DEVELOPMENT OF A SUSTAINABLE CATTLE FARMING BUSINESS MODEL FOR SMALL SCALE CATTLE FARMERS: THE CASE OF NAMWALA DISTRICT OF ZAMBIA

BY

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A Dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the award of the Degree of Philosophy in Business and Management.

THE UNIVERSITY OF ZAMBIA

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DECLARATION

I, **Enock Siankwilimba**, do hereby declare that this work is my original work achieved through personal reading and research. This work has never been submitted to the University of Zambia or any other Universities. All sources of data used and literature on related works previously done by others, used in the production of this Dissertation have been duly acknowledged. If any omission has been made, it is not by choice but by error.

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APPROVAL

This Dissertation by ***Enock Siankwilimba*** is approved as a partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy in Business and Management

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ABSTRACT

The transformation of the livestock sector from non-functional to functional has had numerous systemic hurdles due to the different interactions of systems at play. This research study's primary objective was to develop a dynamic and sustainable cattle farming business model for traditional cattle farmers in the Namwala District of Zambia to ensure cattle business growth, profitability and sustainability. This research study used a mixed method approach, which employed both quantitative and qualitative data collection methods. This research study used descriptive and causal research designs. Quantitative data was collected from 405 cattle farmers in Namwala District using a structured questionnaire. A further 12 focus group discussions and 405 individual interviews, using an interview guide, were used to collect qualitative data. Multiple linear and logistic regression analyses were used to establish causality among variables. Results revealed that the traditional cattle business is characterised by family operation, open communal grazing for cattle, and a lack of cattle market associations. The majority of the farmers do not achieve formal revenue from the by-products, and farmers have no insurance cover for their cattle. Supplementary feeding, access to extension services, regular dipping of animals, adequacy of water, regular vaccination, access to open communal land, secondary education, land adequacy, and traditional ceremony (Shimunenga and Shikaumpa), were statistically significant in affecting cattle herd size. This research study found that milk selling, selling cattle to processors, business attractiveness, selling calves and steers, price and the number of cattle sold are statistically significant in affecting the profitability of the cattle business. Further, this research study found that supplementary feeding, attractiveness of the cattle business, access to extension services, regular dipping of animals, adequacy of water, regular vaccination, profitability of business, savings and insurance, and access to open communal land, have significant impact on cattle business sustainability. Furthermore, this research study developed a dynamic cattle business model for sustainability and a framework for implementation.

The research study recommends that the government and private sector business enterprises, through a private-public partnership (PPP), develop a meat and dairy market enterprise that will stimulate and support smallholder farmers to improve their investment within the livestock value chain. The initiative aims to increase livestock income for smallholder farmers, provide a reliable market for their livestock, and enhance their livelihoods and business enterprises.

The government and private sector should embark on the intensive promotion and branding of traditional cattle farmers and their products to attract investment by many Zambians in the sector via different media platforms such as field days, auction sales, and market days, as in the case of Shimunenga and Shikaumpa ceremonies in Maala and Baambwe areas of the Namwala district. Furthermore, this study recommends that the government, Ministry of Livestock and Fisheries, and stakeholder organisations support and empower cattle farmers with acquisition to cattle production knowledge, support and empower cattle farmers with acquisition to resources such as land, water, financial capital and financial services, develop policies that empower cattle farmers in terms of acquisition to resources, and develop and facilitate the market for livestock products. Future research is required for a needs assessment for financial and extension services and willingness to pay for these services among the traditional cattle farmers.

KEY WORDS: Traditional Cattle Farmers, Traditional Management Practice, Cattle Business, Business Growth, Profitability and Sustainability, Monetization, dynamics, Business Model, Framework, Namwala Cattle farmers, Zambia livestock farming business, Southern Province cattle

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Abounding affection!

DEDICATION

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LIST OF ACRONYMS

AI	Artificial Insemination
BM	Business Model
BMC	Business Model Canvas
BMI	Business Model Institute
CBPP	Contagious Bovine Pleuro-Pneumonia
CDPF	Cobb-Douglas Profit Function2
CLDs	Causal Loop Diagrams
CMM	Concurrent Mixed Research Method
CSA	Climate Smart Agriculture
CSO	Central Statistical Office
DFID	Department of International Development
DVS	Department of Veterinary Service
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FG	Focus Group
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
GHG	Green House Gasses
GM	Gross Margin
GMB	Group Model Building
HSSREC	Humanities and Social Sciences Research and Ethnical Committee
IAPRI	Indaba Agriculture Policy Research Institute
ICT	Information Communication Technology
IMF	International Monetary Fund
MAL	Ministry of Agriculture and Livestock
MCC	Milk Collection Centre
MOE	Margin of Error
MCTI	Ministry of Commerce Trade and Industry
MMD	Movement for Multiparty Democracy

M4P	Making Markets Work for the Poor
N	Population Size
OLS	Ordinary Least Square
P	Sample Proportion
SADC	Southern African Development Community
SD	Systems Dynamic
SE	South East
SGMB	Spatial Group Model Building
SNAP	Seventh National Agriculture Policy
SSA	Sub-Saharan Africa
VOP	Value of Production
USAID	United States of America

CHAPTER 1

INTRODUCTION

1.0 Context of the Research Study

The livestock sector plays a crucial role in improving the lives of millions of people by providing sufficient and reliable supplies of meat and milk for consumers, as well as providing income for suppliers and stakeholders involved in the industry (ARENA, 2018; Krajcsák, 2020; Nkonki-Mandleni et al., 2019; Pardo & del Prado, 2020). Livestock, in generating income and create employment, strengthens the asset base that rural households use to achieve their livelihood objectives (Waha et al., 2018). Historically, traditional cattle farmers in many developing nations such as Zambia have been interested in rearing cattle for prestige, daily usage and social security in line with their traditional cultural, legal framework systems, regulations and societal standards (Lubungu, 2017; Mumba et al., 2018). The livestock sector in Zambia is estimated to contribute around 3.2% to the overall national GDP and 42% to the agricultural GDP (Ministry of Fisheries and Livestock, 2020). These figures do not include animal draught power, manure, and other cattle by-products (Lubungu & Mofya-Mukuka, 2012; Wezi et al., 2023), with animal draught power referring to domesticated animals, typically oxen but can be cows or bulls where oxen are unavailable, used to assist humans in agricultural tasks such as ploughing and transport.

Traditional livestock practices are passed from one generation of cattle keepers to another and, as such, have had some adverse impact in the development of more sustainable rural cattle farming (Fielder, 1973; Lubungu, 2017; Mumba et al., 2018). In Zambia, cattle are a product of geography, tribes, breed type, market participation, infrastructure development, disease prevalence and, to some extent, the entrepreneurship acumen (Lubungu et al., 2012; Mumba et al., 2017; Saasa et al., 2015). Mwaanga and Parés-Casanova (2017) postulate that the Southern Province is a home for the Tonga and Baila cattle breed, while the Eastern Province is home for the Angoni breed, the Western Province is home for the Barotse breed, and the Northern is home for the Mambwe breed. Moreover, along the rail line and main road network, exotic and cross breeds owned by a

mixture of commercial, emergent and smallholder farmers are spotted (Moder et al., 2019; Siankwilimba, 2019b). Mulenga et al. (2020) report that traditional cattle farming is characterised by inadequate infrastructure, limited access to cattle breeding and market information, climatic shocks and changes, seasonal changes in cattle pricing, high cattle disease burden, insufficient business financing and high cost of inputs. When weighed, most of these factors have been found to contribute to relatively high herd mortality rates and small animal sizes, thus reducing the capacity of the livestock businesses to exponentially and sustainably grow (Di Marco et al., 2021; Kebebe, 2019; Siankwilimba et al., 2023).

Studies continue to show that many traditional farmers have consistently adhered to traditional cultural practices of cattle farming (Flagg et al., 2014; Lubungu et al., 2015; Mumba et al., 2018), limiting the growth and sustainability of the cattle business farming leading to more impoverished communities (Siankwilimba et al., 2023). Therefore, given the complex, multi-dimensional and dynamic nature of the livestock production setup, there was a clear need for developing a dynamic and sustainable business model for small scale cattle business entities that would consider the attractiveness of the business offer, monetisation/profitability and sustainability as outlined in Muehlhausen (2013) business model template.

1.1 Background

Despite the seemingly significant contribution to the national economy, the cattle livestock subsector, which is mostly in the hands of traditional small scale animal farmers (84%), remains inefficient with a low uptake of innovative business technologies, while the remaining 16% is in the hands of more efficient emergent and commercial cattle farmers found along the main line of rail in Zambia (Kabisa et al., 2019a; World Bank,2011;Wezi et al., 2023).

The cattle business is becoming increasingly important, accounting for 42% of agricultural GDP and employing more than half of the people in rural areas (African Financials, 2023). Zambia's large resource endowment offers tremendous possibilities for livestock

development, with a carrying capacity of 12,000,000 and 15,000,000 cattle (World Bank, 2011). However, the sub-productivity sector remains poor, yet the country has a grazing area of 20.3 million hectares, currently supporting just 4.7 million cattle (World Bank, 2011; Siankwilimba et al., 2024). Statistics show that the stocking density of traditionally managed cattle in Zambia is low at 0.14% heads of cattle per hectare of suitable grazing land, against the one animal per hectare that have been attained in neighboring countries like Kenya, Tanzania and Zimbabwe (World Bank, 2011). Low production output has, over a long time, negatively impacted on the smallholder cattle farmers' economic well-being despite being the custodians of cultural practices and over 90% of Zambia's cattle.

The production and productivity situation has been the same for many years going by the trend of cattle population growth rate from past decades. According to Mumba et al (2018) productivity of cattle in the traditional sector is characterized by slow growth rates (5-8 years to reach market weight), high calf and adult mortality rates (20-30% and 9%, respectively) and low reproductive performance. Low reproductive performance is exhibited by low conception and calving rates (50%) and long calving intervals. The national herd growth rate is estimated at 3% with an average offtake of 8-9%. In comparison, production ratios for the commercial sector feature low calf mortality (1-2%), high reproductive rates (65-70%) and an offtake between 17-18% (Mumba et al.,2018).

The current off-take rate of the traditional herd is still only around six percent, while that from the commercial herds is over 30 percent. Poor uptake of new technology such as improved genetics, new methods for endo and ectoparasites control, herd health plans, supplementary feedings etc, coupled with lack of contemporary business entrepreneurship skills could be some of the factors that have continued to compromise cattle productivity thereby limiting Zambia's ability to meet its cattle national potential population and beef market for many years.

Traditional cattle farmers are defined as farmers who keep local breeds of cattle integrated with crop farming on approximately five hectares of land (World Bank, 2011b). An estimated 348,966 household cattle farmers in Zambia depend on their livestock in several ways (Chapoto & Subakanya, 2019). According to FAO and World Bank (Mtimet et al., 2015), two widely used classifications of cattle use are based on the kinds of output

produced benefits (World Bank, 2011b). Other types of output produced are food, cropping inputs and raw materials (Siankwilimba et al., 2023). Output utilisations comprise subsistence consumption by the livestock holder's household, direct supply of information, cash income through sales of live animals or their output, savings and investment, and social functions such as paying bride wealth or providing animals for communal feasts (Chaabila, 2012).

In Zambia, these small-scale cattle farming entrepreneurs or businesses are characterised by transhumant cattle herding systems under communal grazing with poor quality animal husbandry and management systems (Mumba et al., 2018). Limited animal husbandry techniques, disease outbreaks, low livestock population, inadequate animal feed, and poor access by animals to watering locations and pastures are exacerbated by climate change, COVID-19, and other challenges limiting these systems (Siankwilimba et al., 2023). In addition, the country faces severe competition from more advanced cattle-producing countries in the Southern African Development Community (SADC) (Ministry of Fisheries and Livestock, 2020), resulting in the danger of cheaper livestock imports. Despite these limitations, these methods have supported rural communities' lives for millennia. In many cases, cattle sales are low, as small-scale farmers only sell a median of two cattle per year (Imakando,2015). The situation has been compounded by climate change issues, with many studies suggesting that livestock productivity has been negatively affected (Todaro & Smith, 2015)

However, the biggest challenge the government and its cooperating partners face is how to change the cultural behaviour of most smallholder farmers to turn traditional cattle farming entrepreneurial ventures into viable and sustainable entities through different innovations. Traditional cultural business models that cattle farmers practice is based on prestige value, based on transhumance practices, poor nutrition, poor quality meat which continue to reinforce the traditional and cultural agricultural practices year after year (Bailey et al., 2018; Chaabila, 2012; Kalapula & Mweemba, 2018a; Lubungu et al., 2015). These animals are also used for draught power and other social systems rooted in a culture inherited and

passed on from generation to generation that does not fetch good prices (Mumba et al., 2018; Zulu et al., 2021).

While the small-scale cattle business sector is struggling in Zambia, attributed partly to the linear approach to cattle development, the global livestock sector has continued to grow (Pound & Conroy, 2017; Zeder, 2022). Countries such as Brazil, India and Pakistan have witnessed unprecedented livestock business growth due to favourable policies (Gerssen-Gondelach et al., 2015; Gilbert et al., 2018; Vale et al., 2019). These countries have managed to enter into livestock trade agreements with other countries like Japan and China to supply animals, meat and milk products with fewer trade barrier restrictions (Bawm et al., 2021; Šūmane et al., 2018). These agreements justify the need for policy to influence and produce a sustainable cattle business model that delivers optimal prices, resources, and activities as demanded by the market.

