that market linkages positively influenced smallholder farmers' market participation and profitability. Collaborative efforts among farmers, input suppliers, and processors in establishing efficient market linkages and sharing market information were crucial. These linkages allowed farmers to access higher-value markets and improve their marketing outcomes.

Tran et al. (2019) emphasised the significance of market linkages in their research on small-scale pig farmers in Vietnam. They argued that developing relationships with market intermediaries, such as traders and wholesalers, improved farmers' market access, reduced market risks, and enhanced their marketing outcomes. These studies collectively highlight the relevance of market linkages as a crucial factor in successful livestock marketing. Building strong, reliable connections with market actors, establishing strategic partnerships, and developing direct marketing channels enhance farmers' market access, improve price negotiation, and increase market competitiveness. Therefore, fostering market linkages and promoting collaboration among different actors in the livestock value chain is essential for small farmers to achieve better market outcomes and succeed in livestock marketing.

In communal areas of Namibia, most cattle are sold informally through private transactions at the homestead or village level. These informal markets are preferred because they allow for immediate payment upon delivery, minimal administrative

processes, and the ability to market cattle at any time. Togarepi et al. (2016) note that in the Ohangwena Region, informal cattle sales account for over 70% of all transactions, with spot cash payments. This is particularly attractive for smallholder farmers who require quick access to cash for emergencies such as school fees, droughts, or funerals.

Informal markets also provide greater autonomy and bargaining power for sellers, especially in the absence of local formal infrastructure (Shiimi et al., 2012). These markets operate without formal grading, inspection, or taxation, making them less burdensome for communal farmers who may not meet the veterinary or quality standards demanded by formal buyers. In South Africa's Nguni Cattle Project, similar behaviour was observed: only 4% of cattle were sold through formal abattoirs, while 79% were sold privately or at informal auctions (Khapayi & Celliers, 2020).

Formal cattle marketing in Namibia is largely managed through auctions and Meatco, which impose regulatory requirements including ear tagging, brand registration, veterinary inspections, and movement permits. These procedures, while essential for disease control and export standards, can be prohibitively expensive and time-consuming for communal farmers. The requirement to hold cattle in quarantine zones for up to 21 days prior to slaughter further discourages participation, as animals lose weight and value during this period (De Bruyn et al., 2001).

In addition, delayed payment structures are often several days or weeks after delivery, reducing the attractiveness of formal markets. A study by Shiimi et al. (2012) found that payment timing was among the top three determinants of whether a farmer chooses to sell formally or informally. The lack of trust in formal systems, driven by inconsistent pricing, slow transactions, and poor communication, further compounds these issues.

Transaction costs, defined as the time, effort, and financial resources required to engage in a market transaction, play a critical role in livestock marketing decisions. In northern

Namibia, Shiimi et al. (2012) employed Probit and Tobit models to show that transportation, seller age, access to communication technologies, and distance to market significantly influenced the likelihood of selling through formal channels. Farmers with mobile phones and access to price information were more likely to use formal channels, while older farmers and those located far from auction facilities preferred informal transactions.

Similar findings were observed in Botswana, where Mahabile (2013) reported that transaction costs related to veterinary checks, transportation, and time delays discouraged farmers from participating in formal auctions. Instead, most relied on village sales and brokers, who offered immediate payments and eliminated logistical burdens. Despite the economic importance of cattle, Namibia lacks permanent, daily livestock markets that offer continuous sales and support services. Instead, cattle marketing is largely reliant on periodic auctions or on limited facilities operated by Meatco (Togarepi et al., 2016). These are often underutilised, operating far below capacity due to low throughput and limited access by rural farmers.

A permanent market could offer consistent services, such as weigh stations, grading, veterinary inspection, and on-site payment, thereby greatly reducing transaction costs and improving traceability. However, current infrastructure is largely centralised in urban areas or restricted to the veterinary cordon fence (VCF) zones, excluding most communal farmers in the northern regions (De Bruyn et al., 2001).

Access to market information is another factor limiting formal participation. Many farmers are unaware of current cattle prices, upcoming auction dates, or the requirements of potential buyers. Without timely and transparent data, they are more likely to accept lower prices from local brokers offering immediate cash (Shiimi et al., 2012). Mobile technologies and digital platforms present an opportunity to bridge this gap, as demonstrated in Kenya and Uganda, but remain underutilised in Namibia.

Farmer cooperatives can help reduce transaction costs, improve bargaining power, and facilitate access to formal markets. By pooling resources and negotiating as a group, farmers can access better prices, organise transport, and manage compliance with veterinary standards. However, collective action remains limited in Namibia due to weak organisational capacity, lack of trust, and minimal government support (Togarepi et al., 2016).

The literature reveals a consistent trend: communal farmers prefer informal, pay-on-spot arrangements due to their simplicity, speed, and reliability. However, these systems limit the potential for formal value chain integration, quality control, and national livestock development. There is a strong case for introducing permanent livestock markets, streamlining payment systems, and reducing transaction costs through infrastructure development and mobile technology integration.

2.4.7 Access to Finance and Input Investment

Access to financial services, particularly credit, has been shown to directly influence smallholder farmers' ability to purchase livestock feed and other essential inputs. Feed is a major production cost in livestock systems, and financial liquidity enables farmers to sustain a feed supply, which in turn enhances growth rates and increases the volume of market-ready animals. According to Melesse et al. (2023), livestock market participation in Zimbabwe is significantly associated with increased use of improved inputs and better food security, implying a feedback loop between financial empowerment and market engagement.

Moreover, Langyintuo (2020) emphasised that financial constraints are a major bottleneck to the use of inputs in Sub-Saharan Africa. When credit is accessible, farmers are more likely to invest in quality feed, veterinary care, and other resources essential for increasing livestock productivity and market throughput.

Farmers with access to finance are also more likely to invest in higher-quality breeding stock, such as bulls with superior genetics, which can significantly increase cattle's body mass and market value. Credit enables such capital-intensive investments. Though not often quantified in isolation, the acquisition of improved breeds through financial support is documented in various livestock value chain analyses (Mutambara et al., 2013). Better genetics result in animals that better meet market preferences, thereby enhancing sales prospects and pricing power.

Infrastructure related to livestock management, such as housing, water access, and veterinary services, is another area where finance plays a crucial enabling role. According to Yuliyus et al. (2022), infrastructure development (including health-related investments like deworming and vaccination) improves livestock productivity and profitability, especially when integrated with financial support systems. Similarly, studies in South Africa by Sebola et al. (2022) found that farmers with access to veterinary and extension services, which are often financed through credit or co-operative schemes, were more likely to participate in livestock markets. This suggests that access to capital not only enables better care but also enhances the farm's structural capacity, reducing animal mortality and improving the quality of marketed livestock.

While financial access is vital, it operates most effectively within a broader framework that includes extension services, road infrastructure, and market information systems. For instance, Chingala et al. (2017) reported that farmers receiving both extension advice and financial services were significantly more engaged in livestock marketing compared to those lacking these supports. Infrastructure deficiencies can therefore mitigate the benefits of financial access.

Formal credit for livestock farmers in Namibia is constrained. Agribank and other formal institutions serve commercial operators more than smallholders. Demand-side

constraints include a lack of collateral, particularly among communal farmers' bureaucracies, and limited working capital (Amadhila & Ikhide, 2019; Vidrigu, 2023). Only a small fraction (~13%) of maize and livestock producers use formal credit; many rely on informal sources (Vidrigu, 2023). Thus, while facilities exist, farmers often struggle to be eligible or to realise their use (Amadhila & Ikhide, 2019; Vidrigu, 2023).

Lack of tangible collateral: Communal landholding does not provide acceptable security (Vidrigu, 2023; Namibia Economist, 2022). Low awareness of options: Many farmers are unaware of credit products beyond Agribank (Vidrigu, 2023; Nedbank Survey, 2024). Perceived high risk: Climatic shocks (e.g., drought), production variability, and administrative delays deter both lenders and borrowers (Amadhila & Ikhide, 2019; Nedbank Survey, 2024). Small-scale operation: Loans are often too large; transaction costs and product mismatches reduce farmer demand (Namibia Economist, 2022; NN, 2024).

Case studies among Agribank borrowers in the Oshakati region reveal that farmers primarily use loans for fencing, livestock, and milling equipment. However, many, especially subsistence farmers, lack the income to service loans without external sources, often relying on salaries rather than agribusiness revenues (Likius, 2024 MSc research). Those who do develop income from livestock have been able to repay on time (Likius, 2024). However, during droughts, debt-service challenges increased, and many emerging farmers sold cattle prematurely at low prices to meet their obligations (Dlamini, 2025).

While access to credit enables investment in production, for example, by purchasing more stock, there are indications that financing is not always utilised to enhance marketing infrastructure or strategies. Instead, credit is more commonly used to expand herd size or meet immediate cash needs, without guaranteed market entry or profitability. Farmers who borrow may face pressure to market more livestock to service their loans, especially under drought conditions where costs surge, and revenues decline (Dlamini, 2025).

However, this can pressure them into distress sales at low prices, undermining income potential. The Agricultural Bank's repossession of farms upon default underscores this risk (Dlamini, 2025). Thus, the linkage between borrowing and improved marketing depends heavily on context and governance of loan terms.

2.4.8. Infrastructure

Adequate infrastructure is essential for the efficient marketing of livestock and for farmers' success in the sector. Kansiime et al. (2018) conducted a study on smallholder dairy farmers in Uganda, highlighting the importance of infrastructure in livestock marketing. They emphasised that the availability of well-maintained roads, transportation networks, and market facilities greatly enhanced farmers' access to markets. Improved infrastructure not only reduced transportation costs but also improved market outcomes for smallholder dairy farmers.

Gakuru et al. (2019) conducted a study of smallholder pig farmers in Rwanda and discussed the significance of infrastructure for their marketing efforts. They argued that the presence of proper livestock handling facilities, cold storage facilities, and slaughterhouses significantly improved the quality and marketability of livestock products. With improved infrastructure, farmers gained access to higher-value markets and increased their profitability. Seng et al. (2019) conducted a study that revealed the critical role of infrastructure in the marketing success of small farmers. They found that efficient transportation systems, storage facilities, and processing units played a crucial role in reducing post-harvest losses, ensuring product quality, and expanding market opportunities for farmers. Improved infrastructure directly contributed to better marketing outcomes.

Temesgen et al. (2020) researched the beef value chain in Ethiopia and found that infrastructure positively influences smallholder farmers' market participation and profitability. Access to well-functioning market facilities, such as cattle markets and

abattoirs, improved farmers' ability to sell their livestock, negotiate prices, and access formal markets. The availability of such infrastructure directly impacted their marketing success.

Ahmed et al. (2019) conducted a study of small-scale dairy farmers in Bangladesh, emphasising the importance of infrastructure for livestock marketing. They argued that access to reliable electricity, milk collection centres, and chilling facilities enabled farmers to maintain the quality and freshness of their milk, thereby improving marketability and returns. Infrastructure played a crucial role in ensuring product quality and enhancing market outcomes. The Mangeti Block, situated in Namibia's Oshikoto and Kavango West regions, is a government-initiated ranching area intended to boost commercial livestock production. However, a major constraint in the area is poor road infrastructure. Most roads are gravel or earth roads, which become impassable during the rainy season due to flooding and erosion. These conditions significantly hinder the movement of livestock and goods, leading to high transaction costs and delays in marketing activities (De Bruyn et al., 2001).

According to Mwandemele et al. (2015), road development has not kept pace with agricultural investment in Mangeti, with farmers citing poor connectivity as a leading barrier to accessing auctions and abattoirs. Limited government investment has been made over the past decade to upgrade feeder roads in the area, despite ongoing concerns raised by the Mangeti Farmers' Association. A permanent livestock auction facility was established in Mangeti Block approximately five years ago at the Oshondili private auction pen. It operates monthly and serves as the primary marketing venue for most local farmers. However, a clear need for additional marketing infrastructure in the area remains (Namibian Sun, 2019; Togarepi et al., 2016).

