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Developing a framework on the contribution of small livestock to food security and livelihoods of rural households in Chiredzi District.

CHIZORORO TUNGAMIRAI

(B212828B)

SUPERVISOR: DR JOSEPH MUROIWA

A dissertation submitted in partial fulfilment of the requirements of the Master of Science Degree in Food Security and Sustainable Agricultural Production.

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Name of Author: CHIZORORO TUNGAMIRAI

Student Registration Number: B212828B

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Date: _____

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SUPERVISOR'S NAME: DR JOSEPH MUROIWA

SUPERVISOR'S SIGNATURE: ……..……..……

DATE: ……..……..……

DEDICATION

I dedicate this to my family.

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List of Acronyms

AU	African Union
CSA	Climate-Smart Agriculture
FAO	Food Agriculture Organisation
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Program
US$	United States Dollars

ABSTRACT

Small livestock has been broadly in-cooperated into rural livelihoods in African communities as an asset that can be liquidated in times of need. Their contribution to food security have been immense thought limited to specific regions and communities. This study developed a comprehensive framework to enhance the contribution of small livestock production to food security and livelihoods of rural households in Chiredzi District, Zimbabwe, through a cross-sectional survey of rural households across six wards using structured questionnaires, key informant interviews, and quantitative data analysed through descriptive statistics, t-tests, Spearman correlation, multiple linear and logistic regression models. The findings revealed that small livestock ownership significantly improved household food security, with owners having a 3.3-point higher dietary diversity score (7.4 vs. 4.1, $p<0.001$) and a 38.7 percentage point higher prevalence of food security compared to non-owners, while each additional US$100 from small livestock was associated with a 0.42-point increase in dietary diversity and a 28% increase in the odds of being food secure, even after controlling for total household income, household size, and land area, with the primary pathways being direct income used for food purchases (82.6%), livestock sales as a buffer against seasonal shortages (73.9%), and manure use for crop production (71.7%). Socio-economic benefits were substantial, with small livestock contributing an average of US$780 per year to household income, representing 18–35% of total income depending on wealth quintile, while manure users achieved 40% higher maize yields (32.4 vs. 23.1 bags/ha, $p=0.003$), and 63% of owners consumed livestock products at least weekly, with perceptions confirming that over 85% agreed small livestock improves income and diet, yet cooperative membership (ß=US$390, $p=0.024$) and proximity to markets (ß=-US$18.70 per km, $p=0.022$) were significant determinants of higher livestock income, while age and land size also positively influenced earnings. However, severe constraints were identified, including alarmingly high disease prevalence (coccidiosis 82.6%, Newcastle 76.1%), with nearly half (47.8%) of owners administering zero vaccinations annually, overwhelmingly traditional management practices (free-range grazing 91.3%, traditional kraals 95.7%), severe market access constraints (average distance to formal markets 46.5 km, with 67.4% relying on informal markets, and a strong negative correlation between distance and income, $\rho=-0.54$, $p<0.001$), acquisition barriers with 30.4% relying on inheritance and 17.4% on gifts indicating limited access to credit, and distress selling where 50% of households traded livestock as their primary coping mechanism during food shortages, with regression analysis showing

cooperative membership significantly increased vaccination frequency (β=0.91, p=0.002) while distance to market reduced it (β=-0.03, p=0.018). Based on these integrated findings, a three-pillar framework was developed comprising biological and technical resilience (village-based animal health blitzes, improved housing, supplementary feeding training), economic and market integration (mobile abattoir buying points, strengthening cooperatives with transport and grading equipment, formalizing crop-livestock synergy through manure management), and institutional and social empowerment (community-based livestock insurance, conditional cash transfers during lean seasons, participatory monitoring of dietary diversity and market prices, and strengthening cooperatives as primary delivery hubs), which collectively address the interconnected constraints and amplify the proven food security and livelihood benefits of small livestock. The study concludes that while small livestock production is a powerful, evidence-based pathway to improved food security and socio-economic welfare in Chiredzi District, its full potential is critically constrained by disease burden, poor management practices, and market remoteness, necessitating an integrated, multi-sectoral approach that combines veterinary extension, cooperative strengthening, market infrastructure, and social protection to transform small livestock from a last-resort coping strategy into a sustainable, resilient foundation for rural prosperity in semi-arid Zimbabwe.

Keywords; Livestock production, Food security, rural livelihoods, Socio-economic benefits, framework

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CHAPTER 1: INTRODUCTION

1.1 Background of the study

In Southern Africa, small livestock farming represents a crucial component of agricultural livelihoods for smallholder farmers (Banda & Tanganyika, 2021). In countries like South Africa and Zimbabwe, small stock farming is not only a means for food provision but also an important cultural and economic activity that supports rural development and poverty reduction (Banda & Tanganyika, 2021). For example, in the Eastern Cape of South Africa, smallholder livestock farming, primarily focusing on cattle, goats, and sheep, has been shown to contribute positively to household food security and income diversification, despite inefficiencies and constraints faced by farmers (Amejo et al., 2018). The Southern African Development Community (SADC) region recognises livestock production, including small livestock, as a key agricultural sector with immense potential to boost food security (SADC, 2012). This is a result of large proportion of land suitable for livestock farming and the significant livestock population maintained by small rural farmers (SADC, 2012).

In a wider Southern African Context, small livestock production is increasingly recognised as a strategic sector for poverty alleviation and rural development. Countries across the Southern African region with similar agro-ecological conditions have promoted goats, sheep, and poultry as affordable and adaptable livestock options, especially for women and resource-poor households (Alobo Loison, 2015). In South Africa, small livestock production contributes substantially to rural incomes and nutrition, while community based initiatives in Namibia and Mozambique have demonstrated that strengthening small livestock value chains can improve market access and household welfare (Alobo Loison, 2015; Francis, 2019). In Zimbabwe, more than 70% of the rural population depends on livestock in some form, highlighting the sector's centrality to rural livelihoods (Gwaka & Dubihlela, 2020). Regional and international policies and development programmes led by entities such as the Southern Development Community (SADC), Sustainable development goal (SDG) 1- Zero hunger, aim to enhance resilience and food security by promoting livestock health services, sustainable grazing management and inclusive market systems (UN, 2025). Empasizing small livestock, with their quicker reproduction rates and lower maintenance costs compared to

large livestock, is consistent with efforts to ensure food security in the face of climate change and economic volatility.

Small livestock production plays a vital role in enhancing food security and improving the livelihoods of rural households, particularly in semi-arid and vulnerable regions such as Chiredzi District in Zimbabwe. This district, part of the Lowveld area, is characterised by dry climatic conditions and periodic droughts that constrain crop production, making livestock an essential source of food and income for rural communities (Francis, 2019). Small livestock such as goats, sheep, and poultry are more suited to these variable environments due to their lower input requirements, adaptability, and ability to provide a reliable flow of animal protein through meat, milk, and eggs (Nyam et al., 2020). These animals also serve as financial assets, which households can sell to meet urgent needs, including purchasing food and covering other living expenses, thereby stabilising food security (Banda & Tanganyika, 2021). In Chiredzi, statistics show that small livestock, particularly goats, are commonly owned by over half of rural households, contributing significantly to household nutrition and cash income despite challenges such as drought and diseases which impact productivity (Dhliwayo et al., 2022).

In addition to providing direct nutritional benefits, small livestock production supports multiple dimensions of rural livelihoods (Banda & Tanganyika, 2021). Livestock ownership is associated with social status and plays roles in traditional ceremonies and local markets where animals are traded (Alobo Loison, 2015). Many households engage in mixed crop-livestock farming systems, using livestock manure to improve soil fertility and crop yields, thus integrating the two systems for enhanced food security (Descheemaeker et al., 2016; Gwaka & Dubihlela, 2020). Nevertheless, challenges including climate variability, disease outbreaks, limited veterinary and extension services, and underdeveloped market infrastructure, constrain livestock productivity and the economic benefits households can derive (Hegde, 2019). For example, drought conditions severely reduce feed resources, causing losses and forcing farmers to adjust herd sizes. Additionally, proximity to wildlife national parks introduces risks of wildlife-livestock diseases and human-wildlife conflicts, further complicating livestock management (Descheemaeker et al., 2016). Despite these hurdles, livestock production remains one of the most resilient livelihood strategies in rural areas, with many farmers maintaining or rebuilding herds following hardships.

Small livestock production is integral to the rural household economy and food security, complementing other livelihood activities such as rain fed crop production and off-farm income generation (Alobo Loison, 2015; Khatiwada et al., 2017). In semi-arid regions, traditional crop farming risky and the reliance on livestock, especially small ruminants like goats and sheep, as primary sources of nutrition and income is reinforced (Slegers, 2008). Goats are the most widely owned, with over 50% of households keeping at least one, followed by poultry and cattle, pointing to small livestock's broad accessibility and cultural acceptance among rural farmers (Chiredzi District Profile, 2022). On average, herds in the district consist of roughly 10 cattle, 7 goats, and 1 sheep per household, with donkeys and pigs also contributing to livelihood diversification (Chiredzi District Profile, 2022). These animals provide households with meat, milk, eggs, and draft power, while cows and goats serve as financial assets that can be liquidated to meet unexpected expenses or to buy food during periods of scarcity (Chiredzi District Profile, 2022). Furthermore, the sweet veldt vegetation typical of the district supports natural grazing for small stock, although droughts periodically reduce fodder availability, impacting productivity and leading to fluctuations in livestock numbers.

Assessing the contribution of small livestock production to food security in Chiredzi District involves understanding the multiple roles these animals play not only as sources of direct nutrition but also as economic buffers that enhance rural households' resilience against environmental and economic shocks. Leveraging small livestock's adaptability along with targeted support for farmer training, improved veterinary services, and market access can further strengthen their contribution to sustainable rural livelihoods in the district and similar contexts across Southern Africa.

1.2 Statement of the problem

The contribution of small livestock production to food security and rural livelihoods in Chiredzi District remains inadequately quantified and understood, despite its critical role in sustaining household nutrition and income in this semi-arid environment. The district's harsh and variable climatic conditions, characterized by frequent droughts, reduced rainfall, and high temperatures, severely impact agricultural productivity, making small livestock one of the few viable means of livelihood diversification and productivity (Chiredzi District Profile, 2022). However, several constraints, including limited access to veterinary services, poor market linkages, inadequate feeding resources during dry spells, and vulnerability to diseases,

restrict the potential of small livestock to fully support food security and improve livelihoods (FAO, 2019). Additionally, changing socio-economic dynamics, such as population growth, land use changes, and climate change, further exacerbate pressures on livestock production systems (Muroyiwa et al., 2022). Therefore, there is a pressing need for an empirical assessment that holistically examines the contribution of small livestock production to household food security and livelihoods, identifies existing bottlenecks, and informs context-specific interventions to enhance resilience and sustainable rural development in Chiredzi District.

1.3 Research Objectives

1.3.1 Main Objective

To develop a framework to enhance the contribution of small livestock to food security and livelihoods of rural households in Chiredzi District into district economies.

1.3.2 Specific objectives

Objective 1. To quantify the contribution of small livestock production to household food security in Chiredzi District.

Objective 2. To analyse the socio-economic benefits of small livestock production on the livelihoods of rural households in Chiredzi District.

Objective 3. To identify the key constraints and challenges faced by smallholder farmers in Chiredzi District in managing and marketing small livestock.

1.4 Research Questions

1. How do small livestock production contribute to food security in rural households in Chiredzi District?

2. What are the key socio-economic benefits of small livestock on the livelihoods of rural households in Chiredzi District?

3. What challenges and constraints are faced by smallholder farmers in managing and marketing small livestock in Chiredzi District?

1.5 Justification of the study

Developing a framework on the contribution of small livestock production to food security and livelihoods of rural households in Chiredzi District is scientifically justified due to the district's unique semi-arid environment, which restricts conventional crop farming and heightens vulnerability to food insecurity. Smallholder farmers in Chiredzi largely depend on small livestock such as goats, sheep, and poultry as adaptable and resilient livelihood assets that provide essential nutritional resources, income, and socio-economic security amidst climate variability and recurrent droughts. Despite their importance, systematic studies quantifying and structurally assessing the complex contributions of these livestock to household food security remain limited. Moreover, existing challenges including disease outbreaks, limited veterinary and extension services, poor market access, and fodder scarcity hamper the effective utilization of small livestock as sustainable livelihood strategies. For farmers, the study provides a structured understanding of how goats, sheep, and poultry can be effectively managed to enhance household nutrition and income in the face of the district's semi-arid conditions and recurrent droughts. It helps identify best practices, resource constraints, and opportunities for improved productivity, thereby empowering farmers to make informed livelihood decisions. For academia, this research contributes to the body of knowledge on sustainable agricultural systems in marginal environments by establishing a scientific basis for assessing livestock-based resilience strategies. It fills a significant research gap by systematically linking small livestock production with measurable outcomes in food security and rural development. For policymakers and development agencies, the framework offers evidence-based insights necessary for designing targeted interventions, resource allocation, and long-term rural development policies that align with national food security and poverty reduction goals. It also informs the establishment of supportive infrastructure such as veterinary services, extension support, and market linkages to maximize the potential of small livestock systems. For NGOs and environmental practitioners, the framework provides a practical tool for implementing community-based adaptation and livelihoods

programs that enhance resilience to climate change. Such evidence-based guidance is vital for promoting food security, reducing rural poverty, and strengthening adaptive capacities against climate and economic shocks in Chiredzi District.

1.6 Thesis Outline

This thesis is comprised of seven Chapters which constitute both literature and empirical chapters.

Chapter One provides an overview of the contribution of small livestock to food security and rural livelihoods in Africa and Zimbabwe

Chapter Two focused on reviewing related literature on small livestock production and its contribution to rural livelihoods and food security in developing nations worldwide, in Southern Africa and in Zimbabwe.

Chapter Three gave an outline of the research methods employed in this study.

Chapter Four focused on the contribution of small livestock to household food security and livelihoods in Chiredzi District. It discusses how small livestock ownership influences household diversity score, and household income.