Furthermore, as a medium of exchange, people and countries still use cattle to settle court fines and other acceptable modes of payments (BBC-British Broadcasting Corporation, 2020; Kandyata, 2011). Two African nations have amplified such kind of trade to offset the debt. On 17th March 2020, the British Broadcasting Corporation reported that Chad would repay Angola a debt of $100 million with cattle (BBC-British Broadcasting Corporation, 2020). This kind of debt settlement is more sustainable and user-friendly compared to traditional financial institutions, one designed by the International Monetary Fund (IMF)and World Bank (WB) (International Monetary Fund, 2022). The International Monetary Fund, acknowledged a need to develop a more flexible and resilient business environment (International Monetary Fund, 2022). The fund also addressed the issue that emerging markets and developing economies confront, pointing out that growth predictions for 2026 are 6% lower than pre-pandemic levels, implying that recovery will take two or more years (Georgieva, 2022). Therefore, cattle farmers and stakeholders are challenged to identify strategies that can deal with short-term problems without endangering long-term sustainable progress and development.

The low development in the small-scale cattle farming sub-sector in Zambia has been attributed to traditional business models, mostly embedded in the dependency theory of the late 1950s that formed the basis of previous government policies of cattle farming business development (Isaac & Murat, 2019). Prebisch and his colleagues developed the Dependency Theory and asserted that economic growth in the advanced industrialised countries did not necessarily lead to growth in the poorer countries due to a lack of value addition and economies of scale in developing nations (Lorenzen et al., 2020). Thus, it was assumed that the lack of capacity to establish prosperous small-scale cattle farming entrepreneurship systems was due to the lack of investment offered to Zambian rural cattle farmers (Isaac & Murat, 2019). This led to significant investments in farming in Zambia, characterised by subsidies and government control (Kabisa et al., 2019b; Mulenga et al., 2022). However, the advent of multi-party democracy in 1991 saw the liberalisation of the economy and the removal of government subsidies from most agricultural products to resuscitate the farming business, including the cattle marketing systems which was highly monopolized by state institutions cold storage board and Dairy Produce Board of Zambia (Vandome, 2023; Zambia Statistics Agency, 2019). High mortality, low productivity, low budget funding towards livestock sector, and low production in the small-holder livestock sector have been attributed to the elimination of these smart subsidies, which has also been blamed for an increase in cattle sickness and theft (Simuunza, 2022).

Amidst Zambia's traditional cattle business inadequacies, it is interesting to note that the World Bank in 2010 declared the country as one of the world's fastest economically reformed countries in Sub Saharan Africa (Otte et al., 2012), albeit with an equally fast-growing population standing at 20 million, with the majority being women standing at 11 million (Simuunza, 2022). Under this scenario, Zambia's Ministry of Agriculture and Livestock (MAL) projected that demand for meat and related cattle products will increase from 120,000 metric tons in 2012 to over 600,000 metric tons by 2027 (Ministry of Finance and National Planning, 2022). With low cattle production and limited marketing conditions, this demand growth will create a supply gap of roughly 320,000 metric tons (Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022). In the report from FAO 2022 (Simuunza, 2022), along with studies from Lubungu et al. (2015) and Kabisa et

al. (2019), it is suggested to identify strategies that will enable small-scale cattle owners to fill this projected deficit by improving linkages to urban demand opportunities.

To boost small scale cattle farming activities in Zambia and overcome the projected cattle supply deficits, the Government of the Republic of Zambia has formulated a livestock development policy under the Ministry of Fisheries and Livestock. This policy aims to guide the effective implementation of activities and programmes in the livestock and cattle sub-sector that is in line with the Sustainable Development Goals 2030 (Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022). The vision of the Policy is to have a livestock sub-sector that is efficient, productive and sustainable, assures food security, increases household income and significantly contributes to the national Gross Domestic Product (GDP). Further implementation of the seventh and eighth national development plans has continued to put livestock and cattle at the center of an economic and social development trajectory aimed at attaining zero green gas emission within the limit of the $1.5^{o}C$ increase in temperature, zero hunger and poverty in the country by 2030 (Zambia Statistics Agency, 2022). These documents are still far in helping to achieve sustainable cattle business model of which this study envision to propose to lift the smallholder farmers out of poverty and attain business mindset.

The various policy measures seek to provide cattle-farming enterprises with a sustainable steady and reasonable income from cattle production activities (Ministry of Fisheries and Livestock, 2020). In addition, the policy recognises the indigenous knowledge in the management and treatment of animals' diseases used over the years being available to smallholder farmers. This will be subject to robust research and development to determine its efficacy. Livestock farming is also recognised as a priority investment area under Zambia's Seventh National Development Plan (MCTI, 2022). The Zambeef emerged in 1994 and has since evolved into a large local cattle business conglomerate. Zambeef has progressively impacted cattle production in Zambia since its inception, and has expanded exponentially to become one of Zambia's largest agribusinesses with annual revenues of more than $255 million and currently employs over 5,500 people (African Financials, 2023). Together with NGOs such as Musika, Zambeef supports smallholder cattle farmers

in the Northern and Western Provinces to improve dairy management and livestock productivity (African Financials, 2023).

Despite government efforts to enhance the market productivity of small-scale cattle business entrepreneurs, the response from traditional cattle farmers has remained conservative and inefficient (Mumba et al., 2018; Wezi et al., 2023). The traditional cattle market continues to be characterised by high levels of seasonal supply fluctuations, leading to significant seasonal variations in consumer prices for cattle products such as beef and milk. Weak value chain linkages, low coordination, poor governance, and lack of farmer cooperatives disadvantage the traditional cattle farmers market's bargaining power. It also gives them limited access to affordable credit, resulting in little opportunity to improve production and value addition at the cattle farm level (Siankwilimba et al., 2022). These fluctuations in the traditional cattle business dynamics indicate complex market dynamics, cycles and trends, and other phenomena that are seen in natural emerging market ecologies with evolving efficiency (Chowa, 2015; Musonda et al., 2022). Navarrette-Molina and colleagues have suggested the business challenges that cattle farmers and other market players are facing are due to the complex and dynamic nature of the cattle business sector and associated marketing factors that call for business models based on local market ecologies (Navarrete-Molina et al., 2019) and within systems dynamic approaches (Molina-Castillo et al., 2020). Further study carried by Imakando (2015) shows that the biggest challenge the traditional sector is facing is poor-quality carcasses that fetch low prices at the market and the low prices offered to them by the buyer. The solution, according to this study, is to improve winter nutrition (community feedlots) and, secondarily, the marketing system for cattle.

The literature points to various business models that can inform the cattle business practices among small-scale cattle business entities. For example, many scholars have advanced circular and regenerative business models as the most appropriate to employ when establishing systems to address the systemic challenges faced (Borges Oliveira et al., 2021; Newton et al., 2020; Spenceley et al., 2021). Essentially, all business models perform two functions: value creation and capture (Evans et al., 2017). Thus, the aim of any business

model that is adopted to describe the way small scale cattle enterprises create and capture value within a market network of producers, suppliers and consumers must include how these enterprises will assimilate what is being offered, how the business offer will be monetised and how this offer will be sustained (Amit & Zott, 2012; Muehlhausen, 2013). According to Muehlhausen (2013), this was the strategic context of a business organisation. For example, the development of the small-scale cattle business sector in Zambia can be explained in part by a lack of an attractive offer (termed standard beef as opposed to choice beef) (Tonsor et al., 2022), low monetisation or investment leading to low productivity (Mumba et al., 2018; Siankwilimba et al., 2023b) and lack of long-term sustainability (Siankwilimba et al., 2022; Siankwilimba et al., 2023b). It can be argued that the findings of all these local and related international studies (Sikhweni & Hassan, 2014) add to the voice that existing small-scale cattle business models have not functioned according to expectations of different policies, supporting functions and core functions within the market space in the country (The Springfield Centre, 2015).

FAO has amplified the call for a different and more robust approach to enhancing small-scale cattle farming enterprises (FAO and WFP, 2022). When trade reform models are implemented in an unstable macro-economic framework or in countries with fragile institutional backgrounds, the results are usually negative (FAO and WFP, 2022; Georgieva, 2022). Thus, poorly functioning cattle business systems would not work well if fundamental core market systems are not in place first (Alabi & Ajayi, 2018; Moores & Hunters, 2018). There has been a noticeable move by researchers, successive governments and cooperating agencies such as FAO to adopt more robust business that focuses on the whole system and not on parts of the entire agricultural and livestock activity chain (Ferrucci & Lissoni, 2019; Kan et al., 2022; The Springfield Centre, 2015). Gerber (2015) and Herrero et al. (2020) seem to agree that the shift has been triggered by the desire to eliminate business gaps which continue to widen between market players and subjecting the rural farmers to continued poverty despite being recipients of other government reforms. As for Zambia poor policies have continually left a gap leading to poor carcass quality that fetches low prices and ultimately reduced uncompetitive market space.

Therefore, lack of competitiveness by the Zambian smallholder farmers and lack of industry leadership give rise to collusion by meat and dairy processors (Imakando,2015).

Many scholars agree and suggest that when faced with complex challenges, system dynamics is a feasible way to approach the complex cattle farming business industry because it attempts to model the behaviour of constantly changing systems (Arnold & Wade, 2015; Gazoni & Silva, 2021; Neely, 2019; Richardson & Andersen, 2010; Sterman, 2002). System dynamics and systems thinking have been used in facets of life, such as business and climate change complexities (Di Marco et al., 2021; Rahmandad & Sterman, 2022), agricultural development (Donatelli et al., 2017; Thornton et al., 2023; Valdivia et al., 2017), health and disease management and control (Manyori et al., 2017; Neely, 2019; Scheffer et al., 2018), engineering (Maroeto & Santoso, 2022; Tian et al., 2022; Václavík et al., 2013a), the environment and climate change (FAO and INRAE, 2020; Václavík et al., 2013b; Wu et al., 2022), governance and political leadership (Archambault & Ehrhardt, 2022; Isenhour, 2010; Pham et al., 2021; Provizer, 2017), education (Grote et al., 2021; Marco de Marco & Brocke Vom, 2022; Pinto et al., 2023), and, to some extent, understanding traditional life and leadership (Lichtenstein et al., 2006; Manzano et al., 2021; Olalere, 2015). In this context, system dynamics thinking within the cattle sector was a purposeful awareness of interconnected, interdependent systems with self-generated behaviours that drive the farm's small-scale farming setup. A complex adaptive thinking system was seen as an interconnected set of coherently organised elements to achieve a function of purpose (Meadows, 1989; Meadows & Randers, 2012; Neely, 2019). Sterman (2000) suggested that the development of complex systems thinking could replace a reductionist, narrow, short term, static view of the world with a holistic, broad, long-term, dynamic outlook and then redesign suitable policies accordingly.

The central concepts in dynamic system models are stocks, flows, and feedback loops. Stocks represent the accumulation of something, for example, the number of cattle (Neely, 2019; Sterman & Isenberg, 2000). Flows, or rates of change in variables, are used to change the levels of stocks. Feedback loops are circular causality where one component in the model initiates changes in another element, creating changes that result in various

outcomes (Lie & Rich, 2016). Feedback loops can either be positive, meaning that they are self-reinforcing, or negative, which means they are self-correcting (Sterman & Isenberg, 2000). The goal was to build a system dynamics model that represents, in this case, cattle business farming and its dynamic processes. The model can be qualitative, mental maps, or quantitative, enabling scenario testing through simulations (Sterman & Isenberg, 2000).

The systems thinking approach helped analyse and identify the real systemic challenges in the whole picture of livestock production among small-scale farmers in Zambia. With this approach, the common patterns of cattle business farming were recognised by illustrating the entire concept of impact factors and identifying systematic problems to be addressed (Franco & Nielsen, 2018; Mahara, 2020; Václavík et al., 2013b). Therefore, this research aims to develop a dynamic framework for a sustainable cattle business model for traditional or smallholder farmers in Zambia. It described holistically and dynamically the entrepreneurial lags in traditional cattle farming business systems among cattle farmers in Zambia using the systems thinking approach and some of its associated tools, such as feedback loops. This research study also attempted to show how these 'system tools' could be applied in researching relationships in cattle farming practices and developing sustainable farming business models, specifically referencing Namwala District in Zambia.

1.2 Statement of the Problem

It is widely recognised that the cattle farming business is a complex and dynamic business venture. Numerous studies have been conducted around the world to examine and determine why many smallholder farmers, particularly those in developing nations, have been unable to smoothly transition from their current low level of business to the progressive levels that have lifted many out of poverty (Busungu et al., 2019; Mumba et al., 2018; Nyamangara et al., 2019). . Studies conducted recently and in the past have indicated that climate change is causing desertification and threatening food and income security, especially in Zambia and the Southern Province (Hamududu & Ngoma, 2020; Peacock et al., 2023). Results show that the traditional cattle business system is continually underlined by low productivity, poor quality animal husbandry and management systems, inadequate response to market systems, poor adaptations to environmental changes over

time and socio-cultural factors that view animal husbandry as a source of prestige and safer store of value than money (World Bank,2011). These systemic problems are often associated with traditional cattle farming and has been reinforced by neo-liberal government policies leading to continued traditional-dependent and bound small scale cattle farming practices with low technology adoption and market capture, often resulting in poor business outcomes for the business owners. Studies show that the neoliberal policies have supported the elite few that have captured the market and has done little to uplift the living standards of the rural poor including the smallholder farmers which could be the reason why the processors remain flourishing, and the farmers remain downtrodden (Franco & Nielsen, 2018; Mahara, 2020; Imakando,2015). The current small scale cattle business approaches, mostly a legacy of the colonial governance and late 1980s and early 1990s, have not achieved the lofty goals of boosting the traditional cattle farming businesses. Studies show that smallholder farmers have continued surviving in poverty while sitting on abundant natural resources and market opportunities in Zambia (Imakando,2015). Some regions have failed to integrate livestock, and cattle in particular, into their daily business.