In 2019 and 2020, local farmers, through the Mangeti Farmers' Association, organised emergency livestock auctions in response to severe droughts (New Era, 2020). These sales

were supported by the Ministry of Agriculture, Water and Land Reform (MAWLR), but no permanent auction yard was developed as a result. Shiimi et al. (2012) argue that the absence of stable marketing facilities in communal and resettled farming areas, such as Mangeti, leads farmers to default to informal markets and sell livestock at suboptimal prices. The lack of veterinary services, weighing stations, and holding pens also contributes to the market.

Over the past decade, the Namibian government, through MAWLR and the Namibia Development Corporation (NDC), has sought to unlock the economic potential of the Mangeti Block. Between 2015 and 2020, efforts were made to rezone the area north of the Veterinary Cordon Fence (VCF) to give farmers in Mangeti access to broader formal markets, including export abattoirs (MAWLR, 2019). At the same time, the NDC earmarked over 50,000 hectares within the Mangeti Cattle Ranch for commercial cattle production and youth empowerment projects (NDC, 2017). However, despite these policy interventions, on-the-ground infrastructure, especially marketing infrastructure, remains underdeveloped.

The Mangeti Farmers' Association has also advocated for improved access roads, borehole rehabilitation, and communal holding facilities, but implementation has been slow due to limited funding and political prioritisation (New Era, 2020). Given the lack of permanent market facilities in Mangeti, the role of livestock transporters has become vital. Farmers often rely on private individuals or small trucking businesses to move cattle to auction locations or abattoirs. Nomtsas Auctions (2024) lists several transporters, including Piet Koen and Adolf Schnebel, who serve northern farming areas and offer farm-to-market delivery.

While these entrepreneurs provide a valuable service, their availability and affordability remain inconsistent. Transport costs can exceed N\$2,000 per trip, depending on the

distance and livestock load, which limits the participation of smallholder farmers (Shiimi et al., 2012).

Agra Auctions (2025) notes that transport logistics are one of the biggest challenges facing communal farmers, as delays and vehicle shortages can result in missed auction opportunities. This underscores the need for coordinated transport systems or cooperatively owned trucks to reduce the burden on individual farmers.

2.4.9. Policy and Regulations

Favourable policies, regulations, and supportive institutions that address market distortions, promote fair trade, and ensure compliance with quality and safety standards can enhance livestock marketing (Swinnen et al., 2019). Policy and regulations are relevant factors influencing the successful marketing of livestock. They refer to the laws, regulations, and government policies that govern the livestock sector and shape the market environment. In their study on smallholder poultry farmers in Nigeria, Adekunle et al. (2018) emphasise the importance of policy and regulations in livestock marketing. They highlight that clear, supportive policies on market access, quality standards, and value chain development create an enabling environment for farmers and improve market outcomes. Jirousek et al. (2019) discuss the significance of policy and regulations in their research on small-scale beef producers in Tanzania. They argue that well-designed and enforced regulations regarding animal health, product quality, and food safety are essential for ensuring consumer confidence, improving market access, and enhancing farmers' competitiveness.

According to Langyintuo (2020), policy and regulations play a critical role in the marketing success of small farmers. Their study reveals that supportive policies, such as price stabilisation mechanisms, market information systems, and input subsidies, enhance farmers' profitability, reduce market risks, and promote market participation. In a study by Dube et al. (2020), policy and regulations were found to positively influence smallholder farmers' market participation and profitability in Zimbabwe's dairy sector.

The authors highlight the importance of clear policies on milk pricing, milk quality standards, and access to veterinary services to ensure fair market outcomes and protect farmers' interests.

In their research on livestock producers in Kenya, Matasyoh et al. (2020) emphasise the importance of policy and regulations in livestock marketing. They argue that supportive policies, such as access to credit and insurance schemes, market information systems, and improved extension services, enable farmers to overcome market barriers and enhance their market performance.

These studies highlight the relevance of policy and regulations as crucial factors influencing successful livestock marketing. Well-designed and enforced policies and regulations create an enabling environment for farmers, ensure fair market conditions, protect consumer interests, and promote market access and competitiveness. Therefore, formulating and implementing supportive policies and regulations is essential for small farmers to achieve better market outcomes and succeed in livestock marketing.

Livestock marketing in Namibia, particularly in the Northern Communal Areas (NCAs), is governed by a network of regulatory institutions and policies that aim to ensure animal health, traceability, and market integrity. While these frameworks are designed to support national export capacity and food safety, they also present challenges for smallholder communal farmers in complying with technical standards.

The Farm Assured Namibian Meat (FAN Meat) scheme, administered by the Livestock and Livestock Products Board of Namibia (LLPBN) and the Directorate of Veterinary Services (DVS), is the backbone of Namibia's livestock traceability system. It establishes strict requirements for livestock identification, health declarations, and movement control across the production and marketing chain (LLPBN, 2023; NamLITS, 2022).

Under FAN Meat, all producers must register their stock brands and premises. Tag livestock using approved identifiers. Record animal movements and health statuses through the Namibian Livestock Identification and Traceability System (NamLITS). Submit biannual herd health declarations and permit all animal movements through official veterinary channels (LLPBN, 2023). These requirements are vital for maintaining Namibia's disease-free status and export eligibility, particularly for high-value international markets like the EU and China (Meat Board of Namibia, 2022). In response to sector-wide demands for improved quality assurance and trade competitiveness, Namibia enacted the Livestock and Livestock Products Regulations (Government Gazette No. 8533, GN 381 of 2024). This legislation mandates that all producers, abattoirs, and processing facilities register with the LLPBN, introduces permit systems for the handling and export of controlled products, and enforces levy payments on livestock sales to fund regulatory and market development efforts (Government of Namibia, 2024). These regulations reinforce compliance with FAN Meat protocols and expand governance beyond export zones to include domestic markets as well. However, for farmers in the NCAs, the requirements can pose logistical and administrative challenges (Togarepi, Thomas, & Kankono, 2016).

While FAN Meat and the LLPBN framework aim to promote safety and traceability, communal-area farmers in the NCAs often face substantial barriers to compliance. First, administrative burdens such as registering livestock brands, acquiring movement permits, tagging animals, and submitting regular documentation can be overwhelming for subsistence or semi-commercial producers (Togarepi et al., 2016; LLPBN, 2023).

Physical infrastructure constraints, such as limited access to veterinary services, quarantine facilities, and poor road networks, hinder the timely fulfilment of regulatory obligations (Katjuongua & Kavari, 2014). Additionally, the **Veterinary Cordon Fence (VCF)**, commonly known as the Red Line, further restricts NCA farmers by requiring additional quarantine and testing procedures for livestock intended for marketplaces

south of the fence or for export, increasing transaction costs and delaying market access (Pendapala, 2023). The ban on feeding livestock with animal-derived protein, implemented to maintain Namibia's Bovine Spongiform Encephalopathy (BSE)-free status, also affects traditional feeding practices in communal systems (Meat Board of Namibia, 2022).

Several institutions are tasked with enforcement and support, including the DVS, LLPBN, and the Ministry of Agriculture, Fisheries, Water and Land Reform. However, the institutional support available to smallholder farmers in the NCAs is often insufficient. For instance, there is a lack of veterinary outreach personnel, financial resources for transport and vaccination, and limited awareness campaigns about FAN Meat requirements (Togarepi et al., 2016; Pendapala, 2023).

To address these gaps, scholars and practitioners have called for stronger inter-agency coordination, public-private partnerships to fund compliance infrastructure, and targeted subsidies to reduce the financial burden of regulatory adherence on communal farmers (Katjuongua & Kavari, 2014; Meat Board of Namibia, 2022).

In summary, the regulatory frameworks governing livestock marketing in Namibia, particularly the FAN Meat scheme and LLPBN's 2024 regulations, offer a structured and credible path to both domestic and international markets. However, the rigid compliance expectations, coupled with infrastructure and institutional deficiencies, have inadvertently excluded many smallholder farmers in the NCAs from fully participating in these formal marketing channels. For these farmers, navigating the system remains a challenge unless policies are adjusted to accommodate communal farming realities.

Namibia regulates livestock theft under the Stock Theft Act, 1990 (Act 12 of 1990), as amended. The law criminalises the theft, unlawful possession, and illicit dealing in livestock and related products (e.g., hides, meat, and horns). Over time, amendments

introduced mandatory minimum sentences, but they have been subject to constitutional scrutiny.

2.4.10. The role of extension and advisory services

Access to extension services and technical advice on livestock management, production techniques, and market trends can empower farmers with knowledge and skills for successful marketing (Mwacharo et al., 2018). Extension and advisory services play a significant role in improving the marketing performance of livestock farmers by enhancing their knowledge, management practices, and market linkages (Togarepi, Chimvuramahwe, & Muchenje, 2016). They refer to the provision of information, training, and technical support to farmers to enhance their knowledge and skills in livestock production, management, and marketing. The relevance of extension and advisory services can be supported by recent literature:

In their study on smallholder dairy farmers in Kenya, Muriuki et al. (2019) emphasise the importance of extension and advisory services in livestock marketing. They highlight that access to timely and accurate information on market trends, production techniques, and value-added opportunities enables farmers to make informed decisions, improve product quality, and access better markets. Nambiro et al. (2019) discuss the significance of extension and advisory services in their research on small-scale beef producers in Uganda. They argue that effective extension services, including training on marketing strategies, record-keeping, and business planning, enhance farmers' marketing capabilities, increase their market visibility, and improve market outcomes.

According to Adekunle et al. (2018), extension and advisory services play a critical role in the marketing success of small farmers. Their study reveals that personalised advice, technical support, and market information provided by extension agents improve farmers' market knowledge, promote market-oriented production practices, and enhance their marketing outcomes. In a study by Githinji et al. (2020), extension and advisory

services were found to positively influence smallholder farmers' market participation and profitability in the poultry sector in Kenya. The authors highlight the importance of targeted extension programs that focus on marketing skills, value addition, and market access, as they enable farmers to navigate the complexities of livestock marketing and increase their competitiveness.

In their research on livestock producers in Zimbabwe, Nhau et al. (2018) emphasise the importance of extension and advisory services in livestock marketing. They argue that access to extension support, such as training on market-oriented production, record-keeping, and entrepreneurship, empowers farmers to identify market opportunities, adopt market-driven practices, and improve their market performance. These studies highlight the relevance of extension and advisory services as a crucial factor influencing successful livestock marketing. Access to timely information, technical support, and training enables farmers to make informed decisions, adopt market-oriented practices, and navigate the complexities of livestock marketing. Therefore, investing in extension and advisory services and providing small-scale farmers with the necessary knowledge and skills is essential to achieving better market outcomes and succeeding in livestock marketing.

Extension and advisory services play a pivotal role in improving livestock marketing systems in Namibia, particularly within the communal farming sector, where the majority of producers operate under resource-limited conditions. These services are instrumental in enhancing farmers' knowledge, facilitating access to market information, strengthening animal husbandry practices, and promoting compliance with regulatory standards essential for participation in both domestic and export markets (Mutua, Mburu, & Mude, 2017; MAWLR, 2023).

The Namibian Ministry of Agriculture, Water and Land Reform (MAWLR), through the Directorate of Extension and Engineering Services, coordinates livestock extension at

regional and local levels. Extension officers and livestock technicians provide a wide range of services, including technical training, veterinary support, market facilitation, and compliance assistance. One of the key functions of extension services is disseminating market information. Farmers are updated on livestock pricing, market requirements, grading systems, and auction schedules. This helps producers make informed decisions on when and where to sell their animals, reducing the likelihood of exploitation by middlemen and improving profitability (LMP, 2021).

Extension officers also provide capacity-building training focused on improved feeding practices, disease prevention, breeding management, and animal welfare. These skills are essential for improving livestock quality and enabling smallholder farmers to meet the minimum standards required for participation in formal markets such as Meatco and the Livestock and Livestock Products Board (LLPBN) auction platforms (MAWLR, 2023; Rural Development Centre, 2020).

Another critical role is linking producers to markets by organising farmer cooperatives, buyer-producer forums, and bulk sales coordination. Such collective marketing mechanisms help reduce transaction costs, improve economies of scale, and enhance farmers' bargaining power (Mutua et al., 2017).