Chapter Five discussed key socio-economic benefits of small livestock on the livelihoods of rural households in Chiredzi District including direct monetory value and indirect economic and social benefits

Chapter Six discussed key constraints and challenges faced by smallholder farmers in Chiredzi District in managing and marketing small livestock focusing on access to markets, disease and vaccination challenges, and difficulties in acquiring and maintaining herds of small livestock

Chapter Seven focused on a recommended framework to improve contribution of small livestock to food security and livelihoods of rural households in Chiredzi District based on three pillars; Biological and Technical Resilience, Economic and Market Integration, and Institutional and Social Empowerment.

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CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter looks at previous studies done in the importance of small livestock on rural livelihoods and food security. The chapter focuses on the Livestock-Asset theory, Food security framework, and livestock production theory as the theoretical framework, and the contextual framework that demonstrates the interconnectedness of external drivers, livelihood resources, livestock production, and household wellbeing in essence. The chapter is also going to focus the importance of livestock on food security, socio economic value and challenges in small livestock production

2.1 Theoretical Framework

The contribution of small livestock production to food security and livelihoods of rural households in Chiredzi District draws from multiple established concepts in agricultural development, rural livelihoods, and food security theory. Central to this framework is the recognition of small livestock as multifunctional assets that provide direct food products (meat, milk, eggs), income, social status, and serve as financial buffers enhancing household resilience (Tavirimirwa et al., 2013). The Livestock-Asset theory (Hart & Sperling, 1987) posits that livestock serve both economic and socio-cultural functions, offering precautionary savings and insurance against shocks, which is critical in semi-arid regions like Chiredzi where crop production is unreliable (Ngigi et al., 2015). The Food Security Framework by FAO, emphasizing four dimensions availability, access, utilization, and stability guides the examination of how small livestock contribute not only to food availability via production but also to access through income generation and market participation (FAO., 2019). Market-orientation theories further explain livestock producers' behaviour in response to economic incentives, highlighting that smallholder participation in livestock markets can spur

investment in improved inputs and practices, thus increasing productivity and food security outcomes (Amejo et al., 2018). Integrating these perspectives allows for a holistic understanding of how small livestock production fits into mixed farming systems, supports livelihood diversification, and enhances adaptive capacity to climatic and economic shocks (Dlodlo & Kalezhi, 2015). This framework facilitates identifying leverage points for interventions and policy support to maximize livestock's multifaceted contribution to rural food security and livelihoods in rural livelihoods and comparable Southern African contexts.

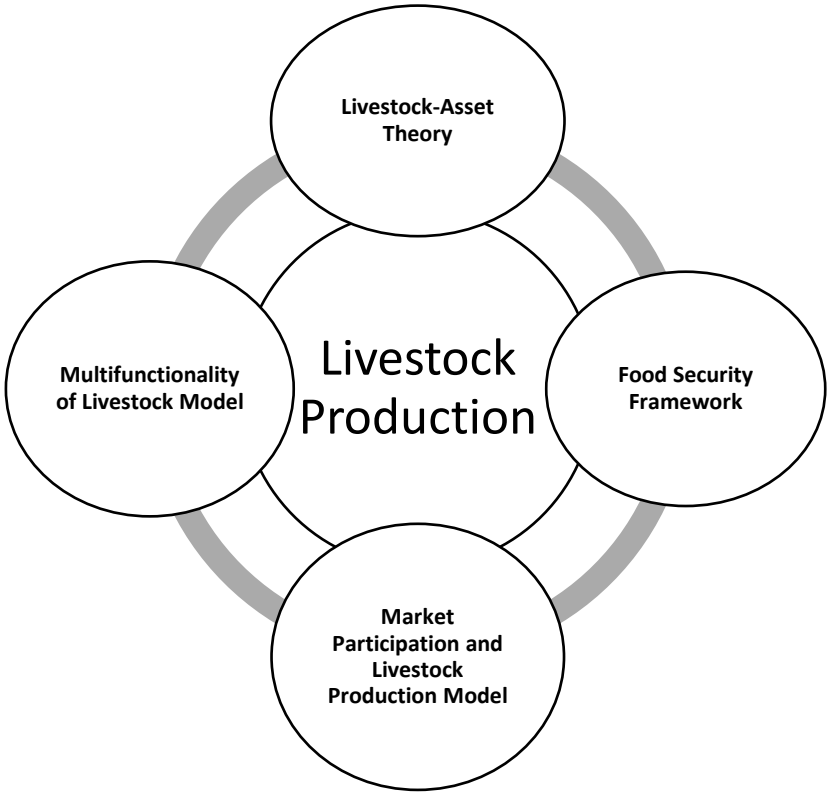

Fig 1.1 Livestock production Theoretical Framework (Banda & Tanganyika, 2021)

2.2 Conceptual Framework

The conceptual framework emphasizes how external influences such as capital and climate change directly impact small livestock production systems in Chiredzi District, shaping rural households' vulnerability and adaptive capacity (Gwaka & Dubihlela, 2020). These livestock systems serve as a vital bridge to socioeconomic benefits, supporting improved food security and more resilient livelihoods for rural families (Tavirimirwa et al., 2013). The framework demonstrates the interconnectedness of external drivers, livelihood resources, livestock production, and household wellbeing in essence, how access to capitals (e.g., financial,

social), coupled with effective adaptation to climate risks, can transform small livestock production into a robust strategy for achieving food security and sustainable livelihoods in the district (Gwaka & Dubihlela, 2020; Hegde, 2019)

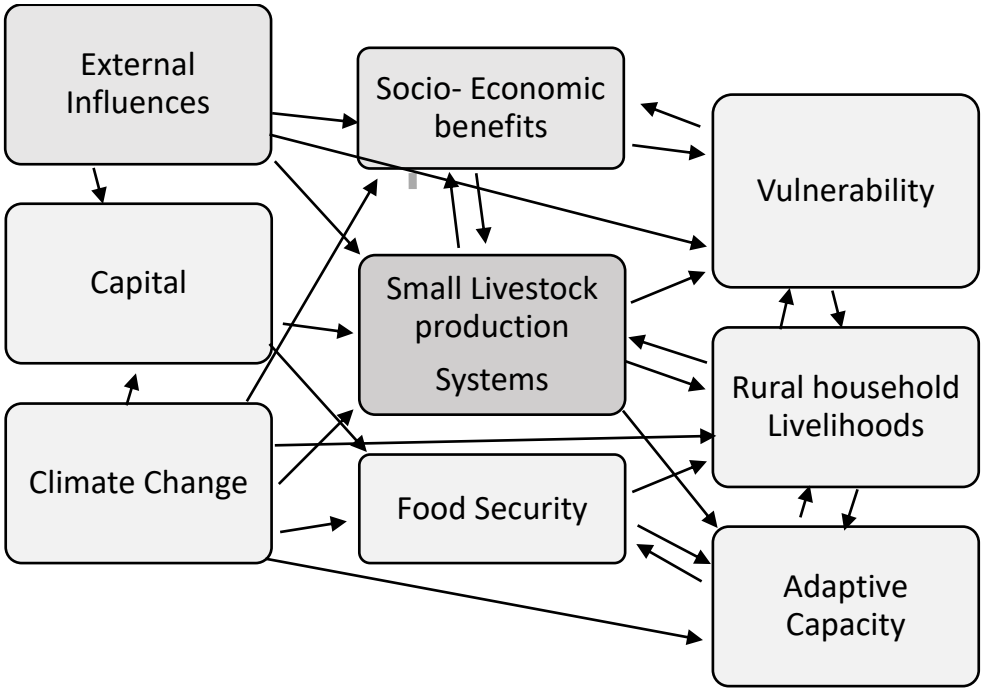

Fig 1.2 Contextual Framework (Hegde, 2019)

2.3 Livestock and Food Security

Small livestock, including goats, sheep, poultry, and pigs, constitute a critical component of rural livelihoods in semi-arid areas, providing direct sources of animal-sourced foods (ASF) such as meat, milk, and eggs which are nutrient-dense and vital for food and nutrition security (Wong et al., 2017; Enahoro et al., 2018). These animals contribute not only to food availability but also enhance food accessibility via income generation from livestock sales, enabling households to procure other essential foods (Melesse, 2023). Market participation by smallholder livestock producers improves food security by encouraging market-oriented production and adoption of improved livestock inputs, resulting in enhanced dietary diversity and per capita food expenditures (Melesse, 2023). In the context of Chiredzi, smallholder farmers predominantly keep goats, cattle, sheep, poultry, and donkeys, with varied livestock compositions across communal, resettlement, and commercial sectors, confirming livestock's

socio-economic importance (Faye, 2008; Chiredzi District Profile, 2022). Moreover, livestock support other farm activities by providing draught power, manure for crop production, and pest control, which collectively raise total farm productivity and resilience against climatic stresses such as drought (FAO, 2019; Defe, 2021).

Globally, small livestock production, encompassing goats, sheep, poultry, and small ruminants, forms a critical economic and nutritional foundation for the livelihoods of an estimated one billion people in low- and middle-income countries (Argent et al., 2014). These animals are often described as living savings accounts due to their vital role in providing financial security, protein, and essential micronutrients for rural households, thereby directly contributing to food security and poverty alleviation (Assan, 2023). However, a significant productivity gap persists; for instance, average cow milk yields in Western Europe are twenty times higher than in Eastern Africa (Adeyanju et al., 2023). This disconnect highlights a global research bias toward technical feed trials rather than studies that trace the pathway from intervention to tangible human benefit.

Within the African context, where agriculture underpins many livelihoods, livestock ownership is deeply intertwined with food security strategies, yet the sector faces constraints from climate variability, disease, and limited market access (AU-IBAR, 2020). Empirical studies across the continent consistently affirm a positive link; for instance, in Madagascar, higher livestock holdings per capita were associated with reduced household food insecurity and better child dietary diversity (Khonje et al., 2022), while in Mauritania, livestock owners had a significantly higher probability of being food secure (Wane et al., 2020). The Southern African region, experiencing acute food insecurity, presents a particularly critical case, with research indicating that cattle ownership has a significant positive impact on household income, consumption, and food consumption, with benefits being notably higher for female-headed households (Bahta et al., 2020; Moyo et al., 2021). The impact, however, is heterogeneous and depends on the composition and scale of herds, as households with mixed, moderate-to-large herds consistently achieve better food security outcomes than those with no livestock or only a few small animals (Acosta et al., 2024; Argent et al., 2014).

Focusing on Zimbabwe, where smallholders manage the majority of the national cattle and goat herd in drought-prone, semi-arid regions, livestock are a fundamental risk-mitigation asset (Musemwa et al., 2010). The national literature highlights that participation in livestock markets is a pivotal driver of food security, as it incentivizes more productive, market-

oriented production and directly leads to improved household food security outcomes through enhanced income (Melesse et al., 2023; Oseni et al., 2014). However, smallholder market integration remains suboptimal, often characterized by distress sales triggered by emergencies and constrained by systemic challenges like poor access to veterinary services, feed shortages, and high animal mortality rates (Melesse et al., 2023).

These national dynamics are acutely manifested at the district level in places like Chiredzi in Masvingo Province, an arid region where crop production is highly risky and livestock become the primary pillar of household resilience (Chanza & Musakwa, 2022). For arid districts like Chiredzi, maximizing the food security contribution of small livestock requires integrated strategies that move beyond promoting ownership alone. Success depends on bundling asset transfers or support with essential inputs such as animal healthcare, training in modern management practices, and financial literacy, as demonstrated by successful models in similar Zimbabwean contexts (Gwaka & Dubihlela, 2020).Ultimately, addressing persistent research gaps on localized species contributions and climate adaptation, and implementing such holistic support, can transform small livestock production from a subsistence activity into a powerful engine of sustainable food security resilience from the household to the district level.

Despite challenges related to drought and disease, livestock remain a vital safety net for rural households, contributing to poverty reduction and improved livelihoods by supplying both nutrition and income (Molina-Flores et al., 2020). Policy implications emphasize the need for improved market access, veterinary services, input supply, and extension support tailored for small livestock systems to unlock their full potential in enhancing household food security (Melesse, 2023; IFAD, 2020). Developing a framework for Chiredzi District should thus consider these multi-dimensional contributions of small livestock, the socio-economic context, the ecological constraints, and the opportunities provided by market participation and supportive policies to optimize the role of small livestock in strengthening food security and rural livelihoods.

Smallholder market participation in livestock production significantly enhances household dietary diversity and food expenditure by motivating farmers to adopt market-oriented production practices and improved inputs, which positively affect productivity and food security outcomes (Melesse, 2023). The engagement in livestock markets also fosters household income generation critical for accessing diverse foods and fulfilling other

livelihood needs. However, adoption of commercial-oriented livestock production remains constrained by affordability and limited access to inputs for many smallholder farmers, emphasizing the need for supportive policies and infrastructure (Melesse, 2023).

Climate change and variability pose significant threats to both crop and livestock systems in Chiredzi. Small ruminants such as goats are identified as more climate-resilient livestock species suitable for the district's arid conditions compared to cattle. Adaptation strategies, including promotion of drought-resistant indigenous livestock breeds, establishment of fodder banks, better use of natural grazing resources, and improved veterinary services, are critical in reducing vulnerability and enhancing the resilience of small livestock systems under climate stress (Defe, 2021; UNDP, 2010). Improved feeds and nutrition for livestock have shown promising results in increasing productivity, which in turn sustains household incomes and food security (ILRI, 2023).

2.4 Livestock Socio Economic Value

Small livestock production also plays a vital role in poverty alleviation in Zimbabwe's rural communities by providing assets that can be sold in times of need and serving as a form of financial security and wealth storage (Mhlanga, 2018). Their relatively low input requirements make them accessible to poorer households, contributing to social equity and inclusion in rural development strategies. Furthermore, livestock enhances women's empowerment by providing opportunities for income generation and decision-making in rural households (FAO, 2019).