On the other hand, their business partners, such as input suppliers, beef and milk offtakers, and processors, have continued to break business barriers, in some cases declaring huge profits and dividends to their shareholders and the public. For instance, Zambeef, Termites, and More Beef, along with some agro dealers, have reportedly seen significant growth in their businesses. Livestock stakeholders work in a disjointed manner, which is expressed by a lack of the ability to effectively communicate with each other innovatively to create and develop shared value for their benefit and the industry at large (Imakando 2015). According to Mumba et al (2018), livestock farmers are operating in a complex and dynamic environment that is full of risks and uncertainties arising from social barriers, economic barriers, regulations, access to finance, and information. They are also at risk of using their managerial capacities to seize entrepreneurial business opportunities based on their geographical location and the financial problems they face. In contrast, the farmers with whom they do business, however, have reportedly remained dependent on state and donor financial and technical subsidies to expand their businesses and are now doing worse

than previously. Smallholder farmers are reportedly in more need of value addition and, to a greater extent, are losing a lot of money on cattle products, whereas commercial farmers and enterprises have been praised for their value addition and economic progress. There is a lack of market business enterprise that would also balance the needs of the farmers and also the needs of the private business enterprises so that a win- win situation is attained.

Recently, the Zambian government created and implemented the constituency development fund to encourage the transfer of power from the national to the local levels of government. The Citizen Economic Empowerment Commission has also been established, which claims that farmers, and small and medium-sized businesses should establish cooperatives to access the funding. However, the benefit is minimal. In contrast to the past, infrastructure has been carefully planned and put into place, including livestock service facilities, spray areas, dip tanks, and most importantly, free access to treatment for sicknesses with economic significance. The fact remains that many animals continue to die from diseases that are farmer and government managed yet experts, and policies and regulations are provided to guide how to manage and prevent them.

From literature scanned, little research has been done to develop a sustainable cattle business model that is farmer-centric and also supports the passing on of how-to best deal with risks and shocks from one generation to another. This creates an interest in knowing why these benefits are not filtering to traditional cattle farmers, who are important stakeholders in the livestock business system, as they are for farmers who use the same environmental policy. This raises questions about the effectiveness of the current business model being pursued by traditional cattle farmers in value creation and capture and its connectivity to the complex reality of Zambian traditional cattle farming. If a study to understand the Namwala smallholder farmers traditional cultural model and a systems-dynamic sustainable cattle business model were constructed, the problem faced above would not have persisted. This is evidenced by the stagnant growth of the livestock cattle population, which stands at about 5 million in Zambia, yet Namwala farmers are seemingly insulated in traditional cattle beliefs and practices in their daily management.

It is hypothesised that a study that aims to generate descriptive knowledge to develop an implementable and sustainable cattle business model based on systems dynamic approaches and Muehlhausen's business model (2013) could be a feasible way to offset the current complex problematic situation of traditional cattle business management in Zambia.

1.3 Research Objectives

1.3.1 Main Objective

This research study's primary objective was to develop a dynamic framework for a sustainable cattle business model for traditional cattle farmers in the Namwala District of Zambia and gain more in-depth insight into the determinant factors of the current traditional cattle business model.

1.3.2 Specific Objectives

To achieve the primary objective, this research study was guided by the following specific objectives to:

1. To describe the traditional cattle business practices used by traditional cattle farmers in the Namwala District of Zambia.
2. Identify factors affecting cattle production, in terms of cattle herd size among traditional cattle farmers in Namwala.
3. Determine factors affecting the profitability of the traditional cattle business system in Namwala District of Zambia.
4. Determine factors affecting sustainability of the traditional cattle business system in Namwala District of Zambia.
5. To create a dynamic, sustainable cattle business model and implementation framework for traditional cattle farmers in Zambia.

1.4 Specific Research Questions

To achieve the primary objectives, the following questions are put forth:

1. What traditional cattle business practices are used by traditional cattle farmers in Namwala District of Zambia?

2. What factors affect cattle production, in terms of cattle herd size among traditional cattle farmers in Namwala?
3. What are the factors affecting the profitability of the traditional cattle business system in Namwala District of Zambia?
4. What are the factors affecting sustainability of the traditional cattle business system in Namwala District of Zambia?
5. How can a dynamic cattle business model and implementation framework be developed to ensure business sustainability for traditional cattle farmers in Zambia?

1.5 Assumptions of the Research Study

The following assumptions relate to the general development of a systems dynamic framework for a sustainable cattle business model for smallholder livestock farmers in Zambia:

- The current traditional cattle farming practices among smallholder farmers in the Namwala District that impact the growth of the cattle business in Zambia have remained the same in the five-year period 2016 to 2020.
- The study assumes distinctive and descriptive cattle farming business patterns that have been inefficiently utilised based on monetisation, business offering and sustainability aspects by smallholder livestock farmers of Namwala District in the last five years.
- There was a likelihood that social, cultural, economic, education, and environmental factors also influence traditional cattle business practices among farmers in Namwala District.
- The study assumed that the systems dynamic model was the most realistic approach to developing an implementable and sustainable cattle business when dealing with complex and dynamic issues affecting the small-scale livestock sector.

1.6 Significance of the Research Study

The main driver of this research study was the continuous trend of systemic poor business offering, low productivity, and limited sustainability among most small-scale cattle business farmers. As such, the study provides unique baseline data on the development of

a sustainable cattle business model among smallholder farmers in Zambia. By assuming a system dynamics perspective to small scale cattle farming in Zambia, it was hoped that this would stimulate the need for livestock business experts and researchers to work towards the development of a dynamic and sustainable cattle business model that is cheaper, easy to manage and use by smallholder livestock farmers in Zambia. Thus, the largely insufficient and unsustainable cattle business models currently being used by different smallholder farmers have been consistently mentioned in the international and local research literature as the possible enablers of the continued poor growth of the small-scale livestock sector in Zambia can be addressed. Consequently, the traditional livestock industry's ability to offer an attractive market with high-value propositions, adequate monetisation and profitable sales performance leading to long term business sustainability could be deemed achievable within a newer and fresher system dynamics business framework.

Such a dynamic model based in systems thinking could help small scale cattle farmers to be modern entrepreneurs who would adopt and adapt to the ever-changing cattle business environment characterised using advanced technologies in livestock management practices, climate change issues, fluctuations in the supply and demand of cattle products and changes in population consumption patterns as Zambia moves towards a fully-fledged middle-income country. This was an objective that the government and cooperating partners have struggled to achieve over the years in Zambia (Arnold & Wade, 2015; Gerber, 2015; Todaro & Smith, 2015).

The findings of this research were presented to the Ministry of Livestock and Agriculture, from which it was recommended that the findings be reflected in the Second National Agricultural policy, and the Livestock and fisheries development policy. The study is also in line with the Seventh and Eighth National development and strategic plan for the Ministry of Commerce, Trade and Industry 2022 -2026, which all feed into the goals, and aspirations of Zambia vision 2030, which ultimately feed into the global sustainable development goals (Ministry of Finance and National Planning, 2022; Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022). The development of sustainable

cattle business model and the meat and dairy business enterprise under the private public partnership hinges on Economic Transformation and Job Creation, Human and Social Development, Environmental Sustainability, and Good Governance Environment which are key pillars of eighth national development plan as also enshrined into the livestock ad fisheries policy and strategic goals which ultimately is poverty reduction in a safe and secure environment without leaving any gender behind. This was anchored on economic diversification by making agriculture and livestock farming the centre of the national economic development through wealth creation, using the private sector players as the driver, to attain a prosperous middle-income Nation by 2030 (Hammond et al., 2017; Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022).

This research study was encouraged by increased local, regional, and international demand for livestock and products due to shifting consumption patterns linked to population growth, urbanisation and purchasing power (Papangelou et al., 2021; Qian et al., 2020). Small scale cattle farmers in Zambia could supply directly or indirectly to the growing local and regional consumer demand for livestock products in the Southern African Development Community (SADC) given the trade opportunities and benefits that exist between member countries (Ministry of Finance and National Planning, 2022; Odubote, 2019). Additionally, there is a fast-growing domestic market through local retail outlets such as Zambeef, Terminate meat supplies, Lactalis (Simuunza, 2022) and regional supermarket chains (Ziba & Phiri, 2017). Furthermore, Ziba and Phiri (2017) and Das Nair (2021) note that Zambia has seen a growth in international supermarkets, mostly through foreign direct investment (FDI) into shopping malls by companies mainly from South Africa. These supermarkets provided an opportunity to commercialise various livestock value chains and a platform for implementing food safety legislation and regulations which appears to be lacking in the country (Garrett et al., 2020; Mpundu et al., 2022). This was critical as it would help smallholder livestock farmers to expand the choices available to them and identify those choices where they could develop significant leverage in the domestic and global market system which has helped Botswana and Namibian farmers to develop and grow their cattle sector sustainably (Dizyee et al., 2017; Temoso et al., 2016).

This research contributes to current knowledge on small scale cattle productivity by unearthing and complementing previous research studies through the provision of evidence-based livestock farming systems. Systems upon which market players may have a solid foundation for the development and adoption of critical small farmer cattle business management strategies that are in line with global development goals of ending poverty through inclusive businesses. This research study helped identify and test a wider variety of possible sustainable actions and solution pathways in a real sense. In addition, it provides an in-depth understanding of perceptions and inadequacies found in the small livestock business sector as measured by qualitative and quantitative outcomes on systems thinking analyses. Further, this study reveals gaps in the organisation and coordination of the livestock (beef and dairy) sectors in the country, as it revealed that the ministry has no section charged with the responsibility of reinforcing standards and quality control. Further, the ministry suffers from ineffective public engagement and communication as it does not have a unit to disseminate critical daily research finding and other issues worth sharing with the public and other stakeholders.

More importantly, the need to take swifter action to attain the SDGs is more pressing than ever and calls for well-developed and implemented sustainable business models that are inclusive of all market players. It is now essential to find concerted and collaborative activities to realise the 2030 SDG Agenda, as there are only seven years until 2030, and adopting the proposed framework will help reach the goals. The need for this is growing increasingly urgent considering the shocks to the business systems that are delaying the world's progress toward the SDGs. Climate change, acting on outdated policies, uncoordinated and organised systems, the financial toll of COVID-19 and other pandemics, and disruption in the livestock business causing rising input prices (the "4 C's") are only a few of the recent shocks to the food systems in the many provinces of Zambia and Africa.

During the implementation of the Fifth National Development Plan, Sixth National Development Plan/Revised Sixth National Development Plan, and Seventh National Development Plan, progress was achieved toward achieving the socio-economic development goals of the Vision 2030 (Ministry of Finance and National Planning, 2022).

However, the country has not been able to realise the vision due to the progress made so far. Therefore, it is imperative to hasten growth during the Eighth National Development Plan (8NDP) period and beyond by the implementation of comprehensive reforms and interventions to build on the successes of the previous NDPs and address the development-impairing issues of cattle sector in Zambia.

1.7 Scope of this Research Study

This research study aimed at developing a system dynamic (SD) business model. This study had referred to a broad definition of livestock cattle market systems by Making Markets Work for the Poor (M4P) as a field that is composed of many market players involved in the demand and supply side of the market, coupled with supportive services. Therefore, this study was broadly defined by monetisation, best market offering for market attractiveness, unique value preposition, and sustainability. The eight distinct components of this study include:

- Market attractiveness: Picking the best market to sell the product to.
- Unique value proposition: Creating a unique product with powerful benefits that are highly differentiated and competitive in the marketplace.
- Profit model: Creating innovative ways to maximise revenues and profits from a differentiated offering.
- Sales performance model: Creating a proven and repeatable sales process to complement a strong offering.
- Ongoing competitive advantage: Creating a business model that keeps competitors at bay and profits high.
- Innovation factor: This area rates the business's ability to innovate versus the competition.
- Pitfall avoidance: This included overreliance on one customer, government regulations, lawsuits, or freaks of nature.
- Graceful exit: Far too many small businesses create an overly dependent model on the owner. These business models are difficult to maintain. Designing a business model that allows graceful exit is imperative.

As a constructivist paradigm, this research study helped establish and describe the nature of the current traditional cattle farming cultural and entrepreneurship practices among cattle farmers and other market players in the Namwala District of Zambia over a five-year duration. The five (5) year period starting from 2015 and ending in July 2020 was selected because it contained an amount of variability in cattle business productivity due to changes in rainfall pattern - two years of normal rains and three years of drought – making it a challenging life span for the cattle business sector.

Secondly, this research conducted an induction study to identify any distinctive cattle farming business patterns based on monetisation, business offering, and sustainability practices used by traditional cattle farmers in the Namwala district for the five-year period in conformity with the Business Model Institute's wheel framework (Muehlhausen, 2013).

Thirdly an attempt was sought to analyse thoroughly contextual interrelationships among different factors present within the traditional cattle business system in Namwala District of Zambia. This helped in understanding all market players how the livestock market is performing in the light of socio-cultural dynamics, individual farm typologies, herd dynamics, communal pasture usage, climate change issues, water availability, cattle disease prevalence, household factors, local and national market factors.

Using both qualitative and quantitative data from primary and secondary sources (Amrawaty et al., 2017; Birkel et al., 2019; Cho et al., 2021; Kabisa et al., 2019b; Lubungu, 2016; Mulenga et al., 2022; Mumba et al., 2018; Njei & Lubungu, 2022) the research employed the dynamic participatory research modelling that helped to establish a framework for a sustainable cattle business model by and for the market players and traditional cattle farmers in Zambia. Using a participatory group model building (GMB) technique was vital to jointly conceptualise and validate the model with stakeholders, which have been missing in the livestock value chain analysis for sustainability in the country (Gerber, 2015; Wilkerson et al., 2020).

1.8 Operational Definitions

The following operational definitions are used throughout this research study:

1.8.1 Traditional Cattle Farmers or Smallholder Cattle Farmers

Farmers owning and keeping cattle in conventional methods such as transhumance. The number of animals they own starts from one to above a thousand. They graze their animals on communal land. The two phrases are used interchangeably to mean the same (Mumba et al., 2018; Steinbach, 2019).

1.8.2 Commercial Cattle Farmers

Keep and own animals for commercial business purposes. Usually, intensive farming systems are practiced in established farms (Mumba et al., 2018; Sikamwaya & Guiyu, 2020).

1.8.3 Business Model

Defines the logic of how an organisation creates, delivers, and captures value in economic, social, cultural, or other contexts. It is a formula for making a profit in business (Muehlhausen, 2013).