Finally, extension services aid in regulatory compliance, especially regarding traceability under the National Livestock Identification and Traceability System (NamLITS). Farmers are supported in registering their livestock, branding animals, and understanding veterinary regulations related to notifiable diseases and the prerequisites for movement permits to access lucrative domestic and regional markets (MAWLR, 2023). Empirical evidence from Namibia and similar contexts indicates that access to well-functioning extension services is positively associated with improved market orientation and formal-sector participation among communal livestock farmers. According to the Livestock Marketing Incentives Programme (LMP, 2021), producers who interact regularly with

extension staff are more likely to sell through formal channels and are better prepared to comply with veterinary and trade standards.

Moreover, in high-risk areas for transboundary animal diseases such as Foot-and-Mouth Disease (FMD) and Contagious Bovine Pleuropneumonia (CBPP), extension and veterinary officers play a critical role in guiding farmers through biosecurity protocols, vaccination campaigns, and quarantine regulations. This has been particularly important for facilitating safe trade from the NCAs under the Commodity-Based Trade (CBT) framework (WOAH, 2023).

Despite their essential role, livestock extension services in Namibia face several constraints. These include high farmer-to-extension worker ratios, inadequate logistical support, limited access to training resources, and poor connectivity in remote areas (Mutua et al., 2017; MAWLR, 2023). These limitations hinder effective service delivery and weaken the impact of livestock development programs. To strengthen the contribution of extension to livestock marketing, the following strategies are recommended:

Investment in Extension Infrastructure: Increasing budget allocations for rural transport, mobile clinics, and training materials can significantly improve reach and efficiency. **Use of Digital Platforms:** Mobile phones, radio programs, and interactive SMS services can be utilised to disseminate timely market information and veterinary alerts to farmers in hard-to-reach areas.

Public–Private Partnerships (PPPs); Collaborations between MAWLR, Meatco, LLPBN, and farmers’ unions can expand the scale and scope of extension delivery, ensuring more inclusive and market-responsive support services. **Farmer Empowerment:** Capacity-building initiatives should also include financial literacy, group marketing, and negotiation skills to equip farmers to engage more effectively with the market.

2.5. Social Capital

Social capital plays a significant role in the successful marketing of livestock, as recent literature supports. Muricho et al. (2020) conducted a study on smallholder farmers in Kenya, emphasising the importance of social capital in livestock marketing. They found that strong social networks and community organisations enabled farmers to access market information, share resources, and collectively negotiate better prices and market conditions.

Mutengwa et al. (2019) discussed the significance of social capital in their research on small-scale pig farmers in Zimbabwe. They argued that social networks and relationships among farmers, traders, and other actors in the livestock value chain fostered trust, cooperation, and knowledge exchange, thereby improving marketing outcomes. Meuwissen et al. (2017) conducted a study that revealed the critical role of social capital in the marketing success of small farmers. They found that social networks and farmer cooperation enhanced their access to market information, market opportunities, and market support services, ultimately improving their marketing outcomes.

Mugera et al. (2018) found that social capital positively influenced smallholder farmers' market participation and profitability in Tanzania's beef sector. They emphasized the importance of collective action, group formation, and social norms in fostering market linkages, reducing transaction costs, and enhancing farmers' market competitiveness. Duguma et al. (2018) emphasized the significance of social capital in their research on livestock producers in Ethiopia. They argued that membership in farmer groups, cooperatives, and associations enhanced farmers' access to credit, market information, and market networks, improving their market participation and marketing outcomes.

Social capital plays a foundational role in facilitating effective livestock marketing in Namibia. It significantly shapes access to financial resources, the flow of market

information, participation in cooperatives, and informal risk-management mechanisms (Musaba, 2010; MCC, 2013). Where social capital is weak—characterised by low trust, fragmented networks, and limited collective action—livestock producers face barriers to scaling operations, securing fair prices, and ensuring quality standards (Musaba, 2010; Nyariki et al., 2015). Conversely, robust social networks can enable market integration, enhance bargaining power, and foster access to value-added opportunities. Achieving these benefits requires strategic investment in trust-building mechanisms, inclusive farmer networks, and partnerships that leverage existing social cohesion to strengthen institutional linkages (MCC, 2013; Tjaronda et al., 2015).

2.6. Institutional Support

Supportive institutions, such as research organisations, agricultural agencies, and development programs, are relevant factors that can significantly influence the successful marketing of livestock, as supported by recent literature. Mahmud et al. (2021) conducted a study on smallholder dairy farmers in Bangladesh, emphasising the importance of institutional support in livestock marketing. They found that access to extension services, training programs, and market linkages provided by agricultural institutions enhanced farmers' knowledge, skills, and market access, thereby improving marketing outcomes.

Mowo et al. (2020) discussed the significance of institutional support in their research on small-scale beef producers in Kenya. They argued that access to credit facilities, input subsidies, market information, and veterinary services provided by government agencies and agricultural organisations improved farmers' market participation, reduced market risks, and enhanced their marketing outcomes. Asfaw et al. (2019) conducted a study that revealed the critical role of institutional support in the marketing success of small farmers. They found that supportive policies, such as market information systems, access to credit, and training programs, enhanced farmers' market knowledge, facilitated market access, and promoted market-oriented practices, thereby improving marketing outcomes.

Ogututu et al. (2019) found that institutional support positively influences the market participation and profitability of smallholder farmers in Uganda's poultry sector. They highlighted the importance of capacity-building programs, farmer trainings, and access to market information and financial services provided by agricultural institutions in improving farmers' marketing capabilities and outcomes. Okeke et al. (2018) emphasised the significance of institutional support in their research on livestock producers in Nigeria. They argued that access to veterinary services, market infrastructure, and training programs provided by government agencies and agricultural organisations enhanced farmers' market access, product quality, and market competitiveness.

The Mangetti Block forms an integral part of Namibia's livestock production landscape, characterised by communal farming practices, limited access to commercial markets, and significant logistical barriers. Within this context, institutional support from organisations such as the Livestock and Livestock Products Board (LLPB) and Agribank is essential for the development and formalisation of livestock marketing systems. The LLPB plays a pivotal regulatory role by enforcing quality assurance and sanitary standards across the livestock industry. In Mangetti Block, the LLPB promotes market access by implementing livestock traceability and certification initiatives, including the Namibian Livestock Identification and Traceability System (NamLITS) and the Farm Assured Namibian Meat (FAN Meat) scheme. These programs assist communal farmers in complying with domestic and regional trade standards. However, export opportunities remain limited due to the classification of the Northern Communal Areas (NCAs) as animal disease control zones (LLPB, 2023).

The LLPB provides market intelligence such as auction pricing and trend analyses, which empowers local producers to make informed marketing decisions (LLPB, n.d.-c). Complementing this regulatory framework, Agribank, Namibia's leading agricultural financial institution, offers loan products specifically tailored to communal farmers. In Mangetti Block, Agribank facilitates access to credit for livestock acquisition, veterinary

services, water infrastructure, and transportation, which are critical inputs for enhancing market preparedness (Agribank, 2022). Innovative financing tools, such as the Emerging Retail Financing Product and the Youth Agri-entrepreneur Scheme, support producers' efforts to increase productivity and achieve financial sustainability.

The collaborative efforts of the LLPB and Agribank represent a strategic synergy aimed at transforming livestock marketing in Mangeti Block. While the LLPB ensures compliance with formal market standards through traceability systems and certification schemes, Agribank provides the capital and advisory support needed to scale production and access these markets. Nonetheless, persistent infrastructural limitations, including poor road conditions, inadequate quarantine infrastructure, and regional disease management protocols, continue to hinder full market integration (MAWLR, 2021; MeatCo, 2013). Additionally, the communal land tenure system presents structural impediments to both marketing and financing. The informal or undocumented nature of livestock ownership complicates traceability efforts. It limits the use of livestock as collateral in securing loans, thereby affecting the overall efficiency of livestock market systems in the region.

2.7. Conceptual framework

This study is grounded in the premise that a combination of socio-economic, institutional, and infrastructural factors influences smallholder cattle marketing decisions. These factors shape farmers' ability and willingness to participate in different market channels. Socio-economic characteristics such as age, gender, education level, household labour, farm size, and off-farm income determine the resource base and decision-making capacity of farmers. For example, education may enhance access to market information, while labour availability affects the ability to transport and manage livestock for sale. Institutional factors, including access to extension services, veterinary support, and participation in community auctions, influence farmers' exposure to market opportunities

and their integration into formal marketing systems. These factors reduce information asymmetries and transaction barriers.

Infrastructural factors such as distance to markets, transport availability, and access to water (boreholes) affect the cost and feasibility of participating in formal markets. Greater distances and poor infrastructure tend to increase transaction costs, thereby discouraging participation in auctions and formal sales channels. These independent variables collectively influence the dependent variable, which is the choice of cattle marketing channel. Farmers may choose among three alternatives: auction markets (formal), open/local markets (semi-formal), and farm-gate sales (informal). The framework assumes that farmers make rational decisions based on constraints and available resources, selecting the market channel that maximises their expected benefits while minimising costs and risks.

Dependent and independent variables

<u>independent variables</u> Socio-economic factors: • Age • Gender • Education • Farm size • Household labour • Off-farm income	<u>independent variables</u> Institutional factors: • Extension services • Veterinary services • Community auction participation • Market information access
<u>independent variables</u> Infrastructure: • Distance to market • Transport availability • Water access (boreholes)	<u>Dependent variables</u> • Choice of marketing channel: • Auction market • Open market • Farm-gate sales

2.7 Chapter summary

Chapter 2 provides a comprehensive review of the existing literature on livestock marketing in the Mangeti Block of the Oshikoto region. The chapter begins by highlighting the importance of understanding the factors influencing cattle marketing and the significance of smallholder farmers in the agricultural sector. It then presents a detailed analysis of relevant studies, theories, and concepts that inform our understanding of livestock marketing dynamics. The literature review focuses on three key themes: factors influencing successful livestock marketing, challenges faced by small farmers in market participation, and strategies to improve market participation. The chapter examines various scholarly works, reports, and empirical studies conducted in similar contexts to shed light on these themes. Regarding factors influencing successful livestock marketing, the review explores key determinants, including market access, market information, pricing mechanisms, quality assurance, animal health, supply chain coordination, financial services, infrastructure, policy and regulations, market linkages, extension services, social capital, and institutional support.

These factors collectively shape livestock marketing outcomes and affect small farmers' participation in the market. The review also highlights the challenges small farmers face in participating effectively in livestock marketing, including limited market access, inadequate market information, financial constraints, infrastructure limitations, policy and regulatory barriers, and institutional shortcomings. These challenges pose significant obstacles to small farmers' participation in the market and must be addressed to improve outcomes. Lastly, the literature review explores strategies and interventions proposed in previous studies to enhance small farmers' participation in livestock marketing. These strategies include strengthening market information systems, improving market linkages, enhancing market infrastructure, providing financial services, strengthening extension and advisory services, promoting collective action and farmer cooperatives, fostering public-private partnerships, supporting policy and institutional reforms, and providing

capacity building and training. The findings from the literature review serve as a foundation for the subsequent chapters of the thesis. The insights gained from the review inform the research methodology, data collection, and analysis approaches adopted in the study. The review also identifies research gaps and areas for further investigation, thereby setting the stage for the empirical research presented in the subsequent chapters.

Chapter 3 provides a clear and comprehensive overview of the research methodology employed in the study. It lays the foundation for empirical research and enables the reader to understand the approach used to investigate the factors influencing cattle marketing in Mangeti Block.

Chapter Three

Research Methods

3.1 Introduction

This chapter presents the research methodology employed in this study. The chapter is organised into three sections: the study area, data collection, and data analysis. The subsequent chapters will present the results and discussions based on the findings obtained through the outlined methodology.

3.2 Study area

This study focuses on cattle marketing within the Oshikoto Region of northern Namibia, with particular emphasis on the Mangetti Block. Oshikoto is in the north-central part of Namibia, bordered by Ohangwena Region to the north, Kavango West to the east, Otjosondjupa to the southeast, Kunene to the southwest, and Oshana to the west. Geographically, Oshikoto spans approximately 17°30'S to 19°30'S and 16°00'E to 17°30'E.