At the regional level in Africa, small livestock are integral to mixed crop-livestock and agro-pastoral systems, serving multidimensional roles that extend far beyond direct food production (Adeyanju et al., 2023). Their benefits are deeply gendered, with women frequently owning and managing smaller species like poultry and controlling income from products like milk and eggs, which is often directed toward household nutrition and children's welfare (Argent et al., 2014). Men, conversely, more commonly control the sale of larger animals and high-value transactions (Tusiime et al., 2016). Research across East and West Africa confirms that livestock functions as a key liquid asset for managing diverse livelihood risks, from climate shocks to health emergencies (Argent et al., 2014; Tusiime et al., 2016). To enhance these benefits, participatory and gender-responsive approaches, such as Community Conversations (CC), have shown promise in engaging both women and men in

collaborative problem-solving and decision-making for improved livestock management, as evidenced by work in Ethiopia (Adeyanju et al., 2023; Assan, 2023). This is crucial because influencing positive behavioral change requires moving beyond prescriptive advice to facilitating community-led analysis and action (Banerjee et al., 2015).

Nationally, in Zimbabwe, livestock is a cornerstone of the agricultural economy and a vital buffer against shocks for rural households, particularly in drier regions where crop failure is common (Bhalla et al., 2018). The government and development partners have historically promoted small livestock projects for poverty alleviation and community development. While specific studies on Zimbabwe from the provided search results are limited, the challenges are consistent with regional patterns: feed scarcity, disease pressure, and constrained market access curtail the potential productivity and socioeconomic returns from goats, sheep, and indigenous poultry (Acosta et al., 2024; Chineka, 2020; Majavu, 2022). The national context underscores the importance of these animals but also points to the need for locally tailored interventions that address these systemic constraints.

As a dry, lowland region, Chiredzi faces acute seasonal feed and water shortages, making drought-tolerant species like goats and indigenous poultry likely pillars of household resilience (Chanza & Musakwa, 2022; Dhliwayo et al., 2022). However, the absence of localized, empirical studies means the precise contribution of these animals to income, nutrition, asset building, and risk management for Chiredzi households is not robustly documented. The critical research question that arise: What are the specific benefit streams from different small livestock species in this agro-ecology

2.5 Challenges in Small Livestock Production

Smallholder farmers are fundamental to global and local food systems, yet they operate within a complex web of constraints that threaten their productivity, resilience, and livelihoods. Globally, smallholder farmers navigate a landscape defined by economic marginalization, climate vulnerability, and unequal access to technology and markets (Nájera, 2017). A dominant theme in the literature is the severe economic constraints they face, including high input costs, volatile output prices, and limited access to credit and insurance, which stifle investment and increase financial risk (Dhillon & Moncur, 2023; Nájera, 2017). This economic precariousness is intertwined with marketing challenges, such as poor infrastructure, stringent certification requirements, and intense competition in both domestic

and international markets, which prevent farmers from capturing fair value for their produce (Oseni et al., 2014). Concurrently, climate change acts as a pervasive threat multiplier, exacerbating water scarcity, soil degradation, and the frequency of extreme weather events, thereby directly undermining crop yields and stability (Bukchin-Peles, 2025).

In Africa, the global challenges converge with acute regional specificities, placing smallholder farmers at the epicenter of climate and food security crises (Danso-Abbeam et al., 2024). The region's heavy reliance on rain-fed agriculture makes it disproportionately vulnerable to climatic shifts, with studies repeatedly identifying droughts, unpredictable rainfall, and temperature rises as primary drivers of crop failure and food insecurity (Danso-Abbeam et al., 2024; Ndwandwe et al., 2026; Omuse et al., 2025; Shilomboleni et al., 2024; Williams et al., 2018). This environmental stress is layered upon foundational barriers like insecure land tenure, limited access to quality seeds and fertilizers, and weak agricultural extension services, which restrict adaptive capacity (Harvey et al., 2014; Omuse et al., 2025).

A significant focus of recent literature is the slow adoption of Climate-Smart Agriculture (CSA) practices. Systematic reviews identify key barriers including limited financial resources, inadequate access to credit, and a lack of actionable climate information and training (Ndwandwe et al., 2026). The debate on building resilience is also prominent. One school of thought, often promoted by major development agencies, prioritizes technocratic solutions and CSA to address biophysical climate risks (Nájera, 2017). In contrast, a critical scholarly perspective argues that such approaches can be depoliticized, potentially exacerbating social inequities by favouring wealthier farmers while overlooking the socio-political stressors such as gender inequality, power relations in resource access, and a lack of collective agency that are equally central to vulnerability (Finizola e Silva et al., 2024; Ndwandwe et al., 2026). This tension underscores the need for interventions that integrate technological solutions with a deep commitment to social equity and co-created innovation

In Zimbabwe, the nation's smallholder farmers undoubtedly experience the compounded African and global challenges within a unique national context. Applying the regional framework suggests critical areas of concern. Zimbabwe's farmers likely face intense climate-induced variability and recurrent droughts, severely impacting staple crops. Historical and contemporary issues of land tenure insecurity, particularly following the Fast Track Land Reform Programme, remain a fundamental constraint on long-term investment and sustainable land management (Cliffe et al., 2014; Maposa, 2010). Economic instability,

characterized by currency volatility and high inflation, would exacerbate the global challenges of input cost and market access, while strained public resources likely limit the reach and quality of extension and veterinary services (Melesse et al., 2023)

Development interventions that incorporate market access improvements, farmer organization through cooperatives, and extension services have demonstrated success in enhancing smallholder livestock productivity and livelihoods (Melesse, 2023; ILRI, 2023). The establishment of transparent and rewarding market mechanisms such as auction sales and price-quality linkages is essential to motivate farmers to invest more into livestock production. Policies promoting small livestock as part of diversified livelihood portfolios align with national strategies aimed at enhancing rural food security and poverty reduction, notably given the increased climate risks in semi-arid districts like Chiredzi (Chiredzi District Profile, 2022; Zimbabwe National Agriculture Policy, 2019).

Overall, integrating small livestock production into rural development frameworks for Chiredzi District must consider the intertwined roles of market participation, climate adaptation, gender empowerment, and supportive institutional arrangements to optimize food security and livelihoods sustainably.

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CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter will focus on the study design, the study area (Chiredzi District) description including climatic patterns. The chapter focus on the study design which included a cross sectional household survey, the sampling design, data collection tools and data analysis matrix used in this study.

3.1 Study area

The study was conducted in Chiredzi District in Zimbabwe. The district is an extensive rural area located in Masvingo Province, covering approximately 14,340km^2, making it the largest district in the province (Figure 3.1) (Tsveta, 2017). The district is geographically characterized by vast semi-arid and drought-prone conditions predominantly falling within Agro-Ecological Regions IV and V, which are known for low and erratic rainfall patterns with annual precipitation generally below 650 mm (Dhliwayo et al., 2022). This arid climate and fragile weather make much of the district marginally suitable for agriculture, favouring drought-resistant crops like sorghum and extensive livestock production or game ranching (Chanza & Musakwa, 2022; Dhliwayo et al., 2022). The area features red soils suitable for certain crops like sugarcane and supports significant livestock populations including cattle, goats, sheep, donkeys, and poultry, which are vital to rural livelihoods and food security (Dhliwayo et al., 2022).

Chiredzi experiences a subtropical steppe climate with warm temperatures averaging around 22.57ºC annually, a long hot rainy season from November to March, and a prolonged dry season from April to October (Chanza & Musakwa, 2022). The district faces climactic

challenges such as periodic droughts, erratic rainfall, and severe dry spells during rainy seasons, which impact crop yields and livestock productivity (Dhliwayo et al., 2022). Smallholder farmers primarily engage in crop and livestock production, and livestock, especially goats and cattle, contribute significantly to household income and food security by providing resources for purchasing food and covering other needs (Chanza & Musakwa, 2022).

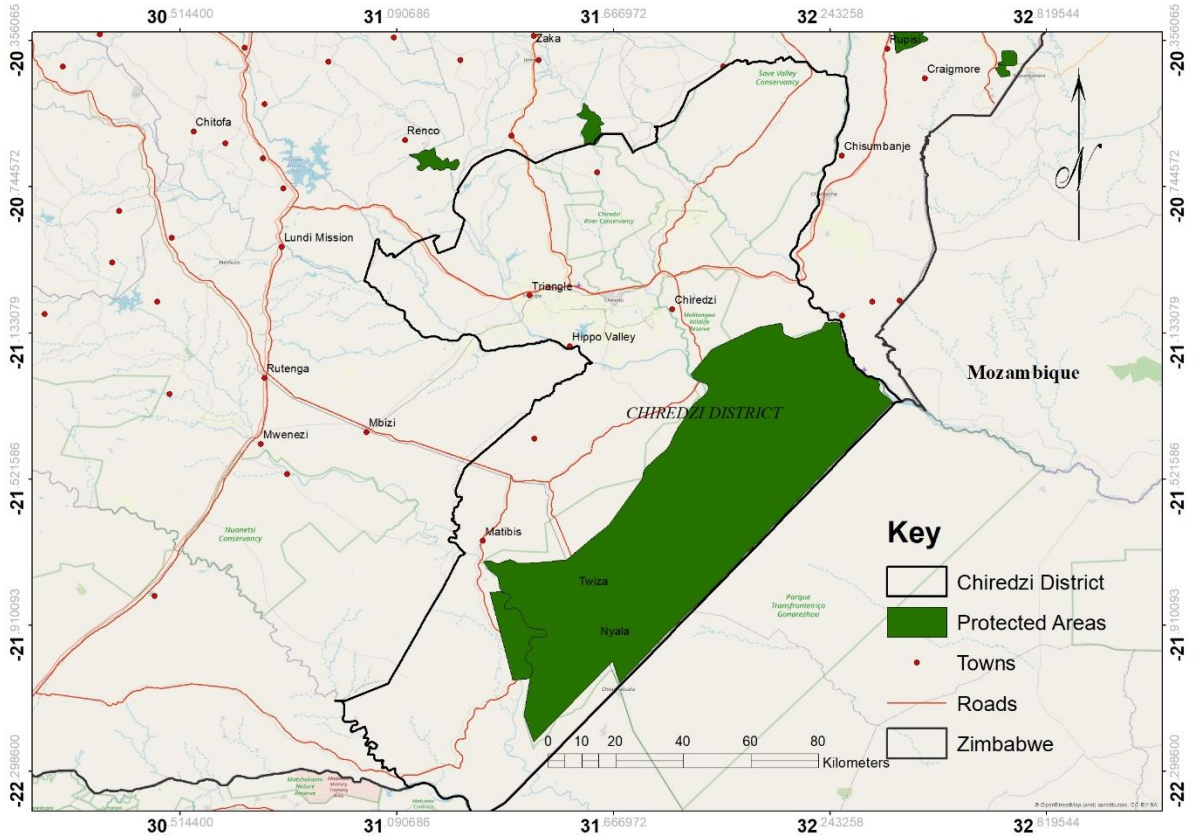

Figure 3.1 Study Area, Chiredzi District (Source; Researcher)

3.2 Study design

The research design incorporated a cross-sectional household survey to quantitatively assess the types, numbers, and productivity of small livestock species owned (mainly goats, sheep, poultry, and pigs), their direct and indirect contributions to household food security, and how livestock supports livelihoods through income generation and risk management. The survey sampled a representative stratified random selection of rural households across 5 different

wards of Chiredzi District to capture heterogeneity in livestock production systems and vulnerability to climate variability. Secondary data from district livestock census, agricultural input-output records, and climate data complemented the survey.

Qualitative methods included questionnaire surveys with local farmers, community leaders, extension workers, and veterinary officers. These explored socio-economic, cultural, and institutional factors influencing livestock production, challenges related to animal health, market access, feed availability, and climate change adaptation strategies.

3.3 Sampling design

A stratified random sampling was used to select wards in Chiredzi District. Wards were put in in strata based on geographical location in the district, that is, Northern wards, Eastern wards, Southern wards, Western wards, and Central wards. In each strata, two wards were randomly selected for the study for a total of 8 wards. The 8 wards were selected based on the Benneh-Mensah's saturation theory (Wutich et al., 2024) which attempt to mathematically predict saturation by weighing study complexity, research expertise and confidence based on the formula:

$$\mathbf{n} = \frac{\boldsymbol{C} \times \boldsymbol{D}}{\boldsymbol{E}}$$

Where **(n)** = Estimated sample size needed for saturation.

(C) = Study Complexity (broadness of research questions, number of distinct sub-groups).

(D) = Population Diversity (how heterogeneous or varied your participant demographic is).

(E) = Researcher Expertise (highly experienced interviewers extract rich data faster, meaning a lower (n) is required)

In the 8 selected wards, 60 local farmer households with livestock were randomly selected for questionnaire interviews, for a total of 60 households based on the industry baseline formula (Wutich et al., 2024), where:

Target Sample Size = $\frac{Method\ baseine \times Diversity\ Factor}{1 - No\ show\ rate}$

Selecting 15 households with livestock per ward strikes a balance between statistical rigor and practical constraints, such as available resources, time, and accessibility, while yielding a robust total sample of 150 households.

3.4 Data collection tools

Quantitative data were collected mainly through structured household questionnaire surveys. These surveys were administered to a representative sample of rural households across Chiredzi District selected via stratified random sampling to ensure diversity in agro-ecological zones, herd sizes, and livelihood strategies. The survey collected data on household demographics, herd composition and numbers for small livestock species (goats, sheep, poultry), production outputs, income generated from livestock, food consumption patterns, and food security indicators such as dietary diversity and frequency of food shortages. Quantitative secondary data, including district livestock census records, agricultural production statistics, and climate data, were also collated to support trend analysis and triangulation.

Key informant interviews with agricultural extension officers, veterinary staff, and local leaders were employed to provide institutional perspectives on livestock support services, market access, and policy environments.

3.5 Data analysis

Data analysis integrated descriptive statistics, inferential methods, and thematic qualitative analysis to generate a comprehensive framework describing the contribution of small livestock to household well-being. This framework focused on pathways linking livestock production to food availability, access, utilization, and stability, as well as livelihood diversification. Quantitative data from household surveys were analysed using descriptive statistics to summarize characteristics of the sample, including livestock ownership, household demographics, and food security status in R version 4.6.0. Inferential statistical methods, including multiple linear regression analysis and linear mixed models, were pplied to examine relationships between small livestock production variables (e.g., number and type

of animals, production outputs, income from livestock) and food security indicators (such as Household Dietary Diversity Score, Food Consumption Score, and household food insecurity scales) in R version 4.6.0 . These models tested the how livestock contribute to food availability, access, and stability, while controlling for other socio-economic factors like household size, education, and access to extension services. Sensitivity analyses using different model specifications (probit and regression) were conducted to ensure robustness of findings.