1.8.4 Cattle Business Model

A formula (business model) profit formula for cattle farmers (Prescott, 2020).

1.8.5 Linear Business Model

A business model that creates value by selling products or services down the supply chain, whose value starts by controlling the supply chain (FourWeekMBA, 2020; Jamwal et al., 2021).

1.8.6 Sustainable Business Model

A business model that combines pro-active multi-stakeholder management, the creation of monetary and non-monetary value for a broad range of stakeholders and holds a long-term

perspective. A sustainable business model offers, creates and delivers value, monetises and sustains all market stakeholders in a win-win situation (Muehlhausen, 2013).

1.8.7 Development of a Business Model

Creating, constructing, or coming up with a business model from a business model canvas template (Teece, 2018).

1.8.8 Implementation Framework

The art of specifying the mechanisms of change. The framework is typically a checklist of factors relevant to various implementation aspects (Cerna, 2013; Dinesh et al., 2021).

1.8.9 Cattle

The term used to refer to domesticated bovine farm animals that are raised for their meat, milk, hides or draft purposes (Simuunza, 2022; Wen & Chen, 2023).

1.8.10 Monetisation

A process of cattle farmers turning their cattle assets into cash through sales to earn a sustainable profit. At the same time, other market players generally convert their assets into profit through sustainable sales performance (Muehlhausen, 2013).

1.8.11 Business Offer

Where a business aims at providing market attractiveness and a unique value proposition (Muehlhausen, 2013).

1.8.12 Systems Thinking

A set of synergistic analytic skills used to improve the capability to identify and understand systems, predict their behaviours, and devise modifications to them to produce desired effects. These skills work together as a system (Sterman & Isenberg, 2000).

1.8.13 System Dynamic (SD) Model

Helps map out the flows, processes, and relationships between market players or actors that operate within a livestock complex system (Lie & Rich, 2016). It is highly interdisciplinary and can test and study complex business ecosystems (Sterman et al., 2022; Sweeney & Sterman, 2000).

1.8.14 Model

A systematic description of an object or phenomenon that shares essential characteristics with the object or phenomenon (Feger & Mermet, 2020).

1.9 Organisation of this Research Study

This research report is organised in six chapters as follows:

- Chapter One – Introduction: Presents the background for analysis, the problem statement, research objectives, questions, justification scope of this research study and operational definitions.
- Chapter Two – Literature Review: Reviews the theoretical and empirical literature behind the systems thinking approach in cattle farming worldwide and Zambia in particular. The empirical review brings out relevant study findings from other researchers that help to explain the factors behind the problem.
- Chapter Three – Research Methodology: Outlines methods and procedures used to carry out this research study in line with the philosophy and the designed strategy.
- Chapter Four – Results: Presents the results of the research data collected and initial interpretation.
- Chapter Five – Discussion: Discusses the results in the light of existing literature, along with presenting the cattle business model and framework developed for implementation.
- Chapter Six – Conclusion and Recommendations: Concludes this research study findings and provides recommendations to build cattle business sustainability and for further research in the cattle business.

1.10 Chapter Summary

Chapter One presents the background to this research study and shows how the small-scale business sector has remained inefficient despite intensive government efforts. This chapter also introduces Muehlhauser's (2013) business model, which can be incorporated into systems dynamic thinking models to develop a sustainable business model for small scale cattle farmers. Finally, this chapter concludes by infusing Muehlhauser's business model into a conceptual framework for further analysis. The problem statement, research objectives, questions, justification scope of this research study and operational definitions are also provided, along with the organisation of this research study.

Chapter two provides the literature review, exploring the theoretical and empirical literature behind the systems thinking.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter provides a comprehensive overview of the cattle business sector in Zambia and the globe. The literature review critically examines previous research, identifies gaps in knowledge and practice, and highlights the contributions of this research study. It acknowledges limitations in earlier analyses and research. The chapter explores key theories related to cattle and livestock production and emphasizing the importance of a sustainable cattle business model framework. It synthesizes relevant theoretical and empirical literature on cattle business production, profitability, sustainability and measures to sustain the cattle business among the farmers. The literature starts by giving an overview of the livestock sector in Zambia, and cattle production specifically. After reviewing global, regional and local literature on production, profitability and sustainability of the cattle business, the chapter presents the gaps identified in the literature and the conclusion. The author systematically conducted a literature review encompassing peer-reviewed articles sourced from reputable databases, such as Scopus, Web of Science, Google Scholar, Science Direct, PubMed, Research Gate, Nature Springer, and further articles sourced from the Grey Database. Grey databases included international organization websites and government websites for reports such as the Ministry of Livestock and Fisheries annual reports (2016–2022), the 2018 livestock and fisheries census report, the 2022 livestock annual reports, and the Ministry of Finance report. The key search words included livestock, cattle businesses, smallholder farmers, monetization, business models, market systems, system dynamics, Namwala farmers, and sustainability.

2.1 Zambia Livestock and Cattle Farming Business

Zambia has a significant cattle population, accounting for 27.10% of the total cattle in Southern Africa (Statista, 2022; Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022). The cattle population in Zambia has experienced cumulative increases and decreases at various levels, from household to national levels, over the years (FAO, 2022c; Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022). As shown

in Figure 2.1, the introduction of commercial ranching during the colonial era contributed to the growth of cattle production in Zambia, particularly in the provinces of Southern, Lusaka, and Central (Moder & Zingel, 2022; Siankwilimba, 2019b). The cattle sector in Zambia has shown varying population trends but has generally seen a steady increase over time. Currently the cattle population to human population in Zambia stands at 1:4 or 1 to 4. This ratio means that 4 to 5 people share one animal in Zambia which when fully utilized would deplete the cattle population within the year. therefore, this puts the demand for cattle ever higher than supply.

The industry is focused on meeting the demands of domestic and international markets for meat and milk (Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022).

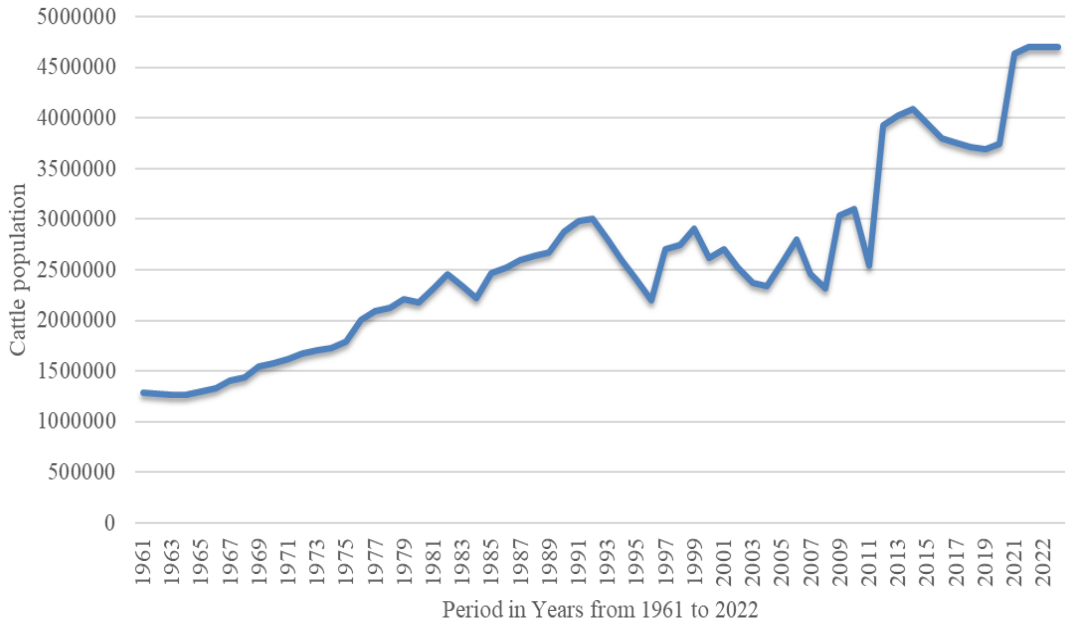


Figure 2.1 Cattle Growth and Development in Zambia: 1961 to 2022

(source data: FAO, 2022a; Kelio, 2022; Simuunza, 2022;Siankwilimba et al.,2024)

Livestock production has been increasing in many developing countries, including sub-Saharan Africa, Southeast Asia, and Central America, with growth rates ranging from 2.7% to 4.1% (FAO, 2023; Herrero & Thornton, 2013; Thornton, 2010). In Zambia, despite having suitable agro-ecological zones for livestock production, the cattle density is relatively low compared to neighbouring countries like Zimbabwe and Kenya (Ministry of

Finance and National Planning, 2022; Zambia Statistics Agency, 2022). The growth of the livestock sector in Zambia is influenced by various complex challenges that require a multifaceted approach (Baker et al., 2023; Enahoro et al., 2019; Mumba et al., 2017; Thornton, 2010). The sector operates within complex systems involving production systems, input supply markets, aggregation systems, transport business systems, processor market systems, and consumption market systems (Odubote, 2022b; Simuunza, 2022). The dynamics of the livestock and cattle sectors are influenced by factors at various levels, from provinces to households, and the interrelationship between commercial and smallholder farmers is crucial for the growth of the smallholder sector (Holden, 2020; Mumba et al., 2018; Odubote, 2022b; Simuunza, 2022).

According to the baseline report of the 2017/2018 livestock and aquaculture census, the livestock population in Zambia was estimated to be 9,520,087, with cattle accounting for 3,714,667 (39%), followed by goats at 3,583,696 (38%), pigs at 1,082,791 (11%) and sheep at 170,487 (2%) (Odubote, 2022b). This reflects an increase in the livestock population compared to previous years. For instance, in 2016, the estimated cattle population was 3,406,932, goats were 3,503,099, sheep were 151,146, and pigs were 1,029,419 (Simuunza, 2022; Zambia Statistics Agency, 2019). The distribution of livestock varies across different regions in Zambia. The Northern Circuit, which includes Luapula, Muchinga, the Northern Province, the Copperbelt, and the North-Western Province, accounts for only 9% of the total cattle population. In contrast, the majority (91%) of cattle are found in relatively drier and moderate rainfall regions, such as the Southern, Western, Central, Lusaka, and Eastern Provinces. According to the 2022 annual livestock survey report, Southern Province has the highest cattle population, with 1,624,961 (35.4%), followed by Eastern Province with 604,308 (16.2%), Central Province with 551,488 (22.3%), and the Western Province with 450,949 (12.1%) (Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022).

The livestock industry in Zambia faces challenges which hinder progress. External shocks such as economic downturns, diseases and natural disasters can disrupt operations and have a particularly negative impact on cattle business systems (Siankwilimba et al.,2024). These challenges contribute to risks of food insecurity, hunger, malnutrition, livelihood

disruptions, increased poverty, and limited opportunities for marginalised populations (Fan et al., 2021; Munguzwe & Miyanda, 2020). The regulatory structure in Zambia has been criticised as burdensome, leading to high costs of doing business in the cattle industry (Anderson et al., 2021; MCTI, 2022). The livestock industry in Zambia has not yet reached its full capacity and offers opportunities for market participants. However, these opportunities are often missed due to the exclusion of certain players from participating in the market (Lubungu, 2016; Siankwilimba et al., 2023a). Nevertheless, as stated in section 2.1, subsequent to the livestock and fisheries report of 2022 and the livestock and fisheries census of 2017/2018, an upward trend in cattle growth has been documented. This can be statistically attributed to the utilization of verified data obtained from the national census reports.

2.2 The Traditional Cattle Business Practices Among Farmers

Smallholder cattle farmers in Zambia primarily offer traditional, locally sourced beef and dairy products to the domestic market. Their value proposition lies in providing affordable and locally produced meat and milk, which aligns with the preferences of most consumers in Zambia. However, there is limited differentiation and value-added offerings in terms of product quality, breed selection, or organic production methods, which could limit their ability to capture higher-value market segments (Sanwal, 2015; Vezzoni, 2023). Livestock herders play a crucial role in managing cattle and ensuring their well-being. They provide security, healthcare services, and make decisions regarding grazing locations, water sources, and nutrition. However, challenges such as conflicts over grazing land, climate change impacts, water scarcity, and theft have been observed in some African countries. The influence of herders on the livestock population through animal husbandry and healthcare systems has been documented in studies by Fuller et al. (2014)and Mohamed (2020).

Commercial farmers have been able to commercialise cattle rearing, especially in central areas of the country where the carrying capacity of vegetation is limited during dry seasons (Siankwilimba et al.2024). These farmers have larger grazing spaces, around 15-20 km^2 per head of cattle, ensuring year-round feed security and preventing overgrazing, as has

been shown in Namibia, Botswana and Zambia (Aschenborn et al., 2022). In some cases, commercial farming has evolved into game farming or mixed systems, as it allows for higher populations of wild ruminant species that are better adapted to the local vegetation (Aschenborn et al., 2022).

Compared to traditional farmers, commercial farmers benefit from well-structured and attractive cattle markets that stimulates continuous investment and reinvestment of saved resources into their businesses (Magande, 2019; Munkombwe et al., 2022) . They have access to value addition opportunities, affordable finance and credit, and engage in timed selling and buying of animals (Katunga et al., 2021; Madugu, 2022; Ngwira et al., 2012). Livestock auctions play a crucial role in livestock marketing, particularly among commercial farmers (Esther, 2021; Magande, 2019). Cattle auctions provide a fair platform for farmers to sell their animals and receive competitive prices (Mastaphu, 2021). These auction events are open to all participants, and buyers and sellers engage in public bidding to determine the prices. Given these market incentives, most commercial farmers operate on forward contracts for their beef, milk, and many other livestock and livestock products and services, which makes them risk-takers and mitigators in their businesses. Despite the numerous disasters that smallholder farmers have experienced, research by Munkombwe et al. (2022) and Ng'ombe et al. (2023) has revealed that they hardly ever make the investment to purchase insurance coverage to protect their operations from human and natural losses. Additional investigation reveals that the uptake of investments by those who do make them is low, which effects the kind of disaster that is most likely to occur and the need for insurance coverage. It was also shown that the conceptual framework and theory in use show strong prediction powers for classifying insurance uptake. As an intriguing option for modeling earthquake insurance and other classification challenges, Ngombe et al. (2023) claimed that random forests demonstrated greater precision and robustness. As such, it is noteworthy that it underscores the significance of insurance as a tool for managing environmental risks and the need for education and awareness regarding earthquake insurance, in addition to the application of supervised machine learning algorithms for classification issues.