Covering an area of approximately 38,653 km², the Oshikoto region accounts for about 4.69% of Namibia's total landmass. According to the 2023 Population and Housing Census, the region has a population of 257,302, resulting in a low population density of 6.7 persons per square kilometre. The population is predominantly rural, with approximately 82% residing in rural settlements, reflecting the region's largely agrarian character. Omuhiya, Tsumeb and Oniipa are the key urban centres within Oshikoto (Namibia Statistics Agency, 2023).

The region's economy is predominantly subsistence-based, with mixed crop-livestock farming as the main livelihood activity. Staple crops include pearl millet (mahangu), maize, and sorghum, cultivated primarily for household consumption. Livestock farming, especially cattle, goats, and sheep, plays an equally important role, providing food, income, and social status within communities (Ministry of Agriculture, Water and Forestry [MAWF], 2019). In addition to agriculture, many households engage in small-scale trade, artisanal crafts, and occasional wage labour. At the same time, remittances from relatives working in urban areas or mines constitute a critical component of household income. This diversified livelihood strategy is crucial for resilience against climate variability and economic shocks (Namibia Statistics Agency, 2023)

Climatically, Oshikoto experiences a semi-arid environment characterised by hot temperatures and seasonal rainfall averaging 400-600 mm annually, predominantly between November and April. Despite periodic droughts, these conditions support the region's mixed farming systems (Makungwa & Murwira, 2019; Ndebele et al., 2021). The natural vegetation is mainly savannah woodland dominated by mopane (*Colophospermum mopane*) and miombo (*Brachystegia spp.*) trees, which underpin both communal and commercial agricultural activities (Mendelsohn, Jarvis, Roberts, & Robertson, 2002; Saka, Chidumayo, & Ouge, 2013). Fertile soils and accessible groundwater resources, particularly near Tsumeb and Oshivelo, also enable the cultivation of fruits and vegetables, further diversifying agricultural production (Shikangalah, 2018).

Agriculture remains a cornerstone of the regional economy, with the northern areas predominantly focusing on crop production and the southern areas favouring livestock farming. The integration of crop and livestock farming systems is widespread and contributes significantly to food security and livelihoods (Mbaiwa, 2017; Kalaba, Quinn, & Dougill, 2013). According to the most recent livestock census data, the Oshikoto Region hosts approximately 198,270 cattle, 176,313 goats, and 119,313 sheep, primarily within

the northern communal areas. These figures are subject to fluctuation due to climatic and market factors but illustrate the importance of livestock farming in the regional economy (Muasya, 2019).

Despite agriculture's economic significance, per capita income in the Oshikoto Region remains lower than in Namibia's urban centres. The regional economy is predominantly subsistence- oriented, with the majority of households engaging in farming primarily for self-sufficiency rather than for commercial gain. Additional income sources often include remittances and government social assistance programs; however, significant disparities persist between rural and urban income levels. According to Uusiku (2021), the average household income in Oshikoto is approximately N\$10,183 per month and N\$122,196 annually, while the regional poverty rate was estimated at around 42% in 2016. Given the heavy reliance on subsistence agriculture, many households' actual cash income is likely to be lower than reported averages (Uusiku, 2021).

3.3. Mangeti Block in Oshikoto Region, Namibia

Mangeti Block is situated within the Nehale Iya Mpingana Constituency of the Oshikoto Region, northern Namibia, with Omboto serving as the administrative centre. Established in 1970 by the erstwhile ENOK, precursor to the Namibia Development Corporation (NDC), this government-owned land is leased to communal farmers. It comprises approximately 106 fenced farms, each ranging from 1,100 to 1,300 hectares, primarily dedicated to cattle farming (Shivute & Shilongo, 2017). Roughly 70 kilometres east of the regional capital, Omuthiya, Mangeti Block is part of Namibia's Northern Communal Areas (NCA), characterised by extensive livestock production (Nauyoma, 2019).

Geographically, Mangeti Block lies in the southeastern sector of the Oshikoto Region and is bordered by communal areas, including Nalusheshete within Nehale Iya Mpingana Constituency, with the southern boundary demarcated by the Cordon fence separating communal from commercial farming zones. This locality benefits from comparatively

fertile soil and favourable grazing conditions relative to other arid parts of the region, contributing to its status as an agricultural hub (DVS, 2020; LLPB, 2021; Angombe & Likando, 2020).



Figure 1: Study area map

The block is recognised as a critical node for cattle farming, hosting an estimated population of 25,000 to 30,000 head, which constitutes approximately 15.1% of Oshikoto’s total cattle population (DVS, 2020; LLPB, 2021; Tapson & Mwasi, 2016). These livestock resources underpin food security, livelihoods, and social capital for many households, in which cattle serve as both a primary source of nutrition and a symbol of wealth and social status (AgriNamibia, 2019; FAO, 2023). Annual rainfall averages 450-550 mm, facilitating sustainable grazing practices under typical climatic conditions (Sweet & Burke, 2006).

Despite its considerable potential, Mangeti Block faces multifaceted challenges, including inadequate marketing infrastructure, poor road networks, periodic droughts, veterinary health concerns, and grazing land pressures—factors that collectively undermine livestock productivity and market participation (DVS, 2020; LLPB, 2021; Dovie,

Shackleton, & Witkowski, 2006). Drought-induced losses severely constrain farmers' income streams, which are further compounded by the tendency to retain cattle as a store of wealth rather than risk liquidation during dry spells (Antwi & Seahlodi, 2011; Mosimane et al., 2014). The closure of Meatco's Eloo abattoir in 2016 due to throughput inefficiencies further curtailed formal marketing avenues, pushing farmers toward informal and speculative markets, while local cooperatives remain underdeveloped and largely ineffective in bolstering market access (Kruger & Lammerts-Imbuwa, 2015).

Persistently low off-take rates and limited engagement in formal cattle markets across Namibia's Northern Communal Areas reflect systemic barriers within the livestock value chain hindering both regional agricultural development and poverty alleviation efforts (Togarepi, 2016; FAO, 2023). Addressing these constraints requires a deeper understanding of cattle-marketing behaviours among Mangeti farmers to inform targeted policy interventions and support mechanisms. Revitalising cooperatives, introducing auction markets, and improving infrastructure could unlock substantial economic gains, according to estimates, with project agricultural GDP contributions of N\$60–70 million annually if off-take rates rise (GIS, 2020; Agri Namibia, 2019).

Given the critical socio-economic role of cattle in Mangeti Block, identifying and overcoming barriers to effective marketing is essential for fostering sustainable rural livelihoods and promoting inclusive economic growth in Namibia's NCA.

3.3 Research Design

This study adopts a quantitative research approach to examine the factors influencing cattle marketing decisions among smallholder farmers in Mangeti Block, Oshikoto Region. The quantitative approach is appropriate because it allows systematic collection and analysis of numerical data, enabling the identification of relationships between variables and the testing of hypotheses using statistical techniques.

The use of structured questionnaires facilitates the generation of standardised data that can be analysed using statistical software such as STATA. This approach ensures objectivity, reliability, and the ability to generalise findings within the study area. Furthermore, the quantitative method is consistent with the study's objective of assessing the influence of socio-economic, institutional, and infrastructural factors on market participation and channel choice. The study employs a cross-sectional descriptive research design. A cross-sectional design involves collecting data from a sample of respondents at a single point in time, providing a snapshot of current conditions and behaviours. In this case, data were collected from smallholder cattle farmers in Mangeti Block to capture their marketing decisions and the factors influencing those decisions during the study period. The descriptive component of the design allows for the systematic presentation of the study population's characteristics, including demographic attributes, farm characteristics, and market participation patterns. It also facilitates the identification of trends and relationships among variables prior to advanced econometric analysis.

Data were collected through a questionnaire comprising both closed- and open-ended questions, providing a balanced approach to quantitative insights. The target population consisted of smallholder cattle farmers within the Mangeti Block, comprising an estimated 100 individuals. Employing a simple random sampling technique, 45% of the farming population was selected and interviewed to ensure representativeness while minimising sampling bias. The choice of a cross-sectional design was further justified by practical considerations, including time and financial resource constraints, making it a feasible approach for achieving the research objectives within the available timeframe. Despite data cleaning and coding, all collected data were captured and analysed.

A quantitative research approach was chosen to enable the use of various statistical tools in data analysis. Among other factors, the questionnaire assessed the following factors: demographic, environmental, market access & farm income of the participants such as: age of the farmer, gender of the farmer, education level of a farmer, farming experience,

off-farm income, farm size, labour cost, average input cost of the farmer, commission charged at the auction, animals feed cost, licks cost, remedies cost, food ration cost for workers, and distance to the market, as independent variables. Whereas market choices such as Auction sales, farm-gate sales, and open-market sales are identified as dependent variables in the study.

The choice of a cross-sectional quantitative design is justified on several grounds:

First, the study seeks to analyse relationships between multiple independent variables (such as education, farm size, distance to markets, and access to services) and a categorical dependent variable (market channel choice). A quantitative design is therefore necessary to support the application of statistical techniques such as correlation analysis, regression, and multinomial logistic regression.

Second, the cross-sectional approach is suitable given the study's time and resource constraints, as it allows efficient data collection from a relatively large proportion of the target population within a limited period.

Third, the design is appropriate for capturing current market behaviour and the constraints faced by farmers in Mangeti Block, aligning with the study's objective of providing context-specific insights for policy and intervention.

Finally, the selected design is consistent with similar studies in agricultural economics and smallholder market participation, thereby enhancing the comparability and credibility of the findings.

3.4. Model Specification

The student has used a Multinomial Logit Model based on Random Utility theory, where the probability of selecting a market channel is determined by the systematic utility derived from the farmer and the market characteristics. By setting Auction as the base

category, the model estimates the log-odds of choosing the Open market or farmgate relative to the Auction, allowing for an analysis of the factors driving the market channels selection. The model assumes that a farmer i is a rational decision-maker who selects a market channel j from a set of J alternatives (Auction, Open market, Farmgate) to maximise utility. The utility U_{ij} is decomposed into a deterministic component V_{ij} (based on observable characteristic (X)) and a stochastic error term μ_{ij} .

$$U_{ij} = V_{ij} + \epsilon_{ij}$$

Under the assumption that μ_{ij} follows an independent and identically distributed (IID) extreme value type I distribution, the probability of choosing market j is given by:

$$P(Y_i = j) = \frac{\exp(\beta_j X_i)}{\sum_{k=0}^2 \exp(\beta_k X_i)}$$

To make the model estimable, the auction category ($Y_i = 0$) is set as the base category. Consequently, its coefficient vector is normalised to zero ($\beta_0 = 0$). This results in two logit equations representing the log-odds of choosing an alternative market relative to the auction:

Equation (1): Open market vs Auction

$$\ln \left(\frac{P_{i,\text{Open}}}{P_{i,\text{Auction}}} \right) = \beta_{0,1} + \beta_{1,1} X_{1i} + \beta_{2,1} X_{2i} + \dots + \beta_{k,1} X_{ki}$$

Equation (2): Farmgate vs Auction

$$\ln \left(\frac{P_{i,\text{Farmgate}}}{P_{i,\text{Auction}}} \right) = \beta_{0,2} + \beta_{1,2} X_{1i} + \beta_{2,2} X_{2i} + \dots + \beta_{k,2} X_{ki}$$

The coefficient β estimate in this model represents the change in the log-odds of choosing a specific market over the auction for a one-unit change in the predictor variable X .

- Positive Coefficient ($\beta > 0$): As X increases, the probability of choosing that market channel increases relative to the probability of choosing the auction.
- Negative Coefficient ($\beta < 0$): As X increases, the farmer is less likely to choose that market channels compared to the auction.

Odds Ratio: By calculating $\exp(\beta)$, the research obtains the relative risk ratio (RRR), which indicates how the odds of choosing market j over the auction change multiplicatively.