Data Analytical Framework

Objective	**Variables**	**Analytical Tools**
1. To quantify the contribution of small livestock production to household food security in Chiredzi District.	1. Number of small livestock owned 2. Market value small livestock owned 3. Household Food Insecurity Access Scale (HFIAS) 4 Food Consumption Score (FCS)	• Multiple linear Regression • Pearson product moment Correlation
2. To analyse the socio-economic benefits of small livestock production on the livelihoods of rural households in Chiredzi District.	1. Market value of small livestock 2. Economic use of small livestock 3. Social Value of Small Livestock	• Thematic analysis • Pearson product moment correlation
3. To identify the key constraints and challenges	Economic challenges Social Challenges	Thematic analysis

faced by smallholder farmers in Chiredzi District in managing and marketing small livestock.	Political Challenges	

3.6 Ethical Considerations

The study adhered to ethical standards by ensuring informed consent, confidentiality, and voluntary participation obtained from all participants, ensuring confidentiality and voluntary participation. Ethical approval was sought from District Veterinary services and Bindura University of Science Education institutional review board. Data was anonymised to protect identities of respondents, particularly during dissemination of results.

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CHAPTER 4

THE CONTRIBUTION OF SMALL LIVESTOCK PRODUCTION TO HOUSEHOLD FOOD SECURITY IN CHIREDZI DISTRICT

4.1 Introduction

Food security remain a persistent challenge in sub-Saharan Africa, particularly among smallholder rural farmers who depend on rain-fed agriculture and limited asset bases. In Zimbabwe, recurrent droughts, economic instability, and limited access to inputs have eroded traditional crop based livelihoods. In response, rural livelihoods have increasingly diversified into small livestock production including goats, pigs, sheep, chickens, and rabbits as copying mechanisms and accumulation strategies. Small livestock are valued for their low investment costs, rapid reproduction, and ability to convert marginal feed into high quality protein and income (Shilomboleni et al., 2024). However, empirical evidence quantifying the actual contribution of small livestock to household food security in semi-arid regions like Chiredzi district remains sparse. Without such evidence, it is difficult for development interventions to invest in such potentially transformative sub sector. Although small livestock are widely

promoted as a pathway out of poverty and food security, most existing studies are qualitative or based on small non-representative samples. Decision-makers lack robust, quantitative estimates of how much small livestock ownership and income actually improve dietary diversity, reduce food shortages and enhance perceived food security. Moreover, the contribution of small livestock is often confounded by other household assets such as land, income and education. Therefore, there is need to isolate the net effect of small livestock focusing on the semi-arid Chiredzi district, where small livestock have become a central livelihood component.

4.2 Literature review

The widely accepted definition from the 1996 World Food Summit states that food security exists "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). This definition encompasses four pillars: availability, access, utilisation, and stability. In smallholder contexts, food security is commonly measured using experience-based scales such as Food Insecurity Experience Scale (FIES), dietary diversity scores (DDS), and coping strategies indices (Maxwell et al., 2014). Dietary diversity, in particular, is a validated proxy for nutrient adequacy and overall food security (Kennedy et al., 2011). This study employs household dietary diversity score (HDDS) and a self-rated food security status as complementary measures.

Small livestock (goats, sheep, pigs, rabbits, poultry) can contribute to food security through multiple pathways that include direct consumption, income pathway, manure pathway and as assests (Leroy & Frongillo, 2007; Randolph et al., 2007). For direct consumption animals are consumed at home, providing animal-source proteins, vitamins (B12, A), and minerals (iron, zinc) that are otherwise scarce in plant-based diets. Sales of animals or their products (milk, eggs) generate cash that can be used to purchase staple foods or other nutritious items for income pathway. In addition, livestock manure improves soil fertility, increasing crop yields and thus food availability, while small livestock act as a liquid asset that can be sold quickly during food shortages or before harvest, smoothing consumption as asset and buffer function. Most empirical studies confirm positive associations. For example, Hoddinott et al. (2015) found that livestock ownership in Ethiopia improved child anthropometry, while Ayele & Peacock (2003) reported that dairy goats in Kenya increased household milk consumption

and income. However, few studies have isolated the net effect using regression techniques that control for wealth and other livestock types.

Zimbabwe's livestock sector contributes about 30% to agricultural GDP, with small ruminants being the most common asset among rural households (FAO, 2018). Chiredzi District, located in Masvingo Province, falls in Natural Region V characterised by low and erratic rainfall (400–600 mm/year), high temperatures, and frequent droughts. Crop farming is highly risky, leading to widespread diversification into goats, sheep, and, to a lesser extent, pigs and rabbits. Prior studies in similar semi-arid areas (Gwanda, Beitbridge) have noted that goat ownership is associated with fewer meal-skipping episodes (Moyo et al., 2012), but these studies often lacked control variables. No recent, multivariate analysis has been conducted specifically in Chiredzi District.

4.3 Methodology

4.3.1 Study Design

A cross-sectional household survey was employed. The design was observational and analytical, aiming to quantify associations between small livestock production and food security indicators.

4.3.2 Sampling procedure

A multi-stage sampling approach was used which included purposive, and random sampling methods.

Stage 1 – Ward selection; Six wards (18, 19, 21a, 21b, 23, 26) were purposively selected based on the prevalence of small livestock activities and accessibility.

Stage 2 – Village selection; within each ward, 2–3 villages were randomly selected.

Stage 3 – Household selection; A total of 100 households were randomly selected from village rosters, stratified by small livestock ownership (owners vs. non-owners). The final sample comprised 56 small livestock owners and 20 non-owners (Those who own large livestock without any small livestock) due to limited funding and time constraints.

4.3.3 Data collection

A structured questionnaire was administered face-to-face and by post by the researcher in the local language (Shona). The questionnaire included modules on demographics (age, gender, household size, education, farming experience), livestock ownership (numbers of goats, sheep, pigs, rabbits, poultry), livestock income (annual sales, consumption, manure use), food security measures (Household Dietary Diversity Score (HDDS): 12 food groups over a 24-hour recall. Each group consumed scored 1, summed to a maximum of 12), food shortages frequency per year (categorical: never, sometimes, often), self-rated food security status (insecure, moderately secure, secure, very secure), livestock sales preventing food shortages and other socio-economic variables (arable land size, total monthly income, cooperative membership, distance to market) (Appendix 1). The questionnaire was pre-tested on 10 households not included in the final sample.

4.3.4 Data analysis

All analyses were performed in R version 4.6.0 (R Core Team, 2023). A significance level of $\alpha = 0.05$ was used. Means, standard deviations, medians, interquartile ranges, and proportions were computed for all variables, stratified by small livestock ownership status. Missing data were handled by listwise deletion (≤5% missing for any variable). Independent t-test to compare mean HDDS between owners and non-owners was performed, while Spearman's rank correlation was done between yearly livestock income and HDDS. A binary logistic regression was fitted to predict the probability of being food secure (secure/very secure):

$$\text{Log}\left(\frac{pi}{1-pi}\right) = \alpha_0 + \alpha_1 \cdot \text{IncLivestock}i + \alpha_2 \cdot \text{HHSize}i + \alpha_3 \cdot \text{IncTotal}i$$

Odds ratios with 95% confidence intervals were reported. Model fit was assessed using the Hosmer-Lemeshow test and McFadden's pseudo R^2

4.4 Results and Discussions

A total of 76 households were included in the analysis. Of these, 73.68% (n= 56) owned at least one type of small livestock (goats, sheep, pigs and or rabbits), while 26.32% (n = 20) did not own any small livestock.

Households that owned small livestock exhibited considerably higher dietary diversity (mean 7.4 vs. 4.1 out of a maximum of 12 food groups) compare to those who did not own small livestock (Table 4.1). The majority (82.6%) of the small livestock owners directly utilised income from small livestock sales to purchase food whereas only 30% on non-owners reported using other income sources specifically for food (Table 4.1). Furthermore, food security prevalence was nearly three times higher among small livestock owners (58.7%) compares to non-owners (Table 4.1). Conversely, the frequency of reported food shortages was markedly lower among small livestock owners (average 2.5 times per year) than non-owners (mean 5.8 times per year) (Table 4.1).

Table 4.1: Food Security indicators by small livestock ownership status

Indicator	**Small Livestock Owners**	**Small Livestock non-owners**
Mean dietary diversity score (0-12)	7.4 ± 2.1(sd)	4.1 ± 1.8 (sd)
Median Yearly income from small livestock	550	0
Proportion using livestock income for food purchases (%)	82.6	30.0
Propotion food secure (Ssecure/ Very secure) (%)	58.7	20.0
Mean annual frequency of food shortages	2.5 ± 1.4 (sd)	5.8 ± 2.2 (sd)

An independent samples t-test revealed there was a statistical significance difference on the mean dietary diversity score between livestock owners and non-owners ($p < 0.001$), indicating that small livestock ownership is associated with an average increase of 3.3 dietary diversity points (Table 4.2). The difference is both statistically and practically significant given that the maximum possible score is 12.

Table 4.2: Independent t-test results for dietary diversity score

Comparison	Mean Differences	95% CI	t-statistic	Df	Pvalue
Owners vs Non-owners	3.3	[1.9, 4.7]	4.82	54	< 0.001*

The distribution of yearly income from small livestock was positively skewed, Spearman's rank correlation coefficient was used to assess the monotonic relationship between livestock income and dietary diversity score. The moderate positive correlation ($p = 0.62$, $p < 0.001$) suggest that higher income from small livestock is associated with more diverse household diets (Table 4.3). No significant correlation was found between non-livestock income and dietary diversity ($p = 0.09$, $p = 0.52$), underscoring the specific contribution of small livestock income.

Table 4.3: Spearman Correlation between livestock income and dietary diversity

Variable Pair	Spearman's *p*	95% CI	Pvalue
Livestock income vs. dietary diversity	0.62	[0.42, 0.76]	< 0.001*

The unique contribution of small livestock production was isolated while controlling for potential confounders (household size, arable land area, and total monthly income), two regression models were fitted: a linear regression predicting dietary diversity score, and a logistic regression predicting the probability of being food secure. The model explained 48% of the variance in dietary diversity scores ($R^2 = 0.48$). After controlling for household size, land area, and total monthly income, the income from small livestock remained a statistically significant positive predictor (ß = 0.0042, $p < 0.001$) (Table 4.4). This coefficient implies that each addition US$100 from small livestock is associated with a 0.42 point increase in the dietary diversity score. In practical terms, a household earning an extra US$ 500 from livestock would be expected to consume nearly two additional food groups (Table 4.4). None other control variables reached statistical significance.

Table 4.4 Linear regression for dietary diversity score

Predictor	Coefficient (ß)	Std. error	t-value	p-value
Intercept	3.12	0.94	3.32	0.002*

Yearly income from small livestock (US$)	0.0042	0.0011	3.82	<0.001*
Household size (persons)	0.21	0.15	1.40	0.168
Arable land (ha)	0.34	0.22	1.55	0.124
Avarage monthly income (US$)	0.0018	0.0023	0.78	0.435

Model fit: $R^2 = 0.48$, Adjusted $R^2 = 0.44$, $F(4, 51) = 11.76$, $p < 0.001$

The binary logistic regression was perfomed to test the probability of being food secure. The model showed acceptable fit (Hosmer-Lemeshow p = 0.61). After controlling for household size and total and monthly income, each additional US$100 of small livestock income increased the odds of being food secure by 28% (OR = 1.28, p <0.001) (Table 4.5). Neither household size nor total monthly income (excluding livestock income) had a statistically significant effect. This suggest that the source of income, specifically from small livestock, matters for food security beyond the total amount of income.

Table 4.5: Logistic regression for food security status

Predictor	**Odds ratio**	**95% CI for OR**	**z-value**	**p-value**
Yearly income from small livestock (per US$100)	1.28	1.11, 1.48	3.44	< 0.001*
Household size	0.92	0.76, 1.12	- 0.82	0.412
Average monthly income (US$)	1.01	0.99, 1.03	1.24	0.215

*****Model fit: McFadden's pseudo $R^2 = 0.3$, Hosmer-Lemeshow $X^2(8) = 6.34$, $p = 0.61$*

Three additional indicators were analysed to understand pathways through which small livestock contribute to food security (manure use, livestock consumption per year, and livestock sales to prevent food shortages). The most frequently cited mechanism was the improvement in the ability to buy food (84.8%), followed by the use of livestock sales to prevent food shortages (73.9%) (Table 4.6). Manure use was also common (71.7%) indicating an indirect pathway by enhancing crop production (Table 4.6).

Table 4.6: Reported mechanisms of food security improvement from small livestock

Mechanism	**(%) of owners reporting Yes**	**Contribution to food security**
Use manure to improve crop yields	71.7	Indirect – Improves food availability

Consume livestock products (meat, milk, eggs) at least weekly	63.0	Direct – Improves dietary diversity
Livestock production improves ability to buy food	84.8	Direct- Income generation
Livestock sales prevent food shortages	73.9	Direct – Income buffer during lean seasons

Small livestock ownership is evidently associated with significantly higher dietary diversity and a greater likelihood of being food secure. Households that owned goats, sheep, pigs, or rabbits had a mean dietary diversity score (HDDS) of 7.4 out of 12, compared with only 4.1 among non-owners. This difference of 3.3 points is both statistically significant ($p < 0.001$) and practically meaningful: an increase of two to three food groups can be the difference between a diet deficient in micronutrients and one that meets most nutritional needs. The finding aligns with previous studies in Ethiopia (Hoddinott et al., 2015) and Kenya (Ayele & Peacock, 2003), where livestock ownership improved dietary quality, particularly through increased consumption of animal-source foods. In the present study, 63% of owners consumed livestock products at least weekly, directly contributing to the higher HDDS.