Nkadimeng et al.'s (2022) study aimed at assessing the current beef cattle farming practices and limiting factors for improved beef production in South African smallholder farmers. A questionnaire was administered to 460 individual smallholder farmers purposively selected from seven provinces. The questionnaire captured information on demographics and farm profiles, constraints on production, marketing, ecological and reproduction management. Frequency procedure and logistic regression were used for data analysis. Farmers' constraints included extreme weather events, disease outbreaks, lack of access to information on farm management, supply of cattle nutrition and fair market pricing. The majority (93%) of farmers had no knowledge on body condition scoring (BCS) prior breeding and recorded inter-calving periods of two years (77%). The regression model revealed that lack of information and understanding of farm business, and information communicated by government were among the dominating factors associated with the constraints.

Lubungu et al. (2016) explained that farmers often perceive cattle to be a safer store of value than money and only convert to cash when pressing needs arise. Multiple ownership of cattle within extended families contributes to the seasonal supply and price fluctuations, as multiple people must agree to a sale that supports only specific needs. The majority of farmers have limited number of marketable surplus due to small herd sizes and farmers often sell old oxen, which tends to limit commercialisation, as there are only a limited number of animals available within a herd that can be sold in a given year. Disease outbreaks and regional quarantines affect investment in cattle markets as limited number of cattle are sold through formalised channels. Lack of quality and price variations within the standard beef sector leads to substantial underinvestment in herd management and limits commercialisation. In addition, too many marketing charges coupled with a lack of marketing centres increase the transaction costs (Lubungu et al., 2016). Research shows that that the smallholder cattle farmers in Zambia lack value addition to their cattle (Mumba et al.,2018). In the southern province and Namwala district in particular, farmers rarely feed their animals in readiness for the market, which makes them fetch low and poor prices. This appears to strengthen the correlation between cattle business innovations,

entrepreneurship, regional cattle population patterns, and ethnic composition in the country's productivity and production.

2.3 Factors Affecting Cattle Production Among Traditional Cattle Farmers

Yaemkong et al. (2018) analysed the problem and obstacle of beef cattle production based on the factors of age of farmers, educational background, and farm size. The study used purposive sampling, in which 120 farmers in Phitsanulok Province, Thailand, participated in the study. The considering factors were statistically tested. Least square means were calculated and used to compare the studied traits. The results revealed that age and educational background of farmers did not have a statistical effect on the problem and obstacle in breed and breeding, feed and feeding, disease and disease prevention, marketing, and knowledge and technology of beef cattle production ($P>0.05$). On the other hand, farm size did have an effect. Disease and disease prevention, and marketing of beef cattle production were varied across the farm size ($P<0.05$). However, considering the farm sizes, it was found that the medium and large farms had different ($P<0.05$) problems and obstacles in disease and disease prevention and marketing of beef cattle production from the small farms, but no difference between medium and large farms.

Cattle production faces many problems, firstly, attention has not been paid in beef cattle breeding. A study by Yaemkong et al. (2018) found that 32.5% of beef cattle is purebred and the remainder is crossbred (67.5%) and focused on native cattle and crossbred native cattle (Yaemkong et al., 2018). Moreover, artificial insemination from good sire for dam supported by the government was not sufficient for the farmers. This led to the problem of the lack of good sire and dam to improve the quality and quantity of beef cattle production. Secondly, the limitation of roughage and amount of animal feed were problematic. Water shortage for growing roughage as well as farmers' lack of knowledge to store animal feed for dry seasons, it become one of the biggest constraints for the development of beef cattle. The higher mortality rate of beef cattle caused by diseases, especially in small size farms indicated that animals were not kept in good condition (Kankaew et al., 2012; Khemsawat et al., 2014). According to the Imakando (2015) study, feedlot commercial farmers buy the

same crossbreeds from smallholder farmers, fatten for 90 days, and offload to the market as choice beef, which is based on nutrition and management rather than breed types.

Groher et al. (2020) indicated that differences in livestock production have their roots in geographic and climactic factors. The interaction between ecology and livestock introduces a distinct set of animal environments which are considered climatic stress, feed, water supply and disease hazard. Groher et al. (2020) showed that different breeds vary considerably in their ability to withstand reduced water intake or the intake of water at different intervals. The general finding is that Bos taurus need more water than Bos indicus cattle breed types under the same environmental conditions. From the comparison of Afrikander and exotic beef cattle in Tanzania, a study by Kipserem et al. (2011) found that the former lost 1.5% of their body weight if left 24 hours without water and suffered no loss in appetite, while exotic animals suffered 15% loss in live weight and 24% decline in food intake. Water intake was increased by the presence of salt in water and showed a difference between Brahman and Hereford cattle. Live weight gain significantly increased when drinking water was cooled from 31.2 degrees to 18.3 degrees and Kipserem et al. (2011) found that livestock drink less of the cooled water than those given warm water.

Busisiwe et al.'s (2019) study focused on determining socioeconomic factors that affected livestock numbers among smallholder cattle and sheep farmers in the Free State Province of South Africa. The research was qualitative and quantitative in nature. Proportionate random sampling method was used to collect data. A questionnaire was administered to 250 smallholder cattle and sheep farmers. Descriptive statistics results indicated that lack of camp systems, drought prevalence, increased feed costs, poor veterinary interventions, insufficient breeding stock, high cost of fuel and transportation, lack of equipment, diseases, stock theft and pilfering, and insufficient grazing land were the prevalent factors that affected cattle and sheep farming in the province. The regression results indicated that the variables that significantly affected livestock numbers were district, household size, livestock numbers in 2008, planted pastures, grazing land condition, grazing land acquisition, service, advice/training, veterinary services, purchase of dosing products and sales per year.

According to a study by Ramsey et al. (2005) the variables affecting the performance measures in cattle business were: herd size, pounds of feed fed; real estate, machinery, and breeding-stock investments; calving percentage; death loss; and breeding-season length. Management variables were especially important for financial costs and profitability of the cow-herd operation. Ekowati et al.'s (2018) study aimed at analysing the on-farm agribusiness subsystem approach at farm household level to analyse beef cattle production influencing factors and economic efficiency of beef cattle farming. The study had a small sample of 80 farmers. Data were analysed descriptively for on farm sub-system agribusiness approach, multiple linear regression and economic efficiency. The research result showed that the on-farm agribusiness subsystem was on moderate to good condition, the influencing factors of production were breed, forage, concentrate, health, reproduction, labor, year of farming and agribusiness implementation.

Beef cattle production, marketing and value addition issues are yet not well addressed through scientific approaches (Halala et al., 2020). Halala et al. (2020) study was conducted in Maraka and Essara districts in Dawuro Zone, Southern Ethiopia, aimed at analysing factors that determine beef cattle production and value addition. Factors determining access to veterinary services were years of experience in beef cattle production, age of household head, family size and land size. Factors affecting access to feed and feed sources were sex of the household heads, land size, market information and income from other sources.

In recent years, Botswana, along with Namibia, has made significant strides in establishing competitive livestock value chains, according to Syed et al. (2023) and the World Bank (2023). These industries demonstrate compliance with premium market quality and sanitary standards and have effective animal identification and traceability systems. However, challenges such as climate shocks, disease outbreaks, and weaknesses in health systems have hindered productivity. The state's high level of direct involvement and the limited flow of private capital in critical areas of the value chain contribute to a constrained business environment. Overall, while Botswana's cattle industry benefits from export opportunities and government interventions, addressing challenges related to market

access, disease control, and private sector participation is crucial for the sector's sustained growth and resilience.

2.4 Factors Affecting the Profitability of the Traditional Cattle Business System

Kalangia et al. (2016) determined the factors affecting profit of beef cattle farming in East Java, Indonesia and to quantify the profit gained by farmers in lowland and upland areas. Respondents consisting of 89 beef cattle farmers raising Ankole crossbreed were questioned using structural questionnaires. Data were analysed by a Unit Output Price Cobb-Douglas Profit Function (UOP-CDPF) model and estimation was conducted by using an Ordinary Least Square (OLS) method. Average profit gained by farmers in the upland area was higher than that gained by farmers in the lowland area. In order to improve profit of beef cattle farming business, the use of AI, calving rate per cow, number of cattle ownerships, and cattle selling price needed to be increased and animal health examination by animal paramedics needed to be done.

Studies in beef cattle farming showed that feed shares the highest cost component and can affect profit (Funston et al., 2016; Jobirov et al., 2022; Maulu et al., 2022; Tran et al., 2022). Meanwhile, for beef cattle farmers in rural areas, forages and agricultural wastes as animal feed are easily obtained without the need to spend any cash cost. However, farmers still need to pay for feed procurement cost, especially during the dry season. They also need to cover the costs of artificial insemination (AI), drugs and vitamins, and animal housing and equipment.

The livestock breeding is important for the sustainability of human beings. Economic efficiency in production is one of the important factors for the sustainability of livestock farming. A study by Yüzbaşioğlu (2022) determined the factors that affect the economic production values of livestock. A questionnaire was administered to 150 livestock breeders, whose average age was 42 years, had 20 years of experience in farming and had 10 years of education. Average variable cost was calculated as $498.04, gross production value was $1,008.18 and gross margin per livestock animal in a production period was $510.14. The economic values affecting the production value in beef cattle were determined by a

multivariate regression model. The results of the model showed that the production value was affected by the availability of forage crop incentive, live weight increase and number of animals on a farm.

Owning beef cattle is an important survival mechanism for smallholder farmers to alleviate poverty. Therefore, beef cattle farming enterprises should strive to maximise profit to excel and flourish in a free economy. Nevertheless, smallholder beef cattle farmers are known for making little profit (Jobirov et al., 2022). Jobirov and his collegues evaluated the profitability of beef cattle farming and its determinants to enhance profit maximisation among smallholder beef cattle farmers in the Baljovan District of Khatlon region, Tajikistan. A total of 388 farming households were chosen at random and purposive for the study. The beef cattle farmers had an average of 18.23 cattle herd size with 8.54 years of farming experience. Most of the farmers (89.7%) had access to accurate market information. Such market information enabled 75.8% of farmers to sell their beef cattle to the open market (profitable) outlets rather than middlemen. About 89.4% had access to veterinary services. Additionally, about 82.7% of farmers acknowledged the availability of pasture for grazing, which motivated 87.6% of farmers to be involved in selling contracts. Economic analysis of the results revealed that on average, farmers had a gross margin (GM-profit) of $353.77 per cattle, with feed costs (58.6%) and medications costs (26.1%) accounting for the largest share of total variable costs. Meanwhile, the profitability of beef cattle farming among farmers was significantly influenced by education level, family size, farming experience, pasture availability, land size owned, selling contract, feed costs, medications expenses, access to credits, and sales costs ($P < 0.05$).

A study by Tahir et al. (2010) showed that the actual profit in cattle business was not only affected by prices of production inputs, but also by management and socioeconomic factors including age, education, experience, and capital. Shambel (2017) assessed the effect of climate change on livestock production. Among the factor's affecting cattle production was heat stress. Milk yield decline by 0.2kg per unit increase in thermal humidity index (THI) when it exceeded 72. The increase in milk yield increase sensitivity of animals to thermal stress and decline the threshold temperature at which milk losses occur. The mid lactating

dairy cows were the most heat sensitive compared to their early and late lactating counterparts. In addition, mid lactating dairy cows showed a higher decline in milk production (-38%) when the animals were exposed to heat. Animals can adapt the hot environment; however, the response mechanism are helpful for survival but are detrimental to productive and reproductive performances. Heat stress due to high ambient temperature accompanied with excess humidity cause infertility in most of the farm species and adverse effect on reproductive performance of farm animals (Shambel, 2017). Climate change has a direct impact on the growth of palatable grass species and the regeneration of fodder species in pasture and forest fodder is decreasing because of less rainfall leading to a shortage in diversity and quality of livestock fodder. The drought also affected livestock by drying wetlands, pastureland, water resources, streams and decreasing availability of drinking water for livestock. Temperature increase led to outbreak of new borne diseases.

Mahabile et al. (2002) compared herd productivity, levels of investment and socio-economic characteristics of communal and private livestock farmers sampled in the southern region of Botswana during 1999/2000. The objective was to determine whether land tenure and other socio-economic variables might contribute to differences in investment and herd productivity. Descriptive statistics show that levels of investment and herd productivity are higher on private farms than on open-access communal grazing. Private farmers are also better educated, more liquid, and have larger herd sizes, but do not differ from their communal counterparts in terms of age, gender, race or household size. Levels of investment in fixed improvements and operating inputs are negatively correlated with herd mortality, and positively correlated with calving and off-take rates, and with liquidity and private ownership of land.

Harahap and Supriana's (2021) study aimed at obtaining empirical evidence on the effect of simultaneous and partial variable feeder cattle, livestock feed costs, cage depreciation costs, medicine and vitamin costs, and labour costs on beef cattle farming. This research was conducted with 73 respondents. The data analysis used a Multiple Linear Regression method to test the hypothesis simultaneously and partially using the F test and t test. The results showed that the variable of feeder cattle, livestock feed costs, cage depreciation

costs, medicine and vitamin costs and labour costs simultaneously affect the income of beef cattle farming. Feeder cattle, livestock feed costs and cage depreciation costs showed a positive and significant effect on the beef cattle farming. The study concluded that the cost of feeding livestock, the cost of animal feed, and the depreciation of pens are factors that have a significant effect on the income of beef cattle farming. It's extremely important to understand the cost structure of a cattle farming business. Understanding the cost structure of cattle farming involves analysing expenses related to production, operations, marketing, and administration. A sustainable and profitable sector requires careful cost management and monetisation of smallholder farming systems. According to Imakando (2015) and Simuunza, various elements impact the profitability of cattle businesses in Zambia. These elements comprise tax regimes such as bank charges, transport expenses, input costs, and sales taxes, as well as the entrepreneurial prowess of individual farmers (2022).