3.5. Model Justification

The multinomial logistic regression model is appropriate for this study for several reasons: The dependent variable is discrete and non-ordered, making linear regression inappropriate. The model allows simultaneous comparison of multiple market choices, aligning with the study's objective of analysing auction, open market, and farm-gate channels. It enables estimation of how socio-economic, institutional, and infrastructural factors influence the probability of selecting each marketing channel. The model accounts for heterogeneity among farmers and provides robust estimates of relative effects. It is widely used in agricultural economics to analyse market participation and choice behaviour, ensuring methodological consistency with the existing literature.

Table 2: Description of Variable Used in the Model

Variable	Description	Type	Expected Sign
Dependent Variable	Market channel choice (auction, open market, farm-gate)	Categorical	–
dist_auction	Distance to nearest auction market	Continuous	–
com_auction	Participation in community auctions (1 = yes, 0 = no)	Dummy	+
edu	Education level of farmer	Continuous/Ordinal	+
gender	Gender of household head (1 = male, 0 = female)	Dummy	$\pm$
farmsize	Size of the farm	Continuous	+
farmexp	Farming experience (years)	Continuous	+

Variable	Description	Type	Expected Sign
nonfarminc	Off-farm income	Continuous	–
labour	Household labour availability	Continuous	+
foodration	Feed/food ration costs	Continuous	±
remedies	Expenditure on veterinary remedies	Continuous	±
farmown	Land ownership status	Dummy	+
borehole	Access to water (1 = yes, 0 = no)	Dummy	+

3.6. Expected outcome

On the bases of theory and previous studies, the following outcomes are expected:

- Distance to market (–): Long distance increases transaction costs and reduces the possibility of participating in auction markets, shifting farmers toward farm-gate sales.
- Community auction participation (+): Farmers involved in collective marketing are more likely to participate in formal auction markets due to improved access and reduced transaction costs.
- Education (+): Many educated farmers are expected to prefer formal and structured markets due to better access to information and decision-making capacity.
- Farm size (+): Larger farms are more likely to supply formal markets due to higher production volumes.
- Labour availability (+): Households with more labour are better able to manage logistics and participate in formal markets.
- Non-farm income (–): Higher off-farm income may reduce reliance on cattle sales, lowering participation in formal markets.
- Borehole access (+): Access to water improves herd productivity and increases the likelihood of market participation.

- Gender ($\pm$): Male-headed households are often more likely to participate in formal markets due to better access to resources, though this may vary by context.

3.7. Data Collection

Data for this study were obtained through a structured survey administered via face-to-face interviews. The use of a structured questionnaire is widely recognised in social science research for enhancing consistency, reliability, and efficiency of data collection and subsequent analysis. By presenting all participants with a standardised set of questions in a uniform sequence, the instrument facilitates response comparability and minimises measurement error (Lee, 2025; Cui, Harshman, & Komperda, 2024). Such standardisation is especially advantageous in quantitative research, where the validity of statistical findings depends on the uniformity and clarity of data collection tools (Cui et al., 2024).

In addition, structured questionnaires simplify data coding and entry, which is particularly beneficial for postgraduate researchers operating within tight timeframes and resource limitations (MDPI, 2025). When administered appropriately, this method also helps reduce interviewer bias and social desirability effects, thereby enhancing the objectivity and credibility of the findings (Wang, 2024; Kühne, 2023).

Moreover, well-designed, logically structured questionnaires with clear instructions improve response rates by reducing participant fatigue and cognitive burden (Klingwort & Toepoel, 2024). These design features are critical in ensuring data quality, especially in community-based field research where literacy levels and engagement may vary. At the outset of each interview, the researcher introduced him/herself and provided a concise overview of the study's purpose. Although the questionnaire was structured, the interview was conducted in a conversational manner, allowing respondents to elaborate on their answers as needed. Participants were also encouraged to ask questions and seek clarification, thereby fostering rapport and mutual understanding, while maintaining the

integrity of the data collection process. The interviews concluded with an expression of appreciation for the participants' time and insights.

3.8. Data Analysis

The following statistical tools were employed to analyse data to address the overall research objectives at the first level. Correlation analysis: to identify and quantify the relationship among the variables, and to understand the effect of changes among the variables. This will help the researcher to identify the strength and direction of the relationships among the variables. Correlation analysis has been widely used in social science to examine the strength and direction of relationships among continuous or ordinal variables. In a study by Slayi, Shou, and Jaja (2024), correlation and regression techniques were applied to examine the relationship between farmers' participation in feedlot programs and livestock productivity. Positive correlations were found between program participation and improvements in average daily gain (ADG) and household income, validating the approach for identifying key determinants of market success.

Tesfaye (2024) conducted a study to evaluate the efficiency of livestock market performance by examining market structure, conduct, and overall performance. A key focus of the research was to assess how correlations among livestock prices across different markets reflect the degree of market integration. Employing multivariate correlation analysis alongside regression techniques, Tesfaye identified several significant determinants of livestock prices, including breed, sex, age, grade, the number of buyers and sellers, the number of intermediaries involved, and the geographic location of markets. Importantly, the findings indicated a lack of integration among livestock markets in the region, as evidenced by low spatial price correlations and inefficient price transmission mechanisms.

Gwala et al. (2020) investigated the relationships among demographic characteristics, livestock training, and marketing outcomes among beneficiaries of the Nguni Cattle Project. Utilising correlation analyses, including chi-square and association tests, the study revealed a significant positive association between receiving livestock training covering nutrition, animal health, and record-keeping and improved cattle market engagement. Furthermore, age was found to significantly correlate with variables such as the number of cattle sold, distance to the market, and choice of transportation mode. Conversely, educational attainment showed no statistically significant association with marketing performance.

A study conducted by Dube et al. (2023) investigated the relationship between livestock market participation and household food security among smallholder farmers in Zimbabwe. The researchers aimed to determine whether market participation correlated with improved livestock productivity and enhanced household food resilience. The objective was to assess the degree to which participation in livestock markets influences production and food security outcomes in smallholder farming systems. Using correlation and regression analysis, the study found that livestock market participation was positively and significantly associated with several outcomes: improved animal productivity ($r = 0.113, p < .011$), increased household income ($r = 0.129, p < .010$), and dietary diversity ($r = 0.444, p < .012$). These results imply that improved market access can enhance household welfare and production efficiency (Dube et al., 2023).

In the other study conducted in Meatu District, Simiyu Region, Tanzania, Komba et al. (2021) explored the socio-economic factors influencing beef cattle sales among smallholder farmers. The objective was to examine the correlation between selected household- and market-level factors and the volume of cattle sold in rural livestock markets. The study used Pearson correlation coefficients and chi-square tests to reveal that cattle herd size ($r = 0.61, p < .013$), access to market information ($r = 0.42, p < .014$), and cooperative membership ($r = 0.38, p < .050$) were positively and significantly

correlated with the volume of cattle sold. Distance to markets and age of the farmer were negatively correlated, indicating that accessibility and youthfulness may enhance market engagement (Komba et al., 2021).

One of the main strengths of correlation analysis is its ability to detect and quantify relationships between variables. This is particularly valuable in social sciences, where researchers often seek to understand complex interactions between social, economic, and psychological factors (Bryman, 2023; Lee, 2025). For instance, it can show how levels of education might relate to income or how job satisfaction correlates with employee turnover. Correlation analysis is a computationally straightforward process that can be conducted quickly using software such as SPSS, R, or Python. This makes it accessible to researchers even with limited statistical training (Field, 2018). It is especially useful in exploratory studies aimed at identifying variables that warrant further investigation. By revealing patterns in data, correlation analysis helps generate hypotheses for further study. It serves as a precursor to more complex analyses, such as regression or structural equation modelling (Cohen, Cohen, West, & Aiken, 2003; Lee, 2025). Because correlation analysis often uses observational or secondary data, it avoids the ethical and logistical issues of experimental manipulation, which is critical in many areas of social research (Neuman, 2014; Lee, 2025).

The most well-known limitation is that correlation cannot determine causality. A significant correlation may be due to a third variable or a mere coincidence. Misinterpreting correlation as causation is a common error in the social science literature (Brown, 2023; Lee, 2025). Correlation coefficients, especially Pearson's r , are highly sensitive to outliers. A single extreme value can distort the strength and direction of the relationship, leading to misleading conclusions (Field, 2018; Brown, 2023). Traditional correlation methods, such as Pearson's, assume a linear relationship between variables. Nonlinear associations may go undetected unless more advanced techniques are applied (Tabachnick & Fidell, 2013). If relevant variables are omitted from the analysis, the

observed correlation may be spurious or inflated. This is particularly problematic in social sciences, where phenomena are often influenced by multiple interacting variables (Bryman, 2016). In complex systems with multiple variables, bivariate correlations can oversimplify relationships. More sophisticated multivariate techniques may be required to capture the true nature of interactions (Cohen et al., 2003).

These studies illustrate the relevance of correlation analysis in livestock marketing research, particularly in identifying socio-economic and market-access variables that influence participation and performance. Therefore, for this research paper, a correlation analysis has been used to address part of the overall objective by helping the researcher understand the relationships among variables that may influence farmers' market participation. While they do not establish causality, the significant relationships provide a foundation for further causal or policy research.

Regression analysis: To help the researcher identify factors influencing market channel choice, understand and quantify relationships among variables, and predict the research outcome, thereby addressing a part of the study's research objective. It allows the researcher to control for confounding factors, drawing accurate and meaningful conclusions about the phenomena under study. Regression models, particularly linear and logistic regression, provide easily interpretable coefficients that indicate the direction and magnitude of each predictor's effect on the dependent variable. This clarity is vital in policy and development research contexts, such as livestock marketing, where actionable insights are needed (Dataconomy, 2025; Jaro Education, 2023). Regression analysis is computationally efficient and widely accessible, making it suitable for use in resource-limited environments or studies involving moderately large datasets (Singh, 2023). Regression models facilitate hypothesis testing through t-tests and F-tests, enabling researchers to determine whether the associations between variables are statistically significant (SIS International Research, 2023). The model offers flexible variants, such as logistic regression for binary outcomes and Heckman's selection model to correct for

selection bias, which are commonly applied when analysing market participation decisions (Moyo & Bahta, 2023).

Shortcomings of Regression Analysis are as follows: Ordinary Least Squares (OLS) regression assumes linearity, normality of residuals, homoscedasticity, and independence of errors. Violation of these assumptions can lead to biased or inefficient estimates (Singh, 2023; SIS International Research, 2023). If important explanatory variables are omitted and they correlate with the included variables, regression estimates can be biased. This is a common challenge in socio-economic research where all influencing factors cannot be fully observed (Komba et al., 2021). Including too many explanatory variables can lead to overfitting, while high correlation among predictors (multicollinearity) reduces the reliability of coefficient estimates (Singh, 2023). Regression results are sensitive to extreme values, which can distort model estimates and reduce prediction accuracy (Dataconomy, 2025).

To minimise the limitations of Ordinary Least Squares (OLS) regression, researchers should deliberately ensure the key model assumptions are met. The assumption of linearity can be addressed by examining scatterplots of the dependent and independent variables and, where necessary, applying data transformations or introducing polynomial or interaction terms to capture nonlinear relationships (Field, 2018). To verify the normality of residuals, researchers can employ diagnostic tests such as the Shapiro–Wilk test or review normal probability plots; if deviations are observed, transformations or robust regression techniques may be considered (Gujarati & Porter, 2020). Homoscedasticity, the assumption of constant error variance, can be evaluated using residual plots. If heteroscedasticity is detected, techniques such as weighted least squares or heteroscedasticity-consistent standard errors may be applied (Wooldridge, 2019). Finally, to ensure independence of errors, researchers should consider the study design and apply methods such as the Durbin–Watson test to detect autocorrelation, particularly in time-series or panel-data contexts (Cohen et al., 2018). Through these diagnostic and

corrective measures, the validity and reliability of OLS regression results can be substantially improved.

Regression analysis has been widely applied in recent livestock marketing research to examine factors influencing producers' participation in markets and associated welfare outcomes. Several contemporary studies provide insight into how regression techniques, linear, multiple, and logistic, have been effectively used to quantify socio-economic relationships within this sector.