Importantly, the multivariate linear regression revealed that income from small livestock remained a significant predictor of HDDS even after controlling for total monthly income, household size, and arable land. This suggests that the source of income matters: small livestock income may be more likely to be spent on food than income from other activities, possibly because it is often earned in lump sums at the time of animal sales, which coincide with food shortages, or because women (who are more involved in small livestock) have different spending priorities (Shilomboleni et al., 2024). The logistic regression reinforced that each additional US$100 from small livestock increased the odds of being food secure by 28%, while total non-livestock income had no significant effect. This finding challenges a simplistic wealth effect explanation and supports the idea that small livestock serve a unique function as a buffer and a targeted source of food-purchasing power. Similar results have been reported from Bangladesh (Nielsen et al., 2018) and Tanzania (Mdoe & Wiggins, 2016), where small livestock income was preferentially used for food during lean seasons.

The pathway analysis showed that 74% of owners agreed that livestock sales prevent food shortages, and 85% agreed that livestock improve their ability to buy food. These perceptions are consistent with the quantitative income-food security link. Moreover, manure use (71.7% of owners) was associated with a 40% higher maize yield, providing an indirect pathway by increasing staple food availability. This multi-pathway contribution through direct consumption, income for food purchases, and improved crop yields makes small livestock a uniquely versatile food security intervention (Musemwa et al., 2010).

4.5 Conclusions and Recommendations

The results consistently demonstrate that small livestock production makes a substantial, positive, and statistically significant contribution to household food security in Chiredzi District.

Ownership effect; Small livestock owners have a 3.3 point higher dietary diversity score and a 38.7 percentage point higher prevalence of food security compared to non-owners.

Income effect: Each additional US$100 from small livestock is associated with a 0.42-point increase in dietary diversity (linear regression) and a 28% increase in the odds of being food secure (logistic regression), even after controlling for total household income and other covariates.

Pathways: The primary mechanisms are direct income used for food purchases (83% of owners) and the use of livestock sales as a buffer against seasonal food shortages (74% of owners). Manure use (72%) provides an indirect benefit through crop production.

Recommendations

Livestock ownership: Measures to be put in place to aid farmers without livestock to own at least one livestock species or a breeding pair through community pass on schemes or small, fair loans.

Income effect: The need for practical, hands-on training of real skills in building simple raised shelters, mixing local feed supplements, and knowing exactly when to sell an animal for the best price, so as to save every extra dollar earned that puts more nutritious food on the table.

Farmer cooperatives; investment in strong farmer cooperatives, where neighbours support neighbours, share knowledge, and bargain together for fair prices

4.6 References

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CHAPTER 5

SOCIO-ECONOMIC BENEFITS OF SMALL LIVESTOCK PRODUCTION ON THE LIVELIHOODS OF RURAL HOUSEHOLDS IN CHIREDZI DISTRICT

5.1 Introduction

In rural sub-Saharan Africa, livelihoods are increasingly diversified beyond staple crop production, with small livestock emerging as a strategic asset for poor households. Small livestock including goats, sheep, pigs, rabbits, and poultry, offer unique advantages such as low capital entry, rapid turnover, high reproductive rates, and resilience under marginal conditions (Peacock, 2005). Beyond their traditional role as a store of wealth and social capital, small livestock provide a range of socio-economic benefits including cash income, manure for crops, direct family consumption, and a buffer against shocks.

In Zimbabwe, particularly in semi-arid districts like Chiredzi, recurrent droughts have made crop-only farming unsustainable. Households have responded by integrating small livestock into their livelihood portfolios. However, the full range and magnitude of socio-economic benefits remain poorly quantified. Most policy discussions focus on cattle or assume that benefits are self-evident, leading to under-investment in extension, health services, and market access for small livestock**.**

While it is widely believed that small livestock improve rural livelihoods, empirical evidence on the specific socio-economic benefits such as contribution to total household income, manure-induced crop yield gains, consumption patterns, and market participation is often unreliable or based on small case studies. Furthermore, the distribution of these benefits across different household types such as female-headed vs. male-headed, wealthy vs. poor, and the factors that determine the magnitude of benefits are not well understood. Without rigorous analysis, development programmes risk promoting small livestock without addressing the underlying constraints that limit their socio-economic potential.

5.2 Literature Review

Numerous studies confirm that small livestock contribute significantly to household income, especially among the poor. In Ethiopia, goats and sheep accounted for 20–30% of total annual cash income for pastoral and agro-pastoral households (Desta & Gebremedhin, 2012). In Kenya, dairy goats provided 35% of household income in some high-potential zones (Ayele & Peacock, 2003). In Zimbabwe, a study in Masvingo province found that small ruminants contributed 18% of total income for the poorest quintile (Moyo et al., 2017). However, most of these studies rely on recall data without triangulation, and few have examined the distribution of benefits across wealth strata in semi-arid Chiredzi.

Livestock manure is a valuable organic fertiliser in smallholder systems where inorganic fertiliser is often unaffordable or unavailable. Meta-analyses show that manure application can increase cereal yields by 30–50% compared to no fertiliser (Rufino et al., 2007). In Zimbabwe, goat manure has been shown to improve maize and millet yields on degraded soils (Mapfumo & Giller, 2001). However, the adoption of manure use depends on livestock numbers, housing systems, and labour availability. Quantifying the yield gain attributable specifically to small livestock manure is needed to justify investments in manure management training.

Animal-source foods (ASF) provide high-quality protein, bioavailable iron, zinc, vitamin B12, and long-chain fatty acids that are difficult to obtain from plant sources. Regular consumption of ASF has been linked to reduced stunting, improved cognitive development in children, and better pregnancy outcomes (Neumann et al., 2003; Leroy & Frongillo, 2007). In rural Zimbabwe, households that own small livestock consume meat, milk, or eggs 2–3 times more frequently than non-owners (FAO, 2018). However, the frequency and seasonality of such consumption in Chiredzi have not been well documented.

Access to markets determines the extent to which livestock can be converted into cash. Smallholder farmers often face high transaction costs, long distances, poor road infrastructure, and lack of market information (Staal et al., 2002). Informal markets (neighbour-to-neighbour, village traders) dominate, but they may offer lower prices and less reliable demand. Studies in southern Zimbabwe have found that distance to formal markets is inversely correlated with livestock incomes (Chikuvire et al., 2019). Cooperative membership has been shown to improve bargaining power and reduce transaction costs (Markelova et al., 2009).

Farmers' own perceptions matter for adoption and sustained engagement. Perceived benefits income, food security, social status drive continued investment. A study in rural South Africa found that 90% of goat keepers agreed that goats improved their livelihoods, but only 40% believed they could rely solely on goats (Müller et al., 2015). In Zimbabwe, perceived constraints (disease, theft, lack of feed) often outweigh perceived benefits, limiting expansion. Understanding these perceptions helps design realistic interventions.

5.3 Methodology

5.3.1 Study Design and Sampling

The study was conducted in Chiredzi District, Masvingo Province, Zimbabwe, using a cross-sectional survey of 76 households (56 small livestock owners, 20 non-owners). A multi-stage random sampling approach was employed across six wards and associated villages.

A multi-stage sampling approach was used which included purposive, and random sampling methods.

Stage 1 – Ward selection; Six wards (18, 19, 21a, 21b, 23, 26) were purposively selected based on the prevalence of small livestock activities and accessibility.

Stage 2 – Village selection; within each ward, 2–3 villages were randomly selected.

Stage 3 – Household selection; A total of 100 households were randomly selected from village rosters, stratified by small livestock ownership (owners vs. non-owners). The final sample comprised 56 small livestock owners and 20 non-owners (Those who own large livestock without any small livestock) due to limited funding and time constraints.

5.3.2 Data collection

A structured questionnaire was employed to sampled households. The questionnaire included specific questions to address socio-economic indicators. Household income included total monthly income from all sources (crops, livestock, off-farm employment, remittances, etc.) reported in US dollars. Yearly income from small livestock was disaggregated (sales of animals, milk, eggs, hides). Manure use included whether manure was collected and applied to crops (yes/no); for maize growers, the reported yield in bags per hectare was recorded, and households were asked whether manure use increased yields. Consumption of livestock products included frequency of consuming own-produced goat meat, sheep meat, pork, rabbit meat, chicken meat, eggs, and goat milk (daily, weekly, monthly, rarely/never). Market participation included number of animals sold per year, target market (informal: neighbours/village traders; formal: abattoir/buying centre; both), distance to nearest formal market (km, measured using GPS or local knowledge). Socio economic perceptions included nine Likert-scale measured perceptions (1 = strongly disagree to 5 = strongly agree) covering income improvement, livelihood importance, dietary diversification, training needs, complementarity with other activities. All income and yield data were validated through probing and cross-checking with community benchmarks.

5.3.3 Data analysis

All the data analysis was conducted in R version 4.6.0 (R Core Team, 2023) with a 5% significance level ($\alpha = 0.05$). Means, medians, standard deviations, and proportions were calculated for all socio-economic indicators, stratified by small livestock ownership (owners vs. non-owners) and, where relevant, by manure use or market type. For owner households,

the share of small livestock income in total annual household income was calculated and then averaged across quintiles of total income (from lowest 20% to highest 20%). This was presented as a table showing absolute and relative contributions. An independent t-test was used to compare maize yields (bags/ha) between manure users and non-users among livestock owners. Spearman's rank correlation was used to assess the relationship between distance to formal market and yearly livestock income. Market type (informal vs. formal) differences in mean income were compared using a t-test. A multiple linear regression model was fitted to identify factors associated with higher yearly income from small livestock. The model was specified as:

$$\text{Log (Income}_{\text{livestock},i}+1) = \beta 0+\beta 1\text{Age}i+\beta 2\text{HHSize}i+\beta 3\text{Land}i+\beta 4\text{Education}i+\beta 5\text{Distance}i+\beta 6\text{Coop}i+\varepsilon i$$

The dependent variable was log-transformed to normalise residuals and stabilise variance. Robust standard errors were used. Coefficients were exponentiated to interpret percentage changes.

5.4 Results and Discussions

Small livestock owners had moderately higher total monthly incomes (US$325 vs. US$240) and larger land holdings (3.1ha vs. 2.4ha) compare to small livestock non-owners (Table 4.7). The average yearly income from small livestock among owners was US$ 780 ± 940 (sd) which indicate a substantial variation (range: US$0 – US$ 3 200). Manure use was more common among owners (71.7%) than non-owners (20%), suggesting and agronomic benefit. In addition, 63% of owners consumed livestock products (meat, milk, eggs) at least weekly, providing direct nutritional benefits (Table 5.1)

Table 5.1: Socio-economic characteristics of sampled households

Variable	Small livestock owners	Small livestock non-owners
Mean age (years)	46.2 ± 12.3 (sd)	44.5 ± 14.1 (sd)
Gender (% female)	41.3	50
(% male)	58.7	50
Education (% secondary or higher)	69.6	60
Mean household size (persons)	4.8 ± 1.6 (sd)	4.2 ± 1.5 (sd)
Mean arable land (ha)	3.1 ± 1.2 (sd)	2.4 ± 0.9 (sd)

Mean Monthly income (US$)	325 ± 143 (sd)	240 ± 98 (sd)
Mean Yearly income from small livestock (US$)	780 ± 940 (sd)	0
Proportion using manure on crops (%)	71.7	20.0
Proportion consuming own livestock products weekly (%)	63.0	0
Proportion selling small livestock at least once a year (%)	8 9.1	-

For households that owned small livestock, the relative contribution of small livestock income to total annual household was calculated. The absolute and relative contribution of small livestock increased with the total household income. In the highest income quintile, small livestock accounts for over one third (34.5%) of total household income, indicating that successful livestock enterprises are a pathway to higher overall prosperity (Table 5.2)

Table 5.2: Contribution of small livestock to total household income (owners only)

Income quintile	**Mean total annual income (US$)**	**Mean small livestock income (US$)**	**Share of livestock income (%)**
Lowest (0-20%)	1200	220	18.3
Second (21-40%)	2400	580	24.2
Third (41-60%)	3600	980	27.2
Fourth (60-80%)	5000	1450	29.0
Highest (81-100%)	6500	2900	34.5

Market orientation is a key socio-economic benefit indicator. Majority of household (89.1%) sold at least one animal per year, with most selling between 1 and 5 animals in a single calendar year. Informal markets (neighbours, village traders) were the primary outlet (67.4%), while only 28.3% accessed abattoirs or formal markets (Table 5.3). The average distance to the nearest formal market was 46.5 km, which likely constrains formal market participation.

Table 5.3 Market characteristics for small livestock sales (owners only)

Variable	Category	Percentage / Mean
Livestock sales per year	0 (None)	10.9 %
	1-5 animals	54.3 %
	6-10 animals	23.9 %
	>10 animal	10.9 %
Target market	Informal (Neighbours, local buyers)	67.4 %
	Abattoir / formal market	28.3 %
	Both	4.3 %
Mean distance to the nearest formal market (km)	_	46.5 ± 10.2 (sd)

For households using manure from small livestock to improve soil fertility and crop yields, it represented a substantial indirect socio economic benefits. Household using manure achieved significantly higher maize yields (32.4 vs. 23.1 bags per hectare, $p = 0.003$ (t test)). This translate to an additional 9.3 bags per hectare which at current market prices (approximately US$10 per bag) represents an extra US$ 93 per hectare per season, a substantial indirect economic benefit.