2.5 Sustainability of the Traditional Cattle Business System

Developing sustainable business models involves addressing underlying sustainability systemic challenges and considering the impacts of business activities on the environment, society, and future generations (Bocken et al., 2014; Castro et al., 2019; Giller et al., 2021). It is essential to tap into the available financial resources and mobilise collaborative stakeholders to achieve sustainable development goals (World Economic Forum, 2023). Cattle farming can play a role in environmental deterioration, but regenerative agricultural practices can help restore soil health, promote biodiversity, and sequester carbon. Practices such as rotational grazing, agroforestry, agricultural diversification, and cover cropping enhance ecosystem resilience and reduce greenhouse gas emissions (Morris, 2017; Savory et al., 2019). Holistic Planned Grazing, a component of regenerative agriculture, incorporates ecological restoration and land regeneration by managing livestock, crops, wildlife and forests.

Sustainable cattle farming businesses can increase profitability and mitigate risks by exploring value-added product options and engaging in agricultural diversification. Diversifying product offerings, such as organic meat, dairy products, leather, or fertilizer,

and targeting niche markets can create additional revenue streams and enhance the sustainability of a business (Bidwell & Murray, 2019). Agricultural diversification not only increases profits but also reduces risks associated with pests, diseases and weather variability (Mazzocchi et al., 2020; Wezel et al., 2020).

A sustainable livestock and cattle business system is directly linked to food security, income security, and nutrition security (Goryńska-Goldmann et al., 2021; Meier et al., 2022). The interconnectedness of various players in the cattle industry, including farmers, ranchers, processors, distributors, retailers, and consumers, is vital for the functioning and sustainability of the market (International Monetary Fund, 2022; Setianto et al., 2019). Collaboration between players is crucial to overcome industry-specific challenges (Giller et al., 2021; Susanty et al., 2021). The government, private sector, donors, NGOs, and farmer representative bodies also play essential roles in establishing rules, enforcing regulations, and facilitating sustainable development (International Monetary Fund, 2022; Setianto et al., 2019).

The sustainable development of the cattle and livestock sector requires a comprehensive consideration of economic, social, environmental and cultural aspects. To ensure long-term viability, it is important to adopt innovative practices and technologies, foster collaboration through social networks, establish well-functioning market systems, and implement sustainable land and water management practices (Schneider et al., 2023; Simuunza, 2022). Supporting smallholder farmers by providing access to finance, infrastructure and extension services is also crucial (Dieng et al., 2021). Additionally, when selecting cattle breeds and types, it is important to consider cultural norms, consumer preferences, and environmental standards (Mwanyumba et al., 2015; Peel, 2021).

To ensure the sustainability and inclusivity of the dairy sector, mitigation strategies are needed, such as improving animal health, enhancing feed digestibility, implementing effective manure storage and treatment, optimising fertilizer usage, and exploring the use of methane-inhibiting feed additives (AGRILINKS, 2023). These measures can contribute to a more sustainable and resilient dairy production system. Cattle breeds and types

contribute to the availability, affordability, and accessibility of the market, playing a vital role in sustainable business development (Milla et al., 2018; Ziestman, 2014). Factors such as cattle type, breed, category, market access, and price, as well as access to finance, insurance, research and development, nutrition ,infrastructure and transport influences monetisation in the livestock sector (Rosenbaum & Pearl, 2022). Rosenbaum and Pearl (2022) argued that in any business, business profile, financial profile, and market profile are critical factors to sustain the cattle business. These three variables (market, business and financials) are important in achieving business comparables for investment. Optimising water use, minimising feed loss and implementing energy-efficient practices in cattle farming can improve resource efficiency and lead to cost savings. These practices align with the principles of circular economy, which aims to reduce waste and promote the sustainable use of resources (Siankwilimba et al., 2022; Wohner et al., 2019).

The sustainability and development of the cattle and livestock sector require a multidimensional approach that considers economic, social, environmental, and cultural aspects (Pinto et al., 2023; Thornton & Gerber, 2010). Key factors include the adoption of innovative practices and technologies through research and development (Herrero & Thornton, 2013; Kalapula & Mweemba, 2018a) and the role of social networks in fostering collaboration and resource mobilisation (Yoshida & Yagi, 2021). Nigatu (2016) explored factors that are responsible for the drawbacks of the livestock sectors. The study had 364 sample farm households, data were analysed by using regression and descriptive statistics. The regression result showed that quantity of milk production depends on the amount of livestock's feed, adequate water the cattle daily take-in, the distance the cattle daily travel in search of feed and water, land size the farmer holds, and regular medication service for cattle. It was also found that daily water intake (adequate liter), land size the farmer holds, and extension service are factors which make variation in the quantity of meat-production. Cattle farmers in the Namwala district have historically and presently employed the transhumance herding mode of operation. Chaabila (2012) and Mumba et al. (2018) demonstrate that climate change variability has affected the density and quality of water and pasture, despite the fact that this system has historically supported the development and expansion of cattle. In numerous aspects of livestock administration, the expansion of

the herd is impacted by the recurrent droughts that the province and Namwala district endure.

2.6 Measures for Sustainable Cattle Business Production

Pricing policies for livestock meat can have distributed benefits which accrue in the urban and growing industrial sectors (Groher et al., 2020). Furthermore, producers who would invest to commercialise livestock production have less incentive to do so. The government's efforts to establish effective pricing policies have not been successful because they do not account for the environment in which producers make their marketing decisions. Livestock are held for various reasons by the producers such as a convenient repository of wealth yet the call to enterprising the farmers with new business information remains challenge too. This value is greater in many respects than the commercial market value, one that in most cases is an administered price by the government (Maina et al., 2020; Pandey & Upadhyay, 2022; Robinson et al., 2022). Increasing marketing efficiency provides additional incentives for expanded livestock production. However, saturation of milk in the local market can be a disincentive to the livestock farmers.

However, research indicates that livestock sector enterprises in countries such as Brazil, Ethiopia, Colombia, Turkey, the European Union, and others in the Middle East that have used sustainable system dynamic frameworks have greatly improved entrepreneurial skills for small-scale livestock farmers, leading to improved livelihoods through the adoption of innovations (Alexandratos & Bruinsma, 2012; Asres et al., 2012; Dizyee et al., 2018). It appears that the development of the agricultural livestock sector differs from one country to another depending on the business model each country employs.

Kelio's (2022) study found that 56% of the farmers in some counties showed greater effort in seeking out livestock farming related information from sources other than their counterpart farmers. These farmers' quest for extensive information on dairy farming was also highlighted by their expansive peer to peer networks.

According to World Bank (2011a) and Daka (2002), the feed resource base is not fully utilised and this is manifested by low livestock productivity. The quality and production

levels of animal products depend largely on the quality and quantity of feed, which is fed to the livestock. Among the constraints limiting livestock productivity in Zambia, insufficient and low quality of veld grass, particularly during the long dry season (March-November) is responsible for low production levels and poor reproductive performance in ruminants (Nigatu, 2016). The problem of inadequate veld grass can be overcome by feeding crop residues which are in abundance during the dry season. Zambia produces large quantities of sugarcane tops, bagasse and straws from maize, sorghum, wheat, millet and rice. These could sustain livestock productivity if supplemented with protein sources or treated with urea. Despite the production of large quantities of crop residues, these are wasted by burning or are destroyed by termites. There is a need, therefore, to develop feeding systems based on crop residues which are compatible with the farming systems in Zambia and to promote such feeding systems. To improve the production in the livestock sector (in this study area), there's need for community of individual feedlots, and farm households should make bedding, room, feed, and sanitation facilities for their livestock. Government should also take part in providing improved breed, artificial insemination service, extension service, professional experts, farmer training center, and animal health service to promote the sector (Nigatu, 2016). In Zambia, the government has so far failed, and more innovative solutions are needed. For example, there is need focus on private sector incentives in the sustainable business model.

Proper nutrition and health can increase reproduction efficiency by up to 25% (Goedde et al., 2020). Improved reproduction management means improving farm outputs and attraction of marketing channels that lead to maximisation of farm profits. Jobirov et al. (2022) recommended that the government should develop additional measures for addressing concerns such as capacity building, suitable and freely available pasture as well as health management, to boost beef cattle profitability among farmers in Tajikistan. Yüzbaşioğlu's (2022) study findings revealed that new policies should be developed to reduce feed prices or to provide animal purchase support. In an empirical study, Busisiwe et al. (2019) recommended that extension and veterinary services should be strengthened. In addition, it was recommended that smallholder livestock farmers should be encouraged to plant pastures to reduce pressure on the natural veld and make forage available

throughout the year. The government should provide subsidies with distribution policies that will ensure that all smallholder livestock farmers can benefit.

2.7.0. The contextual interrelationships among different factors present within the traditional cattle business system in the Namwala District of Zambia.

Lack of information and local market imperfections are the major challenges that lock the poor into activities that lead to low returns, prevent them from responding to price signals, and efficiently allocating their limited resources (Pica-Ciamarra, 2005). This has also been observed in countries that appear to be in a relatively better position to maximize their resources (de Janvry and Sadoulet, 2005). Therefore, traditional cattle farmers require access to the basics, including adequate and secure inputs such as production land, feed, water for their animals and mechanisms for better risks coping to price changes and natural disasters (Pica-Ciamarra, 2005). However, cattle marketing systems, particularly for traditional farmers, are usually complex and vulnerable to changes due to many factors.

Griffith and Osorio (2008) identify several contextual factors, including institutional, infrastructure, rules and natural resources, as the main drivers of market systems. These factors have critical interrelationships among themselves, affecting their interactions with the market. Achieving a broad impact in market systems requires collaborations among different actors along the cattle value chain (Mathias et al., 2010; Spilsbury et al., 2017). On the other hand, the cattle business is subject to complex relations with other factors that could be social, economic, and environmental. Hence, shifting the marketing philosophy from a production orientation to a market orientation requires a new level of knowledge regarding existing markets and customer availability. This includes the ability to understand, predict, and satisfy your customers' wants and needs while ensuring the production techniques are sustainable. In most developing countries, commercial-scale cattle farmers can handle complex issues related to the selling of their products. However, small-scale farmers lack access to quality inputs and advice and lack effective connections with buyers and potential buyers, making them less competitive and viable players in the market (Griffith and Osorio, 2008).

The competitiveness of the livestock sector at both local and international scale requires consented efforts in identifying areas requiring development and improvements inefficient

marketing of products and distribution chain. In the Namwala district of southern Zambia, the cattle business reportedly faces many challenges related to animal production input and output that affect the entire value chain (Kalapula et al., 2014). These challenges include main access to quality production inputs, animal care services and markets. Addressing these challenges requires the identification of bottlenecks in market systems faced by the cattle farmers and exploring possible solutions to reduce their production costs which can increase their profits. Furthermore, establishing a marketing system that is not only efficient but also sustainable will benefit both the producers and the consumers through the information availability on many aspects such as prices, product availability, and customer availability. Therefore, this chapter explores contextual interrelationships existing among different factors present within the traditional cattle business system in the Namwala District of Zambia.

2.7.1 Impact of international marketing on Namwala cattle business and marketing

Trade is an important economic characteristic of the livestock sector. Due to the high demand for local livestock products consumption, international trade is relatively low in most developing countries (Herrero et al., 2013). However, a steady increase in international trade has been observed in regions with trade liberalization, poor competitiveness and low technological changes (FAO, 2009). Studies show that dairy is among the most traded livestock products globally, while meat products are only demanded in a few countries (FAO, 2009). Generally, though, most livestock products in developing countries are still locally traded, and this is driven mainly by increased local connectivity, improvements in the value chain, and the increasing demand for local products. Aklilu (2008) argued that cattle farmers could participate and compete in international markets provided they acquire and practice knowledge-based market strategies besides availing the required product on time. The author further noted that this could not be achieved without an appropriate policy framework that creates a favourable environment for different actors along the value chain. However, consistency in meeting the required standards for exporting is key (Schroeder et al., 2021). According to Schroeder et al. (2021), access to international markets requires meeting certain criteria, such as the ability to meet the consumer's demand, risks reduction, improved management of the supply chain, and

reduction in price variance. Unfortunately, most traditional farmers cannot meet these requirements, which are a major hindrance to their access to international markets.

Zambia holds huge potential for exporting cattle products to neighbouring countries such as Angola and the Democratic Republic of Congo (DRC) as major potential export markets (Sinha, 2010). However, the country has not taken advantage of this opportunity, probably because of the huge local demand for cattle products (Lubungu et al., 2016). Therefore, the trade of livestock and livestock products is mainly for meeting local demand (Mamo, 2019). On the other hand, Zambia has a high potential to increase its cattle production to meet local demand and enable exports to neighbouring countries (Mamo, 2019). However, low investments in improved milk production and marketing are reportedly the major challenge leading to poor dairy processing, limited cold chain facilities, and limited access to local and foreign markets by traditional cattle farmers (Muwowo and Hamusimbi, 2020). For example, it is estimated that out of 253,000,000 Litres of annual raw smallholder milk produced in the country, only 75,900,000 Litres is processed and marketed via a formal market channel which indicates that 30% of the milk is lost due to a lack of cold chain facilities (Muwowo and Habasimbi, 2020). Hence, Zambia imports milk in powdered form from other countries, such as South Africa. Despite the limited quantities, beef and live animals for slaughtering are reportedly imported to neighbouring countries, mainly in the borders of DRC and Tanzania (Mamo, 2019). For example, it is reported that 2,027,851 Kg and 3,419,167 Kg of beef were exported in 2018 and 2019, respectively, through Zambeef to DRC through the Kasumbalesa border (Mamo, 2019).