Komba et al. (2021) conducted a study in Meatu District, Simiyu Region, Tanzania, with the primary objective of identifying the factors influencing the volume of cattle sold by smallholder beef producers. The researchers employed multiple linear regression analysis to assess the effects of variables, including herd size, access to market information, cooperative membership, and distance to markets, on cattle sales. Their findings revealed that both herd size and access to market information were positively and significantly associated with the quantity of cattle sold. Conversely, distance to the market negatively influenced market participation. This study demonstrated how regression models can effectively quantify the relative influence of household- and institutional-level factors on livestock marketing behaviour (Komba et al., 2021).

In Zimbabwe, Dube et al. (2023) applied both correlation and linear regression analyses to investigate the relationship between livestock market participation and household-level outcomes, including food security and livestock productivity. The study aimed to determine whether greater engagement in livestock markets was correlated with improvements in welfare indicators among smallholder farmers. Results indicated that market participation was positively associated with livestock productivity ($r = 0.113$, $p < .010$) and household dietary diversity ($r = 0.444$, $p < .014$). These statistically significant relationships supported the conclusion that market engagement can serve as a critical

pathway for enhancing rural livelihoods and improving household resilience (Dube et al., 2023).

Ncube et al. (2021) explored the determinants of market participation among smallholder goat farmers in Gwanda District, Zimbabwe. The study aimed to identify key socio-economic and demographic factors influencing farmers' binary decisions to engage in goat markets. A binary logistic regression model was employed to estimate the probability of market participation as a function of multiple predictors. The analysis revealed that variables such as household size, level of education, access to market information, and goat herd size were significant determinants of participation. By utilising logistic regression, the authors were able to appropriately model a dichotomous outcome variable, demonstrating the model's ability to capture non-linear, categorical decision-making behaviour (Ncube et al., 2021).

The application of regression analysis across these studies illustrates its versatility and value in livestock marketing research. Whether modelling continuous outcomes (e.g., volume of cattle sold) or binary decisions (e.g., market participation), regression techniques provide a robust statistical framework for examining the influence of diverse explanatory variables. These examples highlight the methodological rigor and practical relevance of regression in evaluating the complex socio-economic dynamics faced by smallholder farmers in sub-Saharan Africa.

Multinomial logistic regression: Models the relationship between a categorical dependent variable and several independent variables. In this case, the market choice has three possible outcomes: auction, open market, and farm gate. The coefficients in this model represent the influence of the predictors on the likelihood of each choice relative to the base outcome (which is "auction" in this case). This model addresses a part of the overall objective and the second objective of the study.

Multinomial logistic regression (MNL) is a statistical technique specifically designed to analyse dependent variables with more than two unordered categories, enabling the simultaneous modelling of the probability of each outcome relative to a chosen reference category (Long, 2023). The model's coefficients can be exponentiated to yield odds ratios or relative risk ratios, facilitating straightforward comparisons across outcome groups and enhancing policy-relevant interpretations (Shang & Lee, 2022). Compared to alternatives such as multinomial probit models, MNL is less computationally intensive and avoids intensive integration procedures, making it advantageous for empirical research with moderate sample sizes (Smith et al., 2024; Shang & Lee, 2022). Unlike ordinal logistic regression models, MNL does not rely on the proportional odds assumption, offering greater flexibility when it is violated (Jones & Kim, 2021).

However, the independence of irrelevant alternatives (IIA) assumption, which holds that the odds between two outcome categories are unaffected by the presence or absence of other categories, may be unrealistic in practical decision-making scenarios involving close substitutes (Williams, 2023). Since MNL estimates separate coefficients for each non-reference category, the model can be prone to overfitting or unstable parameter estimates in small to moderate samples (Smith et al., 2024). Furthermore, interpretability becomes challenging with a large number of categories and predictors, as each predictor–outcome pair yields distinct odds ratios. Additionally, high multicollinearity among predictors may undermine coefficient stability and reduce clarity in cross-category comparisons (Jones & Kim, 2021).

Multinomial logistic regression (MNL) has been widely applied in development and agricultural economics research, particularly to investigate household decision-making where outcomes are categorical and non-ordinal. For instance, Duressa (2021) utilised MNL to analyse household livelihood diversification strategies in Limmu District, located in the Oromiya Region of Ethiopia. The study sought to identify the determinants influencing households' selection among seven mutually exclusive income categories,

including on-farm, off-farm, non-farm, and mixed sources. Key findings indicated that variables such as education level, access to credit, mass media exposure, dependency ratio, contact with agricultural extension services, access to irrigation, and proximity to roads significantly influenced the choice of livelihood strategy. Conversely, factors such as age, sex of the household head, cooperative membership, and perceived crop risk were not statistically significant. The study demonstrated MNL's capacity to capture the heterogeneous effects of socio-economic variables on diversified livelihood portfolios, thereby validating its suitability for analysing complex rural decision-making contexts (Duressa, 2021).

Additionally, Ndagijimana (2024) employed MNL to investigate women's participation in agricultural roles, utilising data from the fifth round of Rwanda's Integrated Household Living Conditions Survey (EICV 5). The dependent variable captured engagement across three agricultural categories: cropping, livestock management, and household responsibilities. The objective was to assess how socio-demographic factors such as education level, marital status, household size, and geographic location influence women's roles in agriculture. The study found that women without secondary education were significantly more likely to engage in farming activities than those with higher educational attainment. Additional determinants, including age and marital status, also shaped role allocation within agricultural households. This application highlighted the usefulness of MNL in revealing structural and socio-demographic barriers to equitable agricultural participation across Rwanda's regions (Ndagijimana, 2024).

In a separate peer-reviewed study, researchers applied MNL to examine how livelihood asset endowments influence strategy selection among displaced rural households in Nepal (PMC, 2024). The study categorised livelihood outcomes into farming, mixed, and non-agricultural strategies and assessed the predictive value of various household assets. Despite the moderate sample size, the model generated robust and interpretable estimates, validating MNL's applicability in resource-constrained or post-displacement

settings. The findings emphasised the practical utility of MNL in evaluating how physical and financial capital drive diversification strategies, especially when policymakers seek evidence for asset-based interventions in vulnerable populations (PMC, 2024).

Multinomial logistic regression offers a flexible, interpretable framework for modelling categorical outcome decisions with three or more nominal alternatives. It is particularly well-suited for research in rural and agricultural contexts, such as livelihood diversification, market outlet selection, or activity choice, where decision outcomes are non-ordinal and mutually exclusive. Empirical applications in Ethiopia and Rwanda confirm its effectiveness for policy-relevant analysis. Nonetheless, researchers must ensure adequate sample sizes for stable estimation and carefully interpret coefficients in the context of multiple outcome comparisons.

3.9. Chapter summary

This chapter provides a comprehensive account of the research methodology employed in the study. It outlines the demographic characteristics of the target population, details the sampling strategy and sample size, and justifies the selection process while acknowledging potential limitations. Data collection methods, including surveys, interviews, and observations, are described, along with their respective strengths and weaknesses. The chapter also explains the procedures used for data coding, reduction, and interpretation, emphasising techniques such as triangulation and inter-coder reliability to ensure data quality. Ethical considerations, including informed consent, privacy, and data protection, are discussed, alongside issues of reliability and validity. Overall, the chapter establishes a rigorous and ethically sound foundation for the research.

4. Results and Discussion

This chapter presents the study's results and discusses the findings in relation to the research objectives. The analyses include correlation analysis, regression analysis, and a probability choice model. The purpose of this chapter is to identify and interpret the key factors influencing market channel choice among smallholder farmers, as well as to discuss their implications, considering existing literature.

4.1 Socio-demographic Characteristics of Respondents

The socio-demographic profile presented in Table 3 below provides important insights into factors that may influence farmers' participation in livestock markets.

The gender distribution shows that males constitute the majority (60%) of respondents. This finding is consistent with studies in Sub-Saharan Africa, where men tend to dominate market-oriented livestock production due to greater access to productive resources such as land, capital, and market information (Christopher B. Barrett, 2008). However, the relatively high proportion of female respondents (40%) indicates that women also play a significant role in livestock production, although they may face structural constraints that limit their participation in formal markets.

The age distribution shows that a large proportion of respondents are older: 37.8% are aged 55 or older, while only 17.8% are in the 18–35 age group. This suggests limited youth participation in agriculture, a trend widely reported in rural development literature (Paul Collier, 2008). The dominance of older farmers may imply greater farming experience, but it also raises concerns regarding the long-term sustainability of the sector due to low youth involvement.

Regarding marital status, most respondents are married (55.6%), followed by widowed individuals (22.2%). Married households are often associated with greater labour availability and shared decision-making, which can enhance agricultural productivity and market participation (Agnes Quisumbing et al., 2014). However, the relatively high proportion of widowed respondents may indicate the presence of vulnerable households that could face labour and resource constraints.

Regarding health status, most respondents reported being in “very good” (51.1%) or “good” (26.7%) health. This suggests that the majority are physically capable of engaging in livestock production, which is typically labour-intensive. Good health is recognised as a key determinant of agricultural productivity and effective market participation (World Bank, 2007).

The educational profile of respondents is relatively high, with 57.8% having attained tertiary education and 31.1% having secondary education. This contrasts with many rural studies in developing countries, where lower levels of education are more common. Higher levels of education are associated with improved access to information, better farm management practices, and increased participation in formal markets (Robert E. Evenson & Mwabu, 2001).

Household size is evenly distributed: 35.6% have 1–5 members, 35.6% have 6–10 members, and 28.9% have more than 10 members. Larger households may provide greater labour for livestock management; however, they may also increase consumption demands, potentially reducing the volume of livestock available for sale (Barrett, 2008).

Table 3: Distribution of respondents by socio-demographic characteristics

Socio-demographic variables	Categories	Frequency	Percentage
Gender	Male	27	60
	Female	18	40
Age group	18-35	8	17.8
	35-45	14	31.10
	45-55	6	13.30

	>55	17	37.8
Marital status	Single	8	17.8
	Married	25	55.60
	Widowed	10	22.20
	Divorced	2	4.40
Health status	Excellent	6	13.30
	Very good	23	51.10
	Good	12	26.70
	Fair	4	8.90
Highest education	No formal education	1	2.20
	Primary (1-7)	4	8.90
	Secondary (8-12)	14	31.10
	Tertiary	26	57.80
Household size	1-5	16	35.60
	6-10	16	35.60
	>10	13	28.90

4.2 Availability of Livestock for Mangeti-Block

The descriptive statistics in Table 4 below highlight the distribution and scale of livestock ownership among respondents, which are key determinants of market participation. Cattle are the dominant livestock species, with a mean herd size of 123.89 and a wide range (0–500). The high standard deviation (106.78) indicates significant variability in cattle ownership among respondents. This suggests that while some farmers are well-endowed with livestock assets, others have limited holdings. According to Barrett (2008), asset endowment is a key determinant of market participation, as households with larger herds are more likely to generate surplus for sale and access formal markets.

Goats are the second most common livestock category, with a mean of 77.26 and a high standard deviation (91.12), indicating considerable variation across households. Goats are often preferred by smallholder farmers due to their adaptability, lower input requirements, and quicker reproduction cycles, making them an important asset for income diversification and risk management (Doss, 2001).

Sheep ownership is relatively low, with a mean of 10.43 and substantial variability (SD = 19.82), suggesting that sheep farming is practised on a smaller scale. Similarly, donkeys (mean = 5.10) and horses (mean = 2.92) are less commonly owned and are primarily used for draught power and transportation rather than commercial purposes.

The large standard deviations across all livestock categories indicate unequal distribution of livestock assets among households. Such disparities are important, as they influence farmers' ability to participate in different market channels. Wealthier households with larger herds are better positioned to absorb transaction costs and risks associated with formal markets, while smaller farmers may be constrained to informal or farm-gate sales (Boughton et al., 2007).

Overall, the findings suggest that cattle and goats are the primary drivers of livestock marketing in the Mangeti Block. However, unequal livestock ownership may limit market participation among resource-poor farmers.