Direct consumption of small livestock product (meat, milk, eggs) provides both nutritional and economic benefits. Results showed that chicken products are consumed most frequently (67.3% at least weekly), followed by goat meat (21.7% weekly). Regular consumption of animal- source foods contributes to improved protein and micronutrient intake, reducing reliance on purchased foods and thus freeing income for other expenditures (Figure 5.1)

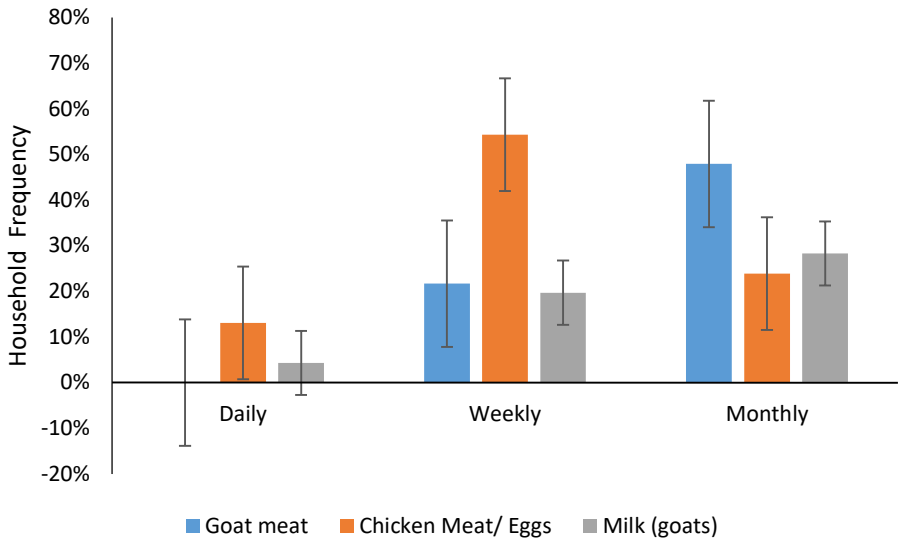

Figure 5.1 Frequency of consuming own livestock products (owners only)

The socio economic benefits of small livestock production were rated by household respondents on a Likert scale. Over 85% of respondents acknowledged that small livestock improves income, diet, and the ability to purchase food. The high proportion (82.6%) agreeing that training is needed for effective livestock production suggest that while benefits are recognised, constraints remain. Notably 78.3% agreed that livestock production need to be complemented with other income generating activities, indicating that households view small livestock as part of a diversified livelihood strategy rather than a sole source (Table 5.4)

Table 5.4: Perceptions of Socio-economic benefits among small holder livestock owners

Perception	**% Agree/ Strongly Agree**
Livestock production improves household income	91.3
Livestock production is important for rural livelihoods	89.1
Livestock production diversifies diet	84.8
Livestock production improves the ability to buy food	84.8
Livestock production should be complemented by other activities	78.3
Farmers need intensive training on livestock management	82.6
Livestock production affect household income positively	87.0

To identify determinants of income from small livestock, factors associated with higher socio-economic benefits (measured as yearly income from small livestock), were estimated using a multiple linear regression. The model explained 52% of the variation in livestock income. Statistically significant predictors included age (ß = 12.4, p = 0.038), arable land (ß = 110.5, p = 0.041), and cooperative membership (ß = 390.4, p = 0.024). Distance to formal market is a significant negative predictor ((ß = - 18.7, p = 0.022) where each additional kilometre from a formal market reduces annual livestock income by approximately US$ 18.70. Household size and education showed positive but non-significant coefficients (Table 5.5). These finding indicate that socio-economic benefits from small livestock are not uniformly distributes, older farmers, those with larger land holdings, cooperative members, and households closer to formal markets derive significantly higher income.

Table 5.5 Linear regression for yearly income from small livestock (US$)

Predictor	**Coefficient (ß)**	**Std. error**	**t-value**	**p- value**
Intercept	-850.3	320.1	-2.66	0.011*
Age (years)	12.4	5.8	2.14	0.038*
Household size (persons)	45.2	38.1	1.19	0.242
Arable land (ha)	110.5	52.3	2.11	0.041*
Education (secondary or higher)	215.6	142.0	1.52	0.137
Distance to formal market (km)	-18.7	7.9	-2.37	0.022*
Cooperative membership (yes=1)	390.4	165.8	2.35	0.024*

Model fit: $R^2 = 0.52$, Adjusted $R^2 = 0.44$, $F_{(6,39)} = 7.04$, $p < 0.001$

Small livestock contributed, on average, US$780 per year to household income, which accounted for 18–35% of total income depending on wealth quintile. The highest quintile derived the largest absolute and relative benefit, indicating that while small livestock are accessible to the poor, the better-off capture more value, possibly due to larger herds, better management, and market access. This pattern of pro-rich benefit is common in livestock development (Chanza & Musakwa, 2022; Dhliwayo et al., 2022) and suggests that interventions must explicitly target the poorest to avoid widening inequality.

The agronomic benefit of manure was substantial. Farmers who used manure achieved 32.4 bags of maize per hectare compared to 23.1 bags for non-users a gain of 9.3 bags worth approximately US$93 per hectare. This is consistent with meta-analyses showing 30–50%

yield increases with manure (Acosta et al., 2024). In Chiredzi, where inorganic fertiliser is often unaffordable, manure represents a critical input. However, manure use depends on having sufficient livestock numbers and collecting it, which requires labour and appropriate housing (e.g., kraals where manure accumulates). The fact that only 72% of owners used manure suggests a missed opportunity: promotion of simple manure management could yield significant returns.

Market participation was widespread, with 89% of owners selling at least one animal per year. However, the majority (67%) relied on informal markets (neighbours, village traders), and the average distance to a formal market was 46.5 km. Distance had a strong negative correlation with income (ρ = -0.54), consistent with findings from southern Zimbabwe (Chikuvire et al., 2019) and East Africa (Adeyanju et al., 2023). Each 10 km further from a formal market reduced annual livestock income by an estimated US$110–150. This is partly because informal markets offer lower prices and partly because remote farmers have higher transport costs. Cooperative membership was a strong positive predictor of income (β = US$390, p = 0.024), likely because cooperatives aggregate sales, provide price information, and sometimes arrange transport to formal markets.

Perception data reinforced the socio-economic importance of small livestock: over 85% of owners agreed that small livestock improve income, diet, and food purchasing ability. Yet 83% agreed that intensive training is needed, and 78% agreed that livestock must be complemented with other activities. This reflects a realistic understanding: small livestock are a valuable component of a diversified livelihood, not a silver bullet. The high demand for training points to a gap in extension services, a finding common in rural Zimbabwe (Shilomboleni et al., 2024)

5.5 Conclusions and Recommendations

Income generation: Small livestock contributes an average of US$780 per year to household income, representing 18–35% of total household income depending on wealth quintile. Over 89% of owners sell livestock annually. Improved small livestock animal welfare is recommended for small livestock owners to maximise the yearly income from livestock, as well as diversifying farmers' income through climate resilience agriculture.

Market participation: The majority (67%) rely on informal markets, but formal market access (abattoirs) is associated with significantly higher income. Distance to market is a major

constraint (average 46.5 km). Improved access to formal markets such as auctions, abattoirs and live markets regulated by market forces is recommended. Farmers need to be trained on different types of livestock markets that bring out the best value in their livestock.

Agronomic benefits: Manure use (72% of owners) is associated with a 40% higher maize yield (32.4 vs. 23.1 bags/ha), providing an indirect economic gain of approximately US$93 per hectare. Use of manure as substitute fertiliser is recommended to better other agricultural yields while maintaining low costs and climate resilience.

Direct consumption benefits: Regular (at least weekly) consumption of livestock products is reported by 63% of owners, improving dietary quality and reducing food expenditure.

Positive perceptions: Over 85% of owners agree that small livestock improves income, diet, and food purchasing ability. However, 83% recognise the need for intensive training, indicating that constraints limit full potential.

Determinants of benefit magnitude: Older age, larger land holdings, cooperative membership, and proximity to markets are significant predictors of higher livestock income.

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CHAPTER 6

KEY CONSTRAINTS AND CHALLENGES IN MANAGING AND MARKETING SMALL LIVESTOCK

6.1 Introduction

Small livestock production (goats, sheep, pigs, rabbits, and poultry) offers a promising pathway to improved food security and livelihoods in semi-arid rural areas of sub-Saharan Africa. However, realising this potential is often hindered by a multitude of constraints related to animal health, management practices, input availability, market access, and institutional support. In Zimbabwe, and particularly in Chiredzi District, smallholder farmers face a harsh environment characterised by recurrent drought, poor grazing, and limited veterinary services. Despite the acknowledged importance of small livestock, the specific constraints that limit productivity and profitability have not been systematically documented in this district. Understanding these barriers is essential for designing targeted interventions such as disease control programmes, training, infrastructure development, and marketing linkages that can unlock the full potential of small livestock.

Policy and development programmes often promote small livestock as a low-risk, high-return activity, yet many farmers struggle with high disease burdens, low vaccination coverage, suboptimal feeding and housing, long distances to markets, and limited access to credit or extension services. Without an evidence-based understanding of which constraints are most severe and how they interact, interventions risk being misdirected or ineffective. In Chiredzi District, while unreliable reports indicate disease outbreaks and market difficulties, no systematic quantitative analysis has been conducted to rank constraints or identify their determinants. This study addresses that gap by providing a rigorous assessment of the key challenges in small livestock management and marketing.

6.2 Literature Review

Disease is consistently reported as the primary constraint to small livestock production in sub-Saharan Africa (ILRI, 2012). Key diseases affecting goats and sheep include peste des petits ruminants (PPR), contagious caprine pleuropneumonia (CCPP), heartwater, coccidiosis, and foot rot. For poultry, Newcastle disease is endemic and often causes high

mortality. In Zimbabwe, a national livestock survey found that 65% of smallholder goat keepers reported disease as their main challenge, with Newcastle disease and coccidiosis being most common (LAP, 2016). Despite this, vaccination coverage is often low due to cost, distance to veterinary posts, and lack of awareness. In Chiredzi, no recent disease prevalence data exist, making this study timely.

Feed scarcity, especially in the dry season, is a major nutritional constraint. Most smallholder farmers rely on communal grazing (free-range) and natural browse, with little or no supplementation. This leads to low growth rates, high mortality, and extended kidding/lambing intervals (Devendra, 2007). Housing is typically traditional kraals (enclosures) that offer limited protection from predators, theft, and extreme weather. Improved housing such as raised floors, roofing, separate sick pens is rare due to cost and lack of knowledge. Studies in Zimbabwe's semi-arid regions have shown that farmers who provide supplementary feed and improved housing have 40–60% lower mortality (Mapiye et al., 2009). However, adoption remains low.

Smallholder farmers face numerous marketing constraints: long distances to formal markets, poor road infrastructure, lack of market information, seasonality of supply, high transaction costs, and weak bargaining power (Jabbar et al., 2010). Consequently, most sales occur through informal channels (neighbours, village traders) where prices are often below formal market levels. For example, a study in southern Zimbabwe found that farmers received 30–40% less for goats sold informally compared to abattoir prices (Chikuvire et al., 2019). Distance to market is a key driver; each 10 km increase reduces the likelihood of selling through formal markets by about 15% (Staal et al., 2002). Cooperative membership can mitigate these constraints by aggregating supply and reducing per-unit transaction costs.

The initial acquisition of small livestock can be a barrier for poor households. Inheritance from parents and gifts (social networks) are common, but they exclude households without such networks. Purchasing requires cash, which may not be available. Credit or livestock loan programmes (e.g., "pass-on" schemes) are rare. In Zimbabwe, only 5–10% of smallholders have accessed formal livestock credit (ZimStats, 2014). Thus, understanding acquisition methods helps identify which households are excluded and what mechanisms could improve access.

During food shortages, small livestock often serve as a buffer: households sell animals to buy food. While this demonstrates the safety-net function, repeated distress sales can erode herd

size and reduce long-term productivity. In extreme cases, households may sell breeding stock, undermining future recovery. A study in Ethiopia found that 60% of livestock sales during drought were distress sales (Sadler et al., 2012). Understanding the proportion of households resorting to trade livestock as a main coping mechanism provides insight into the sustainability of current systems.

Farmers' own perceptions of constraints influence their willingness to adopt improved practices. Common perceived constraints include disease, feed shortages, lack of veterinary drugs, low prices, and theft. In Malawi, goat keepers ranked disease (82%) and feed scarcity (67%) as top constraints (Nantima et al., 2015). Most farmers express a desire for training in animal health, feeding, housing, and marketing. Addressing these perceived needs is critical for intervention success.

6.3 Methodology

6.3.1 Study Design and Sampling

A cross-sectional survey was employed, with a sample of 76 households (56 small livestock owners, 20 non-owners). Sampling was multi-stage random, stratified by village and small livestock ownership. A multi-stage sampling approach was used which included purposive, and random sampling methods. Stage 1 – Ward selection; Six wards (18, 19, 21a, 21b, 23, 26) were purposively selected based on the prevalence of small livestock activities and accessibility. Stage 2 – Village selection; within each ward, 2–3 villages were randomly selected. Stage 3 – Household selection; A total of 100 households were randomly selected from village rosters, stratified by small livestock ownership (owners vs. non-owners). The final sample comprised 56 small livestock owners and 20 non-owners (Those who own large livestock without any small livestock) due to limited funding and time constraints.

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6.3.2 Data collection

The same household questionnaire was used, with modules specifically for constraints. Disease occurrence: For each of 13 diseases (coccidiosis, heartwater, redwater, pneumonia, scabby mouth, goat pox, blue tongue, pulpy kidney, anthrax, January disease, brucellosis,

foot rot, Newcastle), farmers were asked if they had observed any cases in their herds in the past 12 months (yes/no). For vaccination data, number of vaccinations against diseases administered per year (0, 1, 2, 3, 4+). Feeding and housing data were collected on feeding type (grazing free range, grazing controlled, browsing, and supplementary feed) and housing type (kraal, fowlrun, diplitter improved poultry housing). Data on marketing included livestock sales per year (categorical: 0, 1–5, 6–10, >10), target market (informal, abattoir/formal, both), distance to nearest formal market (km, GPS or odometer reading). Acquisition method and coping mechanisms during food shortages were collected including main coping strategy (trade livestock, buy food, receive government assistance, borrow, reduce meals).

6.3.3 Data Analysis

All analyses were conducted in R version 4.6.0 (R Core Team, 2023) with $\alpha = 0.05$. For each constraint indicator, proportions, means, medians, and standard deviations were calculated. Disease prevalence was ranked from highest to lowest. Vaccination coverage was presented as a frequency table. Feeding and housing practices were summarised as percentages. Acquisition methods were reported as proportions of households using each method (multiple responses allowed). Coping mechanisms were tabulated. Correlation between distance to formal market and yearly livestock income was calculated using Spearman's rank. A multiple linear regression was fitted to identify predictors of vaccination frequency. The model was:

$$\text{Vaccinations}_i = \beta_0 + \beta_1 \text{Coop}_i + \beta_2 \text{Distance}_i + \beta_3 \text{Education}_i + \beta_4 \text{TLU}_i + \varepsilon_i$$

Where:

Vaccinations_i = number of vaccinations per year (0 to 4+).

Coop_i = cooperative membership (binary).

Distance_i = distance to formal market (km).