2.7.2. Government interventions

Livestock represents an important component of assets owned by rural communities in most developing countries (Herrero et al., 2013). Interventions by governments in the production and marketing of livestock products in most countries have played a key role in improving or hindering the Livestock sector. From a farmer and trader's perspective, government interventions can be positive and negative. The government's interventions may include land allocation, policy formulation, taxes introduction or removal, subsidies, funding, extension services, and market price control in the livestock sector. Governments need to deliberately intervene in land systems to ensure allocation is pro-poor responsive

(Pica-Ciamarra, 2005). This is because the poorest resource farmers in communities cannot buy land that can support cattle farming. Hence, as Carter and Salgado (2001) observed, wealthy farmers are more likely to acquire huge land while poor ones become the net sellers. This is exacerbated by the failure by policymakers to give adequate recognition of customary tenure, which is often the major cause of conflicts between cattle farmers and settled farmers in most developing countries (Pica-Ciamarra, 2005). Most governments still observe laws that originated from colonial dominations regarding land allocation and ownership. In Ethiopia, for instance, the land is under the ownership of the state, entailing that it cannot be sold or mortgaged, indicating that credit markets have a potential negative consequence; In Kenya, the state has titled most land except the grazing areas leading to increased competition and conflicts between the cattle farmers and expanding farmers; in Sudan, the land is owned by the state but leases it to farmers and entrepreneurs, entailing that long-term investors have limited incentives; while in Uganda, the majority farmers are not given the titled land (Pica-Ciamarra, 2005). Therefore, Therefore, reforms are required in most countries to put deliberate measures that promote land acquisition by traditional farmers.

In Zambia, like in many other African countries, all land legally belongs to the state as stipulated in the Lands Act of 1995. Customary land is entrusted in the hands of traditional authorities by the President. However, statutory land can be leased out to individuals and investors on a long-term basis of up to 99 years (Hall et al., 2017). The British colonial laws still influence land ownership laws in the country. Customary (traditional) represents the largest proportion in Zambia and is usually the most accessible by traditional farmers. Therefore, they keep their animals in these lands at no cost but without permanent ownership, which means that the state has the powers to decide how this land should be allocated even if sometimes such decisions may conflict with the small-scale cattle farmers. Therefore, the farmers are at any time likely to have their village pastures changed into co-management between administrations and the local population (Neudert et al., 2019). Community social leaders and recognition of property regimes by the state have often played a key role in making co-management effective (Alden Wily, 2018). Opportunities exist to reform the land laws in Zambia to ensure equitable acquisition by the population.

Studies show that the Zambian government has been making significant efforts in increasing beef production in the country over the years (Kalapula et al., 2014). This has been observed through the provision of funding to local research institutions and animal care services, although considered inadequate and inconsistent in most years regardless of government changes (Mamo, 2019). However, despite these efforts, the response from the cattle owners, particularly the traditional farmers, has been largely conservative. Furthermore, statistics show that approximately 15% of the cattle owned by the commercial cattle farmers is sold out while traditional farmers sell only about 3% of their cattle [Central Statistical Office (CSO), 2005]. This is mainly because for most tribes in Zambia, such as the Tongas, who own the most cattle in the country, cattle are seen as an object of accumulation for prestigious reasons rather than economic gains (HODI, 2009). Hence, Pica-Ciamarra (2005) argues that the best way to make traditional cattle farmers benefit from an increasingly market-friendly environment requires the creation of a strong link between livestock development and poverty reduction, having appropriate policy entry into the sector through livestock producing households as compared to production function by the government. This can be achieved by focusing on market policies and strategies to reduce vulnerability and costs of transactions incurred by the small-scale farmers to the market (Pica-Ciamarra, 2005). Higher transaction costs on the market are reported to hinder the participation of traditional farmers (Kibona and Yuejie, 2021).

In Zambia, the government through the Ministry of Fisheries and Livestock is responsible for developing policies, strategies, and plans that enable the Livestock sector's development. However, it is at the community level where such an important instrument can either meet or miss the diverse, complex realities of the lives of cattle farmers and other actors in the value chain (Vorley, 2002). To date, much of the Zambian government's intervention and funding programs in the livestock sector have largely focused on improving the quality of beef products and ensuring the animals are disease-free through increasing research activities and the development of facilities. This has played an important role in increasing the production of beef and dairy products in the country. However, inequalities in gender have been reported in most cattle keeping communities in the country. According to Spilsbury et al. (2017), cattle farming in Zambia is largely dominated by males, with only a very few percentages of females. Through the Ministry

of Fisheries and Livestock, Zambia is formulating the National Livestock Policy that will provide an enabling environment for promoting the livestock sector.

2.7.3. Impact of globalization on the local cattle business

The demand for milk and meat products in developing countries has continued to increase, and this is primarily being driven by rapid urbanization (Pica-Ciamarra, 2005; Rosegrant et al., 2009). This rise in demand plays an important role in income generation and job creation along the value chain starting from the animal producers, traders, and retailers (Herrero et al., 2013).

Earlier studies in the mid-1990s noted that fostering competitive advantage among business owners requires putting customers' value as the core focus, what they termed as a return to the origins of marketing thinking".

Many developing countries have similar challenges experienced by traditional cattle farmers in marketing their products. However, addressing these challenges is sometimes unrealistic, particularly by governments, which entails prioritising critical areas. Besides, solving certain challenges in rural communities requires critical analysis of key problems participatory.

Griffith and Osorio (2008) reported that poor access to inputs, extension services, road nets and links with buyers were the major challenges affecting the traditional cattle keepers in Eastern Sudan. Key systematic issues analysis showed that the need for improved animal health services, market coordination and promotion of a more favourable business environment were the priorities areas of focus (Griffith and Osorio, 2008). However, the authors also observed that animal health services provision was directly related to taxation, which affected the competitiveness of the cattle owners on the market. This reveals some complex interrelationships among different factors in cattle selling among the traditional pastoralists. In some countries, such as Zimbabwe, cattle farmers have been compelled to become more creative and develop new business models. This saw the creation of a new business model between lead farmers and input suppliers which significantly strengthened the working relationships between the suppliers and the customers. This led to an increase in the number of farmers that had access to inputs and animal health services, an increase

in the prices of cattle by 8%, an increase in the off-take rate of cattle from 5 to 10%, and a reduction in livestock diseases by 20% (Griffith and Osorio, 2008).

In Zambia, the traditional cattle farming sector faces many challenges that disadvantage small-scale farmers from competing with large-scale farmers on the market. Like in many other developing countries, these include lack of access to inputs, lack of veterinary services, poor animal health services, lack of linkages with customers, and cultural norms (Kalapula et al., 2014). Sometimes, the lack of proper livestock processing services in rural communities is a major challenge resulting in poor and low incomes from cattle farming. For example, the introduction of a Zammilk processing plant in Western Zambia led to a significant increase in the demand for the product (Spilsbury et al., 2017). Generally, the livestock supply chain in Zambia is characterized by numerous intermediaries, including brokers, agents, traders, abattoirs, wholesalers, butcheries, local authorities, and the livestock department (Sikamwaya, and the livestock department (Sikamwaya Guiyu,2020). All these intermediaries are critical in promoting the livestock sector. However, supply chains are usually complex as they involve numerous stakeholders, comprising diverse environmental, social, economic, and ethical characteristics, that exposes them to various risks at all stages (Romano et al., 2021). Therefore, an effective and efficient supply chain must address all these issues and place consumer demand at the core centre of its strategy (Canever, 2006). However, it is important to understand that effectiveness and efficiency in the supply chain are not the same as suppliers often resort to focusing on cost reduction at the expense of customers (Canever, 2006).

In the Namwala district of Southern Zambia, markets for cattle products exist with an increased potential for further development. For example, abattoirs have been established to provide a platform for cattle owners, agents, buyers, and consumers to engage with each other (Kalapula et al., 2014; Machina et al., 2018). Engagements between various actors in the cattle value chain are crucial to establishing sustainable markets and business opportunities. Besides abattoirs, Namwala district has received many other markets for cattle products, with the major ones being Starbeef Butchery and Zambeef limited (Kalapula et al., 2014). These have been the main cattle buyers, especially for the commercial traders.

Furthermore, the presence of small-scale cattle businesses in the district may be a precursor to the development of large-scale commercial cattle businesses (Pigali, 1992). Commercializing the cattle business is an important motivation for farmers to produce high-quality animals, which increases their competitiveness and income (Kibona and Yuejie, 2021). However, cattle markets in the Namwala district have been very dynamic and highly influenced by many factors. For example, fluctuations in trade have had an important bearing on cattle sales in the district. Some traders purchase cattle from the traditional farmers in the district at relatively lower prices and re-sale to other provinces in the country at higher prices (Kalapula et al., 2014; Machina et al., 2018). There are many reasons why farmers would prefer selling their animals to buyers that buy from their farmers rather than taking their animals or animal product to the market. According to Negassa and Jabbar (2008), long distances to the market are major factors as farmers are forced to spend a lot of time and money, increasing their market transaction costs. This could be one example of challenges faced by cattle owners when they lack updated information about cattle and cattle products prices not only within the districts but across the country. Kibona and Yuejie (2021) recommend that farmers have access to market information, improve their farming practices, and establish strategic communication channels, such as cattle farmer cooperatives. Cooperatives development would also promote the participation of youths in the development of the youths in the livestock sector, which is currently low (Machina et al., 2018). It is reported that youths would be interested in adopting improved cattle production technologies and participating in cattle markets compared to adults (Kibona and Yuejie, 2021). Realizing this requires government support by formulating policies and management plans to ensure the sector is pro-poor responsive. Seasonal variation in milk supply due to fodder availability in the grazing lands, particularly in the dry season, has also been reported (Spilsbury et al., 2017). This has been a common challenge in the Namwala district, likely increasing due to climate change impacts. Seasonal changes in the supply of cattle products usually lead to swings in market prices, which later impact the farmers (Pica-Ciamarra, 2005). Therefore, farmers need early warning about weather and climate changes to prepare themselves for any potential changes to their production.

2.7.4 Competitive and comparative advantages in community business

Unlike the commercial sector, cattle farming in the traditional sector usually does not enter commercial markets (Kalapula et al., 2014; Kibona and Yuejie, 2021). This is partially due to poor product quality, as most traditional cattle farmers do not raise their animals to fetch a higher market price. This makes it almost impossible for them to compete with the large-scale farmers whose main goal of raising cattle is to fetch better marketing prices. Kibona and Yuejie (2021) investigated factors that affected the market participation by traditional beef cattle farmers in the Meatu district, Simiyu Region of Tanzania. The authors revealed that numerous factors such as price, size of the herd, the off-farm income, distance to the market of their product, farmer age, and value addition practices, e.g. cattle fattening had a significant influence on the volume of beef taken to the market for sale. Furthermore, other factors, including being a cooperative member, access to information about the market, and years of experience in cattle farming, also influenced the farmers' participation in the market (Kibona and Yuejie, 2021).

A study by Kalapula et al. (2014) in the Namwala district of southern Zambia indicated that most traditional cattle farmers would prefer not to sell a whole animal but rather sell milk. This is because selling the whole animal entails a one-time gain of money while selling milk entails a farmer can gain money instantly and numerous times from the same cow (Kalapula et al., 2014). This, however, is highly dependent on the farmers' needs and whether they want to satisfy a once for or a daily or occasional need. For example, a farmer will prefer selling the whole animal to sponsor the education of their children as it requires relatively huge sums of money, while a farmer whose main need for money to supply day to day needs such as food products, paying for rental bills for the family will prefer selling milk to raise money, referred to as small income" (Kalapula et al., 2014). Other studies have reported that the quantity of animals a farmer owns is also likely to affect the access and number of animals a farmer will sell to the market (Kgosikoma and Malope, 2016; Wenchi and Sicelo, 2019). However, the traditional farmers' main goal for rearing cattle is subject to change due to many social, environmental, and economic factors. Kalapula et al. (2014) revealed that traditional farmers in Namwala are likely to change the reasons for rearing cattle due to the need to meet certain objectives, including financial security, social status, draught power, bride price, and others (milk, meat, or to cover funeral costs).

However, financial security was the most important objective among the farmers because it is related to their needs, while the rest could be viewed as wants and not necessarily needs.

On the other hand, most commercial cattle keepers are unlikely to change the reasons for keeping cattle as most usually have other stable sources of income. This makes traditional farmers less competitive on the market compared. Therefore, efforts to improve the competitiveness of small-scale traditional cattle farmers on the Namwala district market and nationally require a better understanding of these factors and how they can influence the quality of cattle and cattle products.

Furthermore, traditional farmers face many challenges, including poor road networks and poor veterinary services that make them less competent. Most small-scale cattle farmers reside in traditional land, usually in remote areas and without proper ownership. Communication and road networks are critical to developing the livestock sector (Kalapula et al., 2014). However, their locations are usually characterized by dilapidated roads, long distances from markets, and poor communications networks. This makes it extremely difficult for livestock extension officers to reach such groups and provide them with the required information and knowledge on better cattle rearing practices, market prices, animal care services, and market information.

2.7.5. Cattle and environmental issues

Anthropogenic activities are an important factor affecting the existence of all other forms of life, including man himself. For example, the keeping of cattle and cattle in themselves has environmental-related issues such as natural resource degradation, deforestation, wasteful systems, reduction in biodiversity, and a changing climate (Tarazona et al., 2019). In fact, every progress in communities' social and economic aspects has been accompanied by degradation of the environment (Romano et al., 2021). The major critical issues of the environment relate to the utilization of natural resources, management of wastes, environmental practices, greenhouse gases (GHGs) emissions, energy and water use, and biodiversity conservation (Schleper and Busse, 2013). However, these risk factors

influence each other, so it is crucial to analyze how they can create a hierarchical structure between risk factors.