Table 4: Statistics for available livestock in Mangeti-block

Number of Livestock	n	Rx	Min	Max	Mean	SD
Cattle	45	500	0	500	123.89	106.783
Goats	27	300	0	300	77.26	91.118
Sheep	21	50	0	50	10.43	19.821
Donkeys	21	30	0	30	5.10	7.496
Horses	25	20	0	20	2.92	5.041

Number of respondents (n), Rx –Range, Min– Minimum livestock per livestock category, Max –Maximum livestock per livestock category, SD – Standard deviation of the number of livestock

Overall, the findings suggest that cattle and goats are the primary drivers of livestock marketing in the Mangeti Block. However, unequal livestock ownership may limit market participation among resource-poor farmers.

4.3 Correlation Analysis

Table 5 below provides insights into the relationships among the variables. Results show that auction sales were positively correlated with lick cost ($r = 0.40$), average input cost ($r = 0.28$), community auction participation ($r = 0.61$), and labour availability ($r = 0.210$). This implies that higher input expenditures and greater participation in community auctions are associated with increased auction sales. Conversely, auction sales were negatively correlated with distance to auction markets ($r = -0.320$) and non-farm income ($r = -0.230$), suggesting that greater distance and reliance on off-farm income are associated with reduced participation in livestock auctions. These findings align with studies indicating that proximity to markets and reliance on farming income influence smallholder commercialisation (Barrett, 2008; Omiti et al., 2009).

Table 5: Correlation Matrix of study variable

Variables	Auction_sale	Dist_auction	Lickcost	Aveinputcost	Com_auction	Edu	Gender	Farmsize	Farmexp	Nonfarminc	Labour
Auction_sale	1										
Dist_auction	-0.3233	1									
Lickcost	0.4009	-0.1376	1								
Aveinputcost	0.2805	-0.0716	0.7843	1							
Com_auction	0.6134	-0.1145	0.236	0.0871	1						
Edu	0.1328	-0.2209	0.1667	0.2361	0.0318	1					
Gender	0.2372	-0.1642	0.3107	0.3001	-0.0171	0.3723	1				
Farmsize	0.277	-0.3982	0.3344	0.3182	0.1656	0.4793	-0.0311	1			
Farmexp	0.0165	-0.131	0.2762	0.1838	-0.1879	0.3884	0.3758	0.2826	1		
Nonfarminc	-0.2336	0.1967	-0.2388	-0.2616	-0.1789	-0.0442	-0.0442	-0.1722	-0.0034	1	
Labour	0.2167	-0.2485	0.3682	0.4139	-0.2629	0.2396	0.4203	0.2126	0.5833	-0.089	1
Foodration	-0.0607	0.1427	0.3048	0.4191	-0.1028	0.0217	0.2443	-0.0783	-0.041	0.1025	0.0001
Remedies	0.2981	-0.1406	0.2086	0.3656	0.1576	-0.0969	0.2402	0.1343	-0.1094	0.1269	0.0001

4.4 Regression Analysis

Linear regression was conducted to identify factors influencing market channel choice, including auction, open market, and farm-gate sales.

4.4.1 Auction Sales (Table 6 below)

Results table 6 reveal that the regression model for auction sales is statistically significant (Prob > F = 0.000) and explains approximately 60.5% of the variation in auction participation ($R^2 = 0.605$), indicating a good model fit. Community auction participation ($\beta = 0.681$, $p = 0.001^{***}$) and labour availability ($\beta = 1.991$, $p = 0.005^{***}$) are positive and statistically significant determinants of auction sales. This implies that collective marketing arrangements and adequate household labour enhance farmers' ability to participate in formal markets. Gender also shows a weak positive effect ($\beta = 2.002$, $p = 0.093^*$), suggesting that male farmers are more likely to access auction channels. Other variables, including distance to auction, education, farm size, and non-farm income, are not statistically significant, although their signs align with theoretical expectations. These results support the argument that institutional participation and labour capacity are critical enablers of market engagement (Jagwe et al., 2010).

4.4.2 Open Market Sales (Table 7 below)

For open-market sales (table 7 below), the model is statistically significant (Prob > F = 0.000) and has moderate explanatory power ($R^2 = 0.406$). Key determinants include community auction participation ($\beta = -0.506$, $p = 0.029^{**}$), gender ($\beta = 4.205$, $p = 0.021^{**}$), and farm size ($\beta = 7.021$, $p = 0.027^{**}$). Education is marginally significant ($\beta = -3.689$, $p = 0.068^*$). The negative effect of community auction participation suggests that farmers who participate in auctions are less likely to rely on open markets, indicating substitution across channels.

The negative coefficient for education implies that more educated farmers are less inclined to use open markets, possibly because they have better access to information

and a preference for structured marketing systems. The positive effects of gender and farm size indicate that male farmers and those with larger herds are more active in open market transactions.

4.4.3 Farm gate Sales (Table 8)

Results for the farm-gate sales table 8 below indicate that the farm-gate model is statistically significant (Prob > F = 0.005) and Labour availability is the strongest positive determinant ($\beta = 4.584$, $p = 0.026^{**}$), suggesting that household labour facilitates on-farm sales. Community auction participation ($\beta = -0.411$, $p = 0.097^*$) shows a weak negative effect, reinforcing the idea that farmers engaged in formal systems are less likely to sell at the farm gate. These findings indicate that farm-gate sales are primarily driven by household-level constraints rather than broader institutional or market factors.

Table 6:Regression Results for Auction Sales

Auction_sale	Coefficients	Standard error	T-statistics	P-value
dist_auction	-0.7243	0.6119	-1.1800	0.2450
com_auction	0.6812	0.1792	3.8000	0.0010
edu	-0.6490	1.4210	-0.4600	0.6510
gender	2.0019	1.1583	1.7300	0.0930
farmsize	1.8504	2.1355	0.8700	0.3920
farmexp	-0.6167	0.8994	-0.6900	0.4980
nonfarminc	-0.4675	1.0468	-0.4500	0.6580
labour	1.9907	0.6683	2.9800	0.0050
foodration	-2.0908	2.7730	-0.7500	0.4560
remedies	0.3128	0.4271	0.7300	0.4690
farmown	-1.1464	1.3598	-0.8400	0.4050
borehole	1.0436	1.1765	0.8900	0.3810
Constant	7.0625	22.6690	0.3100	0.7570
Observations	46			
F(12, 33)	8.05			
Prob > F	0.0000			
R-squared	0.6053			
Root MSE	3.4516			

Table 7: Regression Results for Open Market Sales

penmkt_sale	Coefficients	Standard error	T-statistics	P-value
dist_auction	0.2824	1.1084	0.2500	0.8000
com_auction	-0.5056	0.2216	-2.2800	0.0290
edu	-3.6887	1.9526	-1.8900	0.0680
gender	4.2045	1.7415	2.4100	0.0210
farmsize	7.0206	3.0361	2.3100	0.0270
farmexp	0.1810	1.8285	0.1000	0.9220

nonfarminc	2.2026	1.5748	1.4000	0.1710
labour	0.0812	1.4727	0.0600	0.9560
foodration	0.2743	4.7334	0.0600	0.9540
remedies	-0.2638	0.5738	-0.4600	0.6490
farmown	-1.7210	2.1419	-0.8000	0.4270
borehole	2.5478	1.7629	1.4500	0.1580
Constant	-48.8572	44.8034	-1.0900	0.2830
Observations	46			
F(12, 33)	4.43			
Prob > F	0.0003			
R-squared	0.4064			
Root MSE	4.7992			

Table 8: Regression results for Farm Gate Sales

Farmgate_sale	Coefficients	Standard error	T-statistics	P-value
dist_auction	-2.5187	2.5346	-0.9900	0.3280
com_auction	-0.4113	0.2410	-1.7100	0.0970
edu	0.5802	2.6249	0.2200	0.8260
gender	-3.1586	2.4900	-1.2700	0.2130
farmsize	1.1824	3.2039	0.3700	0.7140
farmexp	-1.1808	2.2954	-0.5100	0.6100
nonfarminc	-2.5437	2.2822	-1.1100	0.2730
labour	4.5843	1.9719	2.3200	0.0260
foodration	9.7682	11.3544	0.8600	0.3960
remedies	-1.1450	0.6859	-1.6700	0.1050
farmown	0.8409	2.1591	0.3900	0.6990
borehole	1.3028	1.8653	0.7000	0.4900
Constant	-67.5507	73.0249	-0.9300	0.3620
Observations	46			

F(12, 33)	3.07
Prob > F	0.0052
R-squared	0.412
Root MSE	7.0389

4.5 Multinomial Logit Regression

A multinomial logit model was employed to further investigate the determinants of market channel choice, with auction sales serving as the base outcome table 9 below. The multinomial logit model provides deeper insight into market channel choice, using auction sales as the reference category. The model is highly significant ($\text{Prob} > \chi^2 = 0.000$) with strong explanatory power ($\text{Pseudo } R^2 = 0.786$).

4.5.1. Open Market Relative to Auction (Table 9 below)

Significant variables include community auction participation ($\beta = -0.774$, $p = 0.049^{**}$), education ($\beta = -9.291$, $p = 0.009^{***}$), farm size ($\beta = 11.814$, $p = 0.047^{**}$), and remedies ($\beta = -7.608$, $p = 0.018^{**}$). These results suggest that larger farms are more likely to participate in open markets, while higher education and institutional engagement reduce reliance on these channels. This reflects a shift towards more structured marketing systems among better-informed and organised farmers.

4.5.2 Farm-Gate Relative to Auction (Table 9 above)

The farm-gate model shows several highly significant determinants ($p = 0.000^{***}$), including distance to auction, community auction participation, gender, farm size, non-farm income, labour, and borehole access. Labour ($\beta = 41.252^{***}$) and education ($\beta = 21.697^{***}$) positively influence farm-gate participation, while distance ($\beta = -48.080^{***}$), farm size ($\beta = -49.673^{***}$), and non-farm income ($\beta = -30.937^{***}$) reduce it. Labour ($\beta = 41.25$, $p < 0.001$), education ($\beta = 21.70$, $p < 0.001$), and borehole access ($\beta = 9.04$, $p < 0.001$) were associated with increased it. The pseudo- R^2 of 0.786 indicates that the model

has strong explanatory power. These findings confirm that market choice is multidimensional, shaped by socio-economic, institutional, and resource factors.

Table 9: Multinomial Logit Regression

*Choice	Coefficients	Standard error	T-statistics	P-value
Open market				
dist_auction	2.3517	2.1043	1.1200	0.2640
com_auction	-0.7738	0.3930	-1.9700	0.0490
edu	-9.2914	3.5622	-2.6100	0.0090
gender	9.0837	6.3088	1.4400	0.1500
farmsize	11.8140	5.9465	1.9900	0.0470
farmexp	3.0475	1.6499	1.8500	0.0650
nonfarminc	4.3050	2.7321	1.5800	0.1150
labour	-1.5320	1.4832	-1.0300	0.3020
foodration	5.1785	4.3986	1.1800	0.2390
remedies	-7.6077	3.2244	-2.3600	0.0180
farmown	0.1125	2.1772	0.0500	0.9590
borehole	1.4344	1.9598	0.7300	0.4640
Constant	-85.6133	35.8158	-2.3900	0.0170
Farm gate				
dist_auction	-48.0797	2.1774	-22.0800	0.0000
com_auction	-8.4179	0.3632	-23.1800	0.0000
edu	21.6973	5.3134	4.0800	0.0000
gender	-50.6630	8.4995	-5.9600	0.0000
farmsize	-49.6729	8.5293	-5.8200	0.0000
farmexp	-2.6635	1.9538	-1.3600	0.1730
nonfarminc	-30.9372	1.1629	-26.6000	0.0000
labour	41.2521	1.4609	28.2400	0.0000
foodration	-20.1850	9.7537	-2.0700	0.0390
remedies	-5.3063	3.0351	-1.7500	0.0800
farmown	-59.9473	5.9110	-10.1400	0.0000
borehole	9.0401	2.1638	4.1800	0.0000

Constant	707.2116	79.8763	8.8500	0.0000
Observations	46			
Wald chi2(24)	9490.8			
Prob>chi2	0.0000			
Pseudo R2	0.7858			
Log pseudolikelihood	-8.6335			

*Note: Auction market is the base outcome.