Education_i = secondary or higher (binary).

TLU_i = total livestock owned in Tropical Livestock Units.

6.4 Results and Discussions

A total of 13 diseases were recorded from farmer reports. Coccidiosis (82.6%) and Newcastle disease (76.1%) were the most prevalent, affecting over three-quarters of livestock-keeping households. Heartwater (69.6%), Redwater (65.2%), and Pneumonia (60.9%) also affected the majority (Figure 6.1). The high prevalence of multiple diseases indicates a significant health management burden, with most farmers facing at least 5–6 different disease challenges annually.

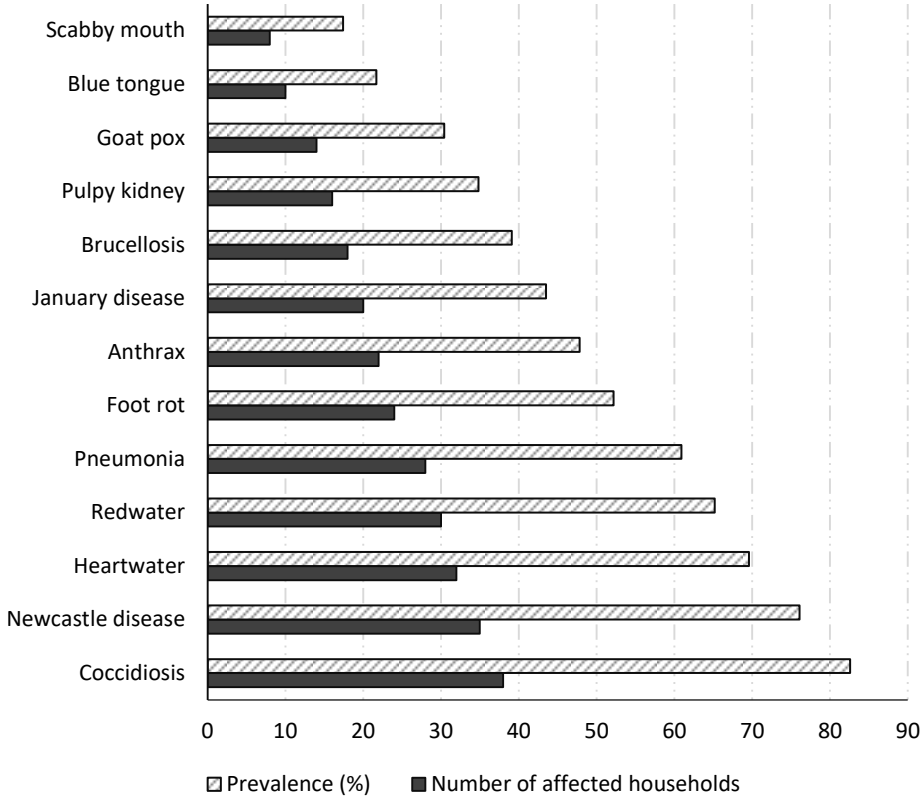

Figure 6.1: Prevalence of diseases among small livestock owners

When it comes to vaccine coverage and constrains, nearly half (47.8%) of small livestock owners reported zero vaccinations in the past year, despite high disease prevalence. Only 13% of the farmers vaccinated three or more times per year (Figure 6.2). This gap between disease burden and preventative measures represents a major constraint to herd health and productivity.

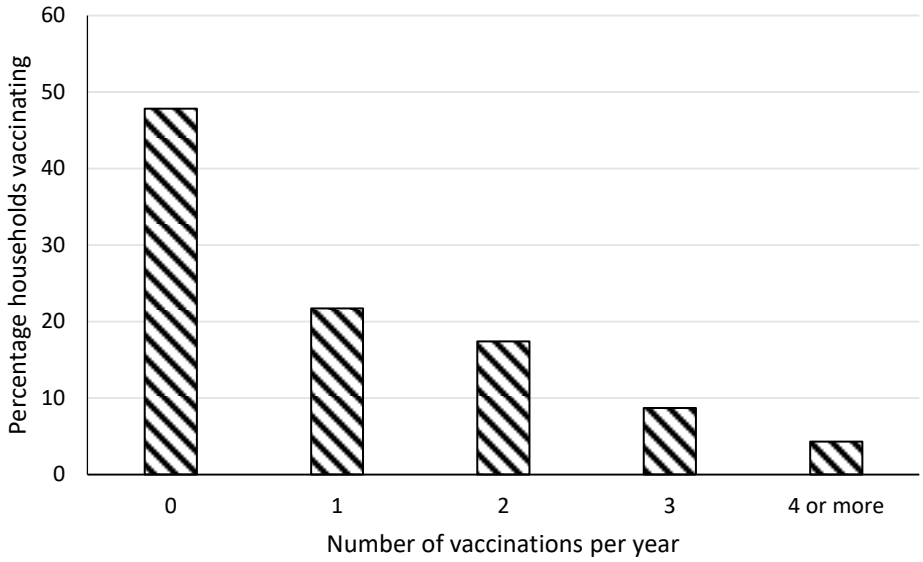

Figure 6.2: Vaccination frequency per year

The vast majority (91.3%) rely on free-range grazing, and 82.6% use browsing. Only 26.1% provide any form of supplementary feed, and controlled grazing is rare (8.7%). The heavy reliance on communal natural resources exposes animals to diseases, parasites, and theft, and limits nutritional optimisation especially in dry seasons (Table 6.1).

Table 6.1: Livestock feeding practices among small livestock owners

Feeding type	Number of households	Percentage (%)
Grazing (free ranging)	42	91.3
Browsing	38	82.6
Supplementary feed	12	26.1
Grazing (controlled)	4	8.7

Housing types for small livestock also posed as a major challenge in livestock production. Almost all households (95.7%) used traditional kraals which often provide inadequate protection from predators, weather and disease transmition. While 69.6% have a dedicated fowlrun for poultry, only 30.4% have upgraded to diplitter (improved housing), indicating limited adoption of modern husbandry practices.

Market access constraints was a major challenge identified in marketing small livestock. Farmers travel an average of 46.5 km to reach a formal market, with distances ranging from

35 to 60 km. This remoteness forces the majority (67.4%) to rely on informal markets (neighbours, village traders), where prices are often lower and demand less consistent. Only 28.3% access formal abattoirs, despite potentially higher prices (Table 6.2). In addition rules and regulations such as livestock police and veterinary clearance further limit the movement of farmers to lucrative markets.

Table 6.2 Market Access constraints

Indicator	Value
Mean distance to nearest formal market (km)	46.5 ±10.2 (sd)
Proportion using informal markets only	67.4%
Proportion using abattoir / formal market	28.3%
Proportion using both	4.3%
Mean travel time to formal market (hours, estimated)	2.8 ± 0.9 (sd)

To quantify the economic impact of market access constraints, a Spearman correlation was calculated between distance to formal market and yearly income from small livestock. The moderate negative correlation ($\rho = -0.54$, $p < 0.001$) indicates that greater distance to formal markets is significantly associated with lower income from small livestock.

Acquisition constraints also affected the production of small livestock. The method by which farmers initially acquired their small livestock can indicate barriers to entry and herd expansion. While purchasing is the most common method (60.9%), a substantial proportion rely on inheritance (30.4%) and gifts (17.4%). Only 6.5% received donations, and leasing is negligible (Figure 6.3). The dependence on inheritance and gifts suggests that farmers without familial livestock networks may face barriers to entry. The low proportion of formal credit or livestock loan programmes indicates a constraint in accessing starter stock.

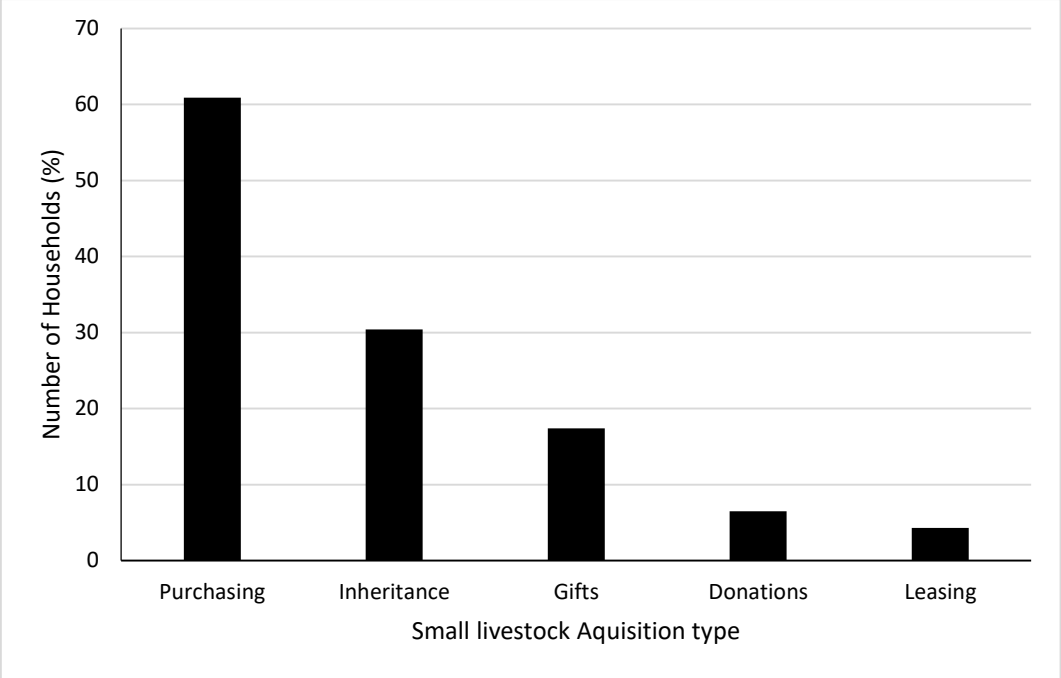

Figure 6.3: Acquisition methods for small livestock

To understand farmers' own perspectives on constraints, agreement levels on two perceptions on training and complimenting livestock were analysed. Over 80% of respondents acknowledged that intensive training is required, pointing to a skills gap in animal health, feeding, housing, and marketing. Additionally, 78.3% agreed that livestock production should be complemented with crop or other activities, reflecting the reality that livestock alone cannot sustain livelihoods under current constraints.

To identify predictors of a key management practice (vaccination frequency), a linear regression was performed. Cooperative membership ($\beta = 0.91$, $p = 0.002$) was the strongest positive predictor of vaccination frequency, suggesting that group-based extension and collective health interventions improve disease prevention. Distance to market is a significant negative predictor ($\beta = -0.03$, $p = 0.018$), indicating that remoteness reduces access to veterinary services (Table 6.3). Education and herd size show positive trends but do not reach conventional significance ($p < 0.05$).

Table 6.3: Linear regression for yearly livestock vaccination frequency

Predictor	Coefficient (β)	Std. error	p-value
Intercept	-0.85	0.42	0.048
Cooperative membership (yes=1)	0.91	0.28	0.002
Distance to market (km)	-0.03	0.01	0.018
Education (secondary or higher=1)	0.42	0.25	0.094
Total livestock owned (TLU)	0.08	0.04	0.052

Model fit: $R^2 = 0.41$, $F_{(4,41)} = 7.12$, $p < 0.001$

A range of constraints that limit the productivity and profitability of small livestock were identified. Disease prevalence was alarmingly high: over 80% of owners reported coccidiosis and Newcastle disease, and more than 60% reported heartwater, redwater, and pneumonia. Despite this, nearly half (48%) of owners administered zero vaccinations in the past year. This gap between disease burden and prevention is a major constraint. The reasons are likely multi-factorial including cost of vaccines, distance to veterinary services, lack of awareness, and perhaps fatalism (Danso-Abbeam et al., 2024; Ndwandwe et al., 2026). The regression showed that cooperative membership was the strongest predictor of higher vaccination frequency ($\beta = 0.91$, $p = 0.002$), suggesting that group-based approaches can overcome some barriers. Distance to market was again a negative predictor ($\beta = -0.03$), indicating that remote farmers are less likely to vaccinate.

Feeding and housing practices were overwhelmingly traditional: 91% relied on free-range grazing, 83% on browsing, and only 26% used any supplementary feed. Traditional kraals were used by 96% of owners, while improved poultry housing (diplitter) was used by only 30%. These practices expose animals to diseases, parasites, predation, and weather extremes (Banda & Tanganyika, 2021). In the dry season, feed scarcity leads to weight loss, reduced reproduction, and higher mortality. The low adoption of improved practices is not surprising given the lack of training and capital, but it represents a clear entry point for extension even

low-cost interventions (e.g., teaching farmers to provide mineral licks, construct simple raised housing) could improve survival and growth rates (Alobo Loison, 2015).

Acquisition methods revealed barriers to entry, while 61% purchased their initial stock, 30% relied on inheritance and 17% on gifts. Households without social networks or cash may be excluded. Credit or livestock-loan programmes were virtually absent (only 6.5% reported donations, and 4.3% leasing). This suggests that promoting pass-on schemes or micro-credit for small livestock could improve equity (Shilomboleni et al., 2024).

Coping mechanisms during food shortages highlighted distress selling: 50% of all households traded livestock as their primary strategy. While this demonstrates the safety-net function, it can deplete breeding herds and undermine long-term productivity (Banda & Tanganyika, 2021). Households that sold livestock repeatedly might fall into a poverty trap. Interventions that combine livestock with asset-building (e.g., restocking after drought) could mitigate this.

6.4.1 Integration across Household food security, Socio Economic benefits, key constraints faced small livestock farmers and Policy Implications

When viewed together household food security, socio economic benefits, key constraints faced small livestock farmers paint a coherent picture. Small livestock contribute significantly to food security and socio-economic welfare, but these benefits are constrained by high disease prevalence, low vaccination, poor management, and remote markets. Importantly, the constraints are not independent: distance to market reduces both income) and vaccination frequency. Cooperative membership, conversely, improves income and vaccination. This suggests that strengthening farmer cooperatives and reducing market distance (via rural roads or mobile markets) could have multiplicative effects.