The demand for livestock products has continued to rise in response to the growing population, which puts significant pressure on the utilization of natural resources (Herrero et al., 2013). Therefore, environmental issues have become a key area of concern in the food production sector due to sustainable development. Globally, life cycle emissions from livestock production (emissions from feed production to consumer) are estimated to be 14.5% of GHG emissions (Place and Miller, 2020). However, cattle production alone contributes approximately 45 % of the sector's total GHGs contribution within the agriculture sector, representing the largest single contributor (Preto et al., 2015). This contribution is in the form of methane and stems from the entire life cycle of beef production, starting from feed production (e.g., soils emissions, manure on pasture lands), use of fuel and electricity, and others (Place and Miller, 2020). Fortunately, the contribution of cattle production is not static, meaning there are several opportunities to reduce this contribution. For example, in the United States (US), a decline from 18 lb in 1975 to 12.1 lb of carbon dioxide equivalents per pound was achieved in 2016, representing a 33% reduction from beef production (FAO, 2020). Also, a global reduction was observed in 2016, where 25.7lb of CO_2 equivalents per pound was recorded compared with 32 lb reported in 1975 from beef production. Therefore, producing more beef to meet the global demand for animal protein while at the same time reducing the GHGs emissions requires improving the efficiency of cattle production to enable the production of more beef with fewer natural resources. This can especially be achieved through improvement in animal production techniques such as breeding genetics, applied nutrition, and animal husbandry practices (Place and Miller, 2020). However, the adoption of improved animal production techniques by rural farmers will highly depend on improvements in research and extensions services delivery which is often a major problem in developing countries.

According to Neubert et al. (2011), the southern part of Zambia is the most affected and vulnerable to climate change, as has been observed through droughts and flooding. Fortunately, the province also has high agricultural and livestock production potential if the resources are sustainably managed.

Therefore, improving production efficiency is seen as the best way to deal with environmental issues in the cattle production industry.

2.7.6. Monetization relations

Monetization is one of the most significant aspects of growth and development, particularly for the economies of less developed countries (Chandavarkar, 1977). In its broad sense, monetization involves the extension in terms of space and time of the use of money in all its features including as a medium of exchange, a unit of account, and a value storage for subsistence and barter sector (Chandavarkar, 1977). Within the cattle farming business, monetization is a critical aspect of the sector that drives its development and expansion. Despite its significance, there are limited studies that have systematically analyzed the conceptual and empirical aspects of monetization in the livestock sector, especially in the traditional sector. This is probably because the traditional livestock sector has largely been characterized by non-monetary economy for most communities (Hicks, 1994; Shava and Masuku, 2019; Mwila et al., 2021). This is the most common economy across many African countries in the traditional sector. For example, the bantu speaking people were traditionally known for their agro-pastoralism whose main identifying feature was the use of livestock as a medium of exchange during trading and other social activities (Shava and Masuku, 2019). Although there could be minor variations in the actual value attached to cattle and social activities in different countries, the general uses are similar. In most indigenous rural communities of Southern Africa, cattle are used as a symbol of wealth, food security, and as an important alternative currency that takes the role of money in modern capitalist economies (Schneider, 1964; Shava and Masuku, 2019). In fact, in modern western capitalist monetary terms, the indigenous communities that are poor usually survive on a flourishing alternative economy that is based on a multi-functional and a currency that is live in form of livestock (Shava and Masuku, 2019). However, as the poor grow poorer, they are more likely to sell their cattle to buy cheaper energy sources of food such as maize, millet, cassava (Simkin, 2004). In some cases, efforts to diversify their income sources or diets could force these traditional farmers to exchange their cattle with money to acquire other necessities to sustain their livelihoods and improve quality of life.

In Zimbabwe and South Africa, the indigenous communities among the Shona and Nguni speaking people respectively, have held cattle as an important living currency that provide a stable and a more holistic mode of exchange in these communities thereby ensuring self-reliance (Shava and Masuku, 2019). However, with the rapid changes in the world including environmental degradation, climate change, rapid urbanization and industrialization, it is very unlikely that such communities would continue to depend on the use of cattle as a form of currency. Hence, it must be noted that there are alternative economies to the dominant modern capitalist economy which is based on monetary terms and the plural economies must co-exist.

In Botswana, cattle are not only a means of acquiring money but also provide a measure of the owner's standing in the community and a storage for wealth (Stevens and Kennan, 2005). However, this has changed due to education, agricultural extension services, desire for consumer goods, and losses experienced resulting from diseases and changes in rainfall patterns. Besides, Botswana had a national livestock plan (1968-1973) that deliberately set livestock export goals in efforts to increase the contribution of the livestock sector to national economy. The selling of cattle often depends on the location, whether it's in tribal area or non-tribal area. In tribal area, the owner can only sell the animal with the permit from the chief presiding that area, while in non-tribal areas, it is the responsibility of the district officer from the responsible government institution to facilitate animal sale (Ansell, 1971). For the traditional cattle farmers, their knowledge of prevailing market prices for their products is usually limited which makes them vulnerable to haggling with the buyer which is worsened by their urgent need of cash (Ansell, 1971). On the other hand, cattle market in Botswana is not largely guided by quality and consumer demand, and the retailers themselves are poorly informed about consumer demand (Bahta et al., 2013).

In Zambia, the social-economic use of cattle among the small-scale keepers date back from the pre-colonial days (Hicks, 1994). These keepers are reported to own 84% of the national cattle population and to them, cattle has always been regarded as a symbol of wealth for families (Mwila et al., 2021). In the Namwala district of Southern Zambia, cattle are rather viewed as an object of accumulation and not necessarily for economic gain. Particularly, among the Tonga and Ila societies, cattle accumulation is equated to accumulation of capital investments in capitalist societies (Kalapula et al., 2014). Also, for most parents,

their cattle are sold to paying for their children's' school fees and this is very common among the Ila and Tonga tribes in Southern Province (Kalapula et a., 2014). Provision of better economic conditions and relevant support services could significantly enhance gross domestic production by this group. However, as observed by Chandavarkar (1977), monetization cannot be measured without an operationally significant concept of monetization. The author further reported that confusions in conceptualizing monetization have led to reliance on indicators that are misleading in empirical investigations.

2.7.7 Cattle business offering

The increasing demand for livestock products in Africa is projected to make livestock the fastest and more quickly expanding sector globally (Livestock Data Innovation in Africa, 2014). However, the livestock market is hampered by numerous challenges that require attention to make this projection a reality.

The existence of business for a venture is an important drive of production and this is very critical when it comes to food production systems. However, this is often a big challenge among small-scale producers. Studies that have looked specifically into business problems in livestock farming by farmers in communal areas have reported some key interlinked marketing challenges including lack of information on market, poor infrastructure, poor quality of livestock, and cultural issues among others (Coetzee et al., 2005; Musemwa, 2008; Mmbengwa et al., 2015). Besides, Simpkin (2004) observed that there was a need for African pastoralists to develop a "tracking" livestock marketing strategy that would also include information on sales, subsidies on transport, emergency purchase and destocking, and where possible livestock capital banking. In South Africa, however, Mbatha (2021) notes that cultural practices have had a significant impact on livestock marketing among the small-scale producers. Meaning that it cannot be assumed that cattle selling is the primary goal of all traditional farmers. For most countries around the horn of Africa, cattle are kept primarily for milk production, trade, meat, and transport (Simpkin, 2004). Therefore, it is important to understand that the primary motivation for keeping cattle among the small-scale producers in most traditional communities differ.

Different are practices employed by traditional cattle farmers in different countries to attract business for their product. This is largely determined by the presence of a market

that will ultimately receive the products in exchange for money. In most countries in Africa, the private sector is the biggest buyer of cattle products usually through some nationwide companies or commission. On the other hand, many governments have intervened in the meat marketing chain by creating or taking over abattoirs that were previous owned by private firms with an aim to regulate and stabilize the prices for the public good and for quality control purposes. Unfortunately, through this structural reform, many companies have ceased operation. In Botswana for example, the Botswana Meat Commission (BMC) is the main market channel for the finished cattle and weaners in the country (Bahta et al., 2013). However, due to the government's intervention, the commission largely depends on the government for financial support and in disease control measures as well as negotiating tariffs during exports. In some districts, butcheries also offer competitive market opportunities for the traditional cattle farmers (Upton, 2004). Other buyers include traders and feedlots, governments, and to a lesser frequency farmer within the community.

In Zambia, studies show that most traditional farmers keep cattle not for the absolute purpose of selling but rather to absorb shocks when crop harvest is poor and to handle emergency needs (Ilri et al., 2008; Lubungu & Mofya-Mukuka, 2012; Tembo et al., 2014). For example, while others could be keeping them for market to derive their livelihoods, others keep them for social-cultural reasons such as bride payments (lobola), community fines and taxes, events and celebrations, and wealth display (Mumba et al., 2013). Therefore, it can be deduced that such farmers have less focus on producing high quality livestock to higher profits. This could be the major reason why the small-scale farmers sector in Zambia has remained underinvested (Lubungu et al., 2016) as farmers would rather sell off their old cattle at the market which results in lower prices (Coetzee et al., 2005; Musemwa et al, 2008). This is despite the increased participation of private companies in cattle buying since the liberation of Zambia's economy in the early 1990s (Chikazunga et al., 2008). For example, the Zambeef products Plc. is the largest beef producer and marketing channel for cattle in Zambia. Besides, there numerous other cattle markets in Zambia and almost all are from the private sector. In the late 1990s, some producer co-operatives had been launched in Zambia to help with meat processing and marketing, however, they did not survive for long time (Moll and Dietvorst, 1999).

Currently, Zambia has a producer co-operative for milk processing and marketing that have improved the income of small-scale cattle farmers in different districts. In developed countries, such as New Zealand, North America and Northern Europe, producer co-operatives for milk processing and marketing have also played a key role in providing a sustainable high income (Upton, 2004). Abattoirs are present in almost all major cattle producing districts in the country and they form the biggest market for the meet from traditional cattle in those districts. Butcheries also account for a considerable proportion of cattle market for the traditional farmers particularly in districts where abattoirs are absent. In most cases, butcheries and abattoirs have agents that go out in the villages to meet the farmers and discuss the prices. Upon agreement, the farmer would be given cash and the agent would take the animal to abattoir for slaughtering. Sometimes these middlemen get more money when the animals are slaughtered in abattoirs because the price is based on the kilograms of the meat while the farmer in the village sold it based on sometimes age, size and visual estimation that could be misleading. This is mainly due to lack information by the farmers regarding the updated prices and farmers' urgent need for cash, for example to pay for their children's school fees or to purchase fertilizer during farming season. Hence as observed by Lubungu et al. (2016), there is a need to deliberately improve market information sharing/dissemination and knowledge of what is considered quality cattle product among the traditional farmers.

On the other hand, farmers must earn a living and the implementation of any farm strategies is usually based on some calculus which presents a trade-off between economic gains and social cultural norms. The ideas and motivations of farmers are usually in line with their farm practices that stem from the belief that they can earn a living from the available resources such as cattle, machines, and biodiversity available locally (Swagemakers et al., 2017). However, the value of these resources is usually not recognized or is underestimated until a farmer recognizes their potential and how to convert them into benefits. This can lead to financial income via market exchanges as well as re-investing in the farm to strengthen and sustain it.

2.7.8 Cattle Sustainable practices

Sustainability in cattle farming business is key for sustaining beef and dairy production to meet the ever-growing human population globally. Despite the potential of traditional cattle farming in increasing the contribution of livestock production to national gross domestic product (GDP), disease outbreaks continue to threaten its sustainability (Mumba et al., 2009). In developing countries, this has been exacerbated by lack of disease management skills, inadequate adoption of animal confinement strategies resulting in high animal mortalities and poor productivity that characterize the traditional (small-scale) cattle sector (Lubungu et al., 2013). This has had a devastating economic impact on the small-scale farmers in Zambia (Upton, 2004). Further, Upton (2004) observed that although diseases control and treatment technology may be available for small-scale farmers in most developing countries, veterinary services delivery is usually incapacitated by severe institutional challenges. Besides, veterinary services delivery has always been subject to the availability of funding through national budgets and in some cases, developmental organizations have been helpful. According to Lubungu et al. (2016), the issue of disease outbreaks could be addressed by improving investments in animal health care management including enhancing the delivery of veterinary services, extension services by aiming to reduce the ratio against farmers, decentralizing quality livestock services, timely delivery of appropriate vaccines, and improving disease surveillance measures across borders. This only be achieved through appropriate and timely funding to the sector and well-trained human resource.

Drought is another significant challenge affecting the sustainability of cattle farming in Zambia's Namwala district is drought and this has consequently led to low pasture availability (Chifuwe et al., 2006). However, most farmers have developed a scoping strategy by moving their animals to Kafue flood plains during such periods and moving them back to the community during rainy season when there is enough pasture (Munyeme et al., 2009). Also, it would be helpful to consider reducing cattle population in overstocked areas while increasing them in areas that could potentially support cattle production.

Institutional development in the livestock sector has often received less attention in efforts to improve livestock production in developing countries. This is usually accompanied by a decline in funding for research aimed at improving livestock production. Therefore, Upton

(2004) notes that institution development in this sector should include strengthening of road networks and communication, contractual agreements and right to property, credit provisions to farmers, animal health services delivery and other inputs. The author further noted that despite the significance of developing appropriate roads and communication infrastructure, there is a need to first develop an effective and appropriate institutional framework.

As most traditional cattle breeds are kept for dual purposes including meat and milk production, it is important to note that milk production usually can meet the need of a family. Milk sales through co-operatives in Zambia has improved the incomes of traditional cattle farmers from their cattle. Therefore, there is a need to strengthen the operations of these co-operatives and any policy development within the livestock sector should recognize this importance. Many traditional farmers should be encouraged to take advantage of such initiatives and the government must make it more attractive for the farmers to subscribe.

2.8.0 Conceptual Framework Based on Muehlhausen's Business model.

Muehlhausen's 8-part wheel-shaped framework is a modern business model to create and analyze a business model (2013), in this case, traditional cattle farming. Compared to other business templates such as those proposed by Osterwalder and Pigneur (2010), this approach is less theoretical and more practical and suited to