4.6 Hypothesis Testing

Likelihood ratio tests confirmed significant differences among the three marketing channels ($\chi^2 = 30.39$, $p < 0.002^{***}$) for auction vs open market; ($\chi^2 = 3042.53$, $p < 0.001^{***}$) for farm gate vs auction. This rejects the null hypothesis that there is no difference between the market outlets. Similar tests confirmed that coefficients differ significantly across models, indicating heterogeneity in determinants of market choice (Wooldridge, 2010).

4.7 Predicted Probabilities and Marginal Effects

Table 10 below presents the predicted probabilities and marginal effects derived from the multinomial logit model, estimating the likelihood of producers choosing among the three main marketing channels: auction, open market, and farm gate. The marginal effects at the sample mean indicate the expected change in the probability of choosing a particular marketing outlet for a unit change in the explanatory variables, holding all other factors constant. Predicted probabilities show that auction markets are the most preferred channel (65.2%, $p = 0.000^{***}$), followed by open markets (21.7%, $p = 0.000^{***}$) and farm-gate sales (13.0%, $p = 0.000^{***}$).

Marginal effects are statistically insignificant ($p > 0.10$), suggesting that individual variables have limited influence at the mean, and that multiple interacting factors shape market participation decisions.

This suggests that, on average, producers are significantly more inclined to sell their products through auctions than through open-market or farm-gate channels. The t-statistics and corresponding p-values further confirm the statistical significance of these predicted outcomes. All probabilities are significant at the 1% level ($p < 0.01$), indicating that the estimated marginal effects are robust and not due to random variation. The large s-value for the auction outcome ($s = 17.1$) underscores the model's strong and reliable prediction for this marketing outlet.

From a practical standpoint, these findings imply that the auction system remains the dominant and preferred marketing channel among producers within the study area. This may reflect greater price transparency, structured market systems, or institutional support associated with auctions compared to other marketing avenues. Conversely, the relatively low probability of farm-gate sales suggests limited reliance on direct-to-buyer transactions, potentially due to low bargaining power, limited access to buyers, or lower farm-level prices. Overall, the marginal effects indicate that producers' marketing decisions are not evenly distributed across outlets but rather skewed toward structured markets. These outcomes reinforce the earlier regression analysis and hypothesis tests, confirming that producer characteristics and market-related factors significantly influence marketing channel choice.

Table 10: Marginal effect at the sample average

Outcomes*	Margin	Std Error	s-stat	P-value
Auction	0.6522	0.0381	17.1	0.0000
Open mkt	0.2174	0.0381	5.7	0.0000
Farm gate	0.1304	0.0001	2.00	0.0000

*Sample average predicted probabilities.

4.8 Discussion

Predicted probabilities indicate that the most likely outlet was auction sales (65.2%), followed by the open market (21.7%) and farm gate (13.0%). Marginal effects indicate that distance to the auction and community participation slightly reduced the probability of auction choice, while education and farm size increased the likelihood of open-market sales. These results support the interpretation that auctions remain the dominant market channel among smallholder farmers. However, open markets and farm gate outlets still serve as alternatives under certain socio-economic conditions.

The marginal effects suggest that while institutional and socio-economic variables, such as community auction participation, labour, and education, matter in shaping market channel choice, their effects are diffuse when evaluated at the mean of the regressors. This reflects the heterogeneity among smallholder farmers, where individual characteristics and localised contexts influence marketing decisions differently. The insignificance of marginal effects, despite strong results in the multinomial regression and hypothesis tests, underscores that market participation decisions are complex and multidimensional rather than being driven by isolated predictors.

Overall, the results demonstrate that a combination of institutional access, household capacity, and resource endowments influences smallholder market participation. Community auction participation and labour availability consistently emerge as key determinants, underscoring the importance of collective action and household resources.

The dominance of auction markets reflects the benefits of structured systems, including price transparency and institutional support. However, open market and farm-gate channels remain important alternatives, particularly for farmers facing constraints such as limited labour, smaller herd sizes, or reduced market access.

These findings are consistent with existing literature, which highlights the role of transaction costs, resource availability, and institutional support in shaping market

participation decisions (Barrett, 2008; Jagwe et al., 2010). Overall, the results confirm that market channel choice is heterogeneous and context-specific.

4.9 Conclusion

The results presented in this chapter demonstrate that multiple socio-economic and institutional factors shape the marketing decisions of smallholder farmers. Correlation and regression analyses revealed that community auction participation and labour availability consistently play significant roles in influencing auction, open-market, and farm-gate sales. The multinomial logit regression further confirmed that education, distance to markets, farm size, and access to resources such as water infrastructure significantly affect market channel choice. Overall, auctions emerged as the dominant market outlet, although open markets and farm gate channels remain important under specific household and contextual conditions. These findings underscore the importance of strengthening collective marketing institutions, improving access to infrastructure, and addressing household resource constraints to enhance smallholder market participation.

Chapter Five

Summary, Conclusion, and Recommendations

5.1 Introduction

This chapter synthesises the principal findings presented in Chapter Four and concludes the research objectives. It further outlines the implications of these findings for policy and practice and identifies avenues for future research. The study investigated the determinants of market channel choice among smallholder farmers, focusing on socio-economic, institutional, and resource-related factors that shape participation in auctions, open markets, and farm-gate sales.

5.2 Summary of Key Findings

Empirical analyses include correlation matrices, linear regression models, and a multinomial logit estimation, indicating that market channel decisions among smallholder farmers are neither random nor homogenous. Rather, these decisions are influenced by an interplay of institutional participation, household resource endowments, and infrastructural constraints.

5.2.1 Correlation Analysis

Correlation analysis demonstrated positive associations between auction sales and variables such as lick cost, average input cost, community auction participation, and labour availability. These positive correlations suggest that higher investment in production inputs and stronger engagement in collective marketing arrangements increase the likelihood of participation in formal auction markets. Conversely, greater distance to auction facilities and dependence on non-farm income were negatively associated with auction sales, underscoring the importance of physical proximity and opportunity costs in shaping market behavior.

5.2.2 Regression Analysis

Linear regression results corroborated the correlation findings: community auction participation and household labour availability emerged as significant positive predictors of auction sales. For open-market sales, factors such as education, gender, and farm size were statistically significant; notably, education had a negative sign, which may reflect the ability of more educated farmers to access higher-value or more formalised channels. Farm gate sales were most strongly influenced by labour availability, indicating that on-farm marketing is contingent on household capacity to undertake time- and labour-intensive transactions. Collectively, the regression models explained a substantial proportion of variance, indicating a robust model fit across outcomes.

5.2.3 Multinomial Logit Regression

The multinomial logit model, which contrasted open-market and farm-gate outcomes with auction sales as the reference category, provided nuanced insights into the multidimensionality of market choice. Education, farm size, and remedies used significantly affected open-market participation, while distance to auctions, gender, non-farm income, and community participation reduced the likelihood of farm-gate transactions. Conversely, labour availability, education, and access to boreholes positively influenced the probability of farm gate sales. The model's high pseudo- R^2 (0.786) indicates that the included covariates jointly provide strong explanatory power for farmers' marketing decisions.

5.2.4 Predicted Probabilities and Marginal Effects

Predicted probabilities derived from the multinomial specification revealed that auction markets were the preferred outlet for the sample, with an estimated probability of approximately 65.2%, followed by the open market (21.7%) and the farm gate (13.0%). This pattern suggests that structured, transparent market platforms such as auctions offer advantages in price discovery and access to buyers, which may explain their dominance.

Lower farm gate probabilities are consistent with limited bargaining power and reduced buyer presence at the farm level.

5.2.5 Hypothesis Testing

Likelihood-ratio and equality-of-coefficients tests confirmed statistically significant differences among the three market outlets, demonstrating heterogeneity in the determinants across channels. These results align with existing literature, which shows that smallholders face differentiated constraints and opportunities depending on the market structure and institutional context (FAO, 2019; IFAD, 2016).

5.3. Conclusions

Several conclusions emerge from this study's findings.

First, participation in institutions, especially community-based auction systems, is crucial for enabling farmers' access to formal livestock markets. Farmers participating in collective marketing arrangements are more likely to engage in auction sales, underscoring the importance of social networks and institutional connections in facilitating market entry.

Second, household resource endowments, particularly labour availability, significantly influence participation across all marketing channels. Adequate labour not only enhances production capacity but also supports activities such as livestock transport and market engagement.

Third, socio-economic factors, including education level, gender, and farm size, have varying effects across marketing channels. Larger farm sizes and male-headed households tend to be more involved in open market transactions. In contrast, higher levels of education are associated with a greater tendency to participate in more organised and formal marketing systems.

Finally, infrastructural limitations, especially long distances to market centres, continue to hinder participation in formal markets. A greater distance increases transaction costs and reduces the likelihood of farmers selling through auction systems, consistent with transaction cost theory (Barrett, 2008).

5.4. Policy Implications

The empirical findings have several implications for policy design and implementation. Interventions should aim to strengthen market institutions, reduce transaction costs, and enhance household capacity to participate effectively in various marketing channels. The findings have important implications for agricultural policy and rural development in Namibia and similar contexts.

Strengthening collective marketing institutions: Policy instruments should support the formation and consolidation of producer organisations, cooperatives, and community auction platforms. Collective action reduces transaction costs, improves price negotiation, and facilitates access to larger markets (Ebata & Hernandez, 2017; IFAD, 2016). **Enhancing market infrastructure:** Investing in rural road networks, auction facilities, and transport services is crucial to lowering physical barriers to market access and reducing the costs associated with bringing livestock to buyers (FAO, 2019).

Promoting labour- and resource-efficient practices: Given the centrality of household labour, extension services should promote labour-saving technologies and post-harvest practices that reduce marketing burdens and losses (Sondi, 2022). **Integrating education and training programs:** Market literacy, record-keeping, and price-information systems should be mainstreamed into extension curricula, enabling farmers to better identify and capitalise on market opportunities (Belete, 2023). **Supporting gender-inclusive market access:** Targeted interventions are necessary to overcome socio-cultural and institutional barriers that constrain women's participation in higher-value market channels, including access to credit, tailored training, and the dissemination of market information (Touch, 2024).

5.5. Recommendations for Further Research

- Strengthening collective marketing institutions: Promote and expand community-based auction systems to improve smallholder farmers' access to formal markets and enhance their bargaining power.
- Investment in rural infrastructure: Improve Road networks and transport services to reduce transaction costs and address distance-related barriers to market participation.
- Enhancement of extension and information services: Provide farmers with timely, reliable market information and targeted training to support informed marketing decisions and improve awareness of price opportunities.
- Promotion of household capacity development: Support initiatives aimed at improving labour efficiency and technical skills to strengthen farmers' ability to participate in market activities effectively.
- Improvement of access to production resources: Expand access to critical resources, including water infrastructure and key livestock inputs, to enhance productivity and facilitate readiness for market engagement.

5.6. Suggestions for Further Research

Future research should adopt longitudinal approaches to capture changes in market participation over time. Increasing the sample size and incorporating variables such as price dynamics, seasonal variation, and institutional quality would deepen the analysis. Qualitative methods could also provide deeper insights into farmers' behavioural and decision-making processes.

5.7. Chapter Summary

In summary, the chapter synthesised empirical findings and offered conclusions and policy recommendations grounded in the study's evidence. Market participation among

smallholder farmers is influenced by institutional engagement, household capacity, and access to infrastructure. Strengthening producer organisations, improving rural connectivity, and expanding farmer training and gender-sensitive interventions are practical priorities for enhancing inclusive market participation.

5.8. Concluding Remarks

This study contributes to the growing body of literature on smallholder livestock marketing by providing empirical evidence from Mangeti Block. The findings demonstrate that improving market participation requires targeted and context-specific interventions that address both structural and household-level constraints. Enhancing access to markets and strengthening farmer capacity will be critical for improving rural livelihoods and promoting sustainable agricultural development.

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