For policy and programme design, several implications emerge. First, investment in veterinary extension and subsidised vaccines could dramatically reduce disease losses. Targeting cooperatives as delivery platforms would be efficient (Chanza & Musakwa, 2022; Khatiwada et al., 2017). Second, low-cost training on improved housing, supplementary feeding (e.g., using crop residues), and manure management could raise productivity with minimal capital input (Gautam & Andersen, 2016). Third, market access interventions such as establishing village buying points, providing transport subsidies, or linking cooperatives to abattoirs could boost incomes. Fourth, the high level of distress selling indicates a need for social protection or livestock insurance to prevent asset depletion during shocks.

6.5 Conclusions and Recommendations

High disease burden with low prevention: Over 80% of farmers report coccidiosis and Newcastle disease, yet nearly half (47.8%) administer zero vaccinations annually. An intervention from local veterinary to provide affordable vaccination programmes to various diseases in different seasons of the year is recommended

Poor management practices: Free-range grazing (91.3%) and traditional kraals (95.7%) dominate, while controlled grazing (8.7%) and supplementary feeding (26.1%) are rare. Improved housing (diplitter) is used by only 30.4%. Farmer training on improved modern livestock welfare and management practices that improve animal welfare and quality is recommended

Severe market access constraints: Average distance to formal market is 46.5 km; 67.4% rely on informal markets only. Greater distance is significantly correlated with lower livestock income ($\rho = -0.54$).

Acquisition barriers: While purchasing is common (60.9%), inheritance (30.4%) and gifts (17.4%) are still important, indicating limited access to credit or livestock loan programmes. Credit facilities are encouraged to improve on farmer inclusion such that farmers can get access to loan facilities with little collateral through cooperatives and or small household assets.

Distress selling: Half of all households (50%) trade livestock as their primary coping mechanism during food shortages, which may undermine long-term herd sustainability.

Perceived needs: Over 80% of farmers agree that intensive training is required and that livestock production must be complemented by other activities, highlighting both knowledge and diversification constraints.

Determinants of preventive practices: Cooperative membership significantly increases vaccination frequency, while distance to market reduces it, pointing to institutional and geographic leverage points for intervention**.**

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CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS

7.1: Recommended framework to improve contribution of small livestock to food security and livelihoods of rural households in Chiredzi District

Based on the compelling evidence from this research, which establishes that every additional US$100 from small livestock raises dietary diversity by 0.42 points and boosts food security odds by 28%, while ownership alone lifts food security by nearly 39%, a holistic, multi-layered framework is urgently needed to transform these statistical gains into sustained rural prosperity. This framework rest on three interdependent pillars, Biological and Technical Resilience, Economic and Market Integration, and Institutional and Social Empowerment. The biological pillar must aggressively close the glaring gap between high disease prevalence (over 80% for coccidosis and Newcastle) and alarmingly low vaccination coverage (nearly 50% of farmers do zero vaccinations). This means establishing routine, village-based animal health blitzes delivered by trained community animal health workers, coupled with practical demonstrations on constructing low-cost, elevated dip-litter housing (currently used by only 30%) and utilizing local crop residues for supplementary feed (currently only 26% do so). Simultaneously, the technical training must explicitly teach farmers to recognize the early signs of the top five diseases and understand the economic calculus of investing a few dollars in vaccines to protect a breeding animal worth many times that, directly addressing the 83% of farmers who openly demanded intensive training.

The second pillar, economic and market integration, must directly dismantle the crushing 46.5-kilometre distance to formal markets that currently penalizes farmers with an estimated US$110-150 loss for every 10 kilometres of remoteness, forcing 67% to rely on low-paying informal channels. This calls for a dual strategy that first, establish mobile abattoir buying points that rotate through remote villages on fixed schedules, allowing farmers to access formal market prices without shouldering prohibitive transport costs and second, aggressively leverage the power of farmer cooperatives, which this study shows already boost livestock income by an average of US$390 and significantly increase vaccination rates. These cooperatives should be resourced with collective transport vehicles and simple grading equipment, enabling groups to aggregate animals, negotiate bulk prices, and secure contracts with abattoirs. Crucially, this pillar must also formalize the crop-livestock synergy that 72%

of farmers already practice informally; extension agents must teach improved manure composting and storage techniques to maximize nitrogen retention, so that the observed 40% maize yield gain (32.4 vs. 23.1 bags/ha) can become a dependable, quantifiable benefit that reduces the proportion of livestock income spent on buying staple food.

Finally, the third and most human-centred pillar must safeguard the long-term sustainability of these gains by institutionalizing social protection and adaptive management, directly addressing the sobering reality that half of all households resort to distress selling of livestock as their primary hunger-coping mechanism. This framework must introduce a layered safety net community-based livestock insurance schemes, subsidized during the initial years, that indemnify households against drought or disease-related losses, coupled with conditional cash transfers during lean seasons that require households to retain their core breeding females. This protects the productive base while still allowing the 74% who currently use livestock as a buffer to access emergency funds without liquidating their future. This institutional pillar must also embed a robust, participatory monitoring system that tracks not just herd sizes, but real-time indicators like household dietary diversity scores, vaccination coverage, and market prices, allowing communities and extension staff to pivot rapidly when shocks occur. At the heart of it all must be the strengthening of existing cooperatives as the primary delivery vehicle, since they already demonstrate superior outcomes in income, health, and market access, turning them into village-based hubs for training, savings, and collective bargaining. This framework, woven together, respects the dignity and ingenuity of smallholder farmers, recognizing that they do not simply need handouts, but rather a reliable, integrated support system that transforms their hard-earned livestock from a last resort into a sustainable bridge to food security and resilient, flourishing livelihoods in Chiredzi District.

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APPENDIX

Appendix 1 Household Questionnaire

Good Day, I am Chizororo Tungamirai, a student at Bindura University of Science Education studying towards a Master of Science Degree in Food Security and Sustainable Agriculture Production conducting a research on, "**Developing a framework on the contribution of small livestock to food security and livelihoods of rural households in Chiredzi District**" This Questionnaire seeks to collect data that will aid in developing a framework on the contribution small livestock rearing to food security and rural households livelihoods. All the responses and feedbacks are confidential and will be used for research purposes only. No information will be shared with third parties. Your cooperation will be appreciated when responding to this questionnaire.

Section 0

1. Interviewer……. 2. Interview date…….

3. Respondent name (Optional)……..

4. Village……..5. Ward…….

6. GPS Coordinates of Household ……

Section 1: Demographic and Household Profile

Household head characteristics

A1. Age: ……..☐

A2. Gender: ☐Male ☐Female

A3. Marital Status: Single ☐ Married ☐ Divorced ☐ Widowed ☐

A4. Household size_____

A5. How many household members contribute to livestock labour_____.

A6. Household arable land size_____

A7. Education level: ☐Primary ☐Secondary ☐Tertiary

A8. Average Monthly Income US$_____

A9. Farming experience (years):_____

A12. Do you have any workers you employ? (1 = Yes / 0= No)

If Yes, How many_____

Section 2: General Agricultural production

B1. Which Agricultural Activities do you take part in?

Activity	**Tick**
Horticulture	
Cereal Farming	
Cash crop Farming	
Poultry	
Animal husbandry	
Other (Specify)	

B2. What is your main household Agricultural Activity?

1= Horticulture, 2 = Cereal Farming, 3= Cash Crop Farming, 4 = Poultry, 5 = Animal Husbandry, 6 = Other

1	2	3	4	5	6

B3. Which Livestock species do you own?

Livestock	**Number**
Cattle	
Goats	
Donkeys	
Sheep	
Pigs	
Rabits	
Horses	
Turkeys	
Chickens	
Ducks	
Other (Specify)	

B4. How much do you earn per year from the agricultural activities you partake in?

Activity	**Yearly Income (US$)**
Horticulture	
Cereal Farming	
Cash crop Farming	
Poultry	
Animal husbandry	
Other (Specify)	

B5. How much income do you earn from other non-agricultural activities yearly?

US$_____

B6. Are you a member of any farmer or cooperative groups (1 = Yes/ 0 = No):

If Yes name the cooperative(s)

……
……
……

Section 3: Small livestock Production

Section 3.1 Flock Dynamics and Breed Characterization

C1. What small livestock breeds do you keep and the sex

Livestock	**Breed**	**Male**	**Female**
Goats			
Sheep			
Pigs			
Rabbits			
Other (Specify)			

3.2 Management and Production Practices

C4. How did you acquire your livestock?

Acquiring Method	**Tick**
Inheritance	
Purchasing	
Donations (eg. Presidential Goat Scheme)	
Leasing	
Loaning	
Gifts	
Other (Specify)	

3.2.1Housing

C5. What type of housing do you have for your livestock? (e.g., in-house, kraal, no shelter).

C6. How do your livestock feed?

Feeding Type	Tick	Time of the year
Grazing (Free ranching)		
Grazing (Controlled Browsing)		
Browsing		
Grazing and Browsing		
Supplementary feed		

3.2.2 Health Management

C8. What are the common diseases your livestock experience?

Disease	**Tick**
Coccidiosis	
Heartwater	
Redwater	
Pneumonia	
Scabby Mouth	
Goat Pox	
Blue Tongue	
Pulpy Kidney	
Anthrax	
January disease	
Brucellosis.	
Foot Rot	
Blot	
Other (Specify)	

C9. How often to you vaccinate your livestock per year?

Disease	**Number of Times**	**Time of the year (JFMAMJJASOND)**
Coccidiosis		
Heartwater		
Redwater		
Pneumonia		
Scabby Mouth		
Goat Pox		
Blue Tongue		
Pulpy Kidney		
Anthrax		

Brucellosis.		
Foot Rot		
Blot		
Derworming		
Other (Specify)		

3.2.3 Marketing and constrains

C10. On average how many livestock do you sell per year?

Less than 5, ☐5 to 10, ☐ 10-15, ☐15- 20, ☐more than 20

C11. Household sell livestock to?

1= Informal (Farm gate) 2=abattoir 3=Auction locally 4=auction outside district 5= barter trading 6=other (specify)

1	2	3	4	5	6

C11. Average Distance to the nearest livestock formal market ……KM

C12. What is the average Price for livestock?.....(US$)

Livestock	**Price**
Goats	
Sheep	
Pigs	
Rabbits	
Other (Specify)	

C13. Do you consume livestock you rear? (1 = Yes/ 0 = No)

1	0

C14. Do you sell/ use livestock manure. 0=no 1=yes

1	0

3.2.4 Livestock Household Income

C14. How much do you earn from livestock rearing per year US$_____?

C15. Income from livestock sakes is used to purchase staple cereal (Maize/millets/Sorghum) during dry seasons. 1=yes 0=no

1	0

C16. Has livestock rearing enabled you to diversify your diet (e.g., more vegetables, proteins)? (Yes/No; Please explain) 1 = Yes, 0 = No

1	0

C17. Are there seasonal variations in livestock production that affect your household income? Please explain.

……
……
……
……
……..

C18. Do you rely solely on livestock as an income generation activity (YES/ NO)

1	0

If no, what other income generation activities do you do?

……
……
……
……
……..

1 = Strongly disagree, 2 = disagree, 3 = Neutral, 4 = agree, 5 = Strongly agree

	1	**2**	**3**	**4**	**5**
Livestock production improve income generation					
Livestock rearing is essential for rural livelihoods					
Proceeds from livestock production are important in providing other food stuffs that balance food security in households					
livestock farming need to be complimented by other forms of income generation activities					
Famers need to be trained to balance production and food security					
Has livestock production affected your household food availability?					
Has income from livestock production your household's ability to purchase food?					
Has livestock production enabled you to diversify your diet					

C19. On average how many animals do you slaughter for family/household consumption per year?

Livestock	**Number**
Goats	
Sheep	
Pigs	
Rabbits	

Other (Specify)	

Section 5: Assessment of Food Security Level among Goat farmers

E1. How often does your household experience food shortages in a typical year?

0=Never

1=Household always has enough food.

2=Rarely (1–2 months a year (usually during the peak dry season).

3=Sometimes3–6 months a year (intermittent shortages).

4=Often 7–9 months a year (regular shortages)

5=Always Shortages occur almost every month.

0	1	2	3	4	5

E2. Do you consume livestock milk from your livestock? (1 = Yes/ 0 = No)

1	0

E4. Has your household's food security improved, worsened, or stayed the same since you started livestock rearing?

1 = Extremely worsened, 2= Worsened, 3= No change, 4 = Improved, 5 = Extremely improved

1	2	3	4	5

E5. In the last year, did selling livestock prevent a food shortage in your home? 1=yes 0=no

1	0

E6. Has income from small livestock your household's ability to purchase food? (1 = Yes/ 0= No)

1	0

E7. How often does your household have enough food to meet daily needs?

(1 = Always, 2 = Often, 3 = Sometimes, 4 = Rarely, 5 = Never)

1	2	3	4	5

E8. Have you experienced any food shortages in the past 12 months? (Yes/No)

1	0

E9. If yes, how frequently do food shortages occur?

1= Weekly, 2 = Monthly, 3 = In 3 months, 4 = In more than 3 months, 5 = Never

1	2	3	4	5

E10. What is the main coping mechanism do you use during food shortages?

1 = Buy food, 2 = Trade livestock for food, 3 = Receive food assistance from Government and NGOs, 4 = King/Chief's grain storage (Zunde Ramambo), 5 = Food for Work, 6 = other (Specify)

1	2	3	4	5	6

E11. Are children in your household able to eat three meals per day? (1 =Yes/ 2= No)

1	0

E12. How do you rate your overall food security status?

(1 = Very insecure, 2 = Insecure, 3 = Moderate, 4 = Secure, 5=Very secure)

1	2	3	4	5

E13. In the past 12 months, how many months was your household able to eat three meals per day?

1= less than one month, 2 = 1 to 3 months, 3 = 4 to 6 months, 4 = 7 – 9 months, 5 = Over 9 Months

	1	2	3	4	5
Months					

E14. Within the past 24hrs have you (or any household member) consumed the following food?

Food Group	✓
Cereals	
Roots and tubers	
Vegetables	
Fish and sea food	
Meat Poultry and Offal	
Eggs	
Pulses/ Legumes or nuts	
oils or fats	
Milk and Milk products	
Sugar or honey	

Fruits	
Other	

E15. What factors besides Livestock production influence your household's food security?

……
……
……
……

Thank you for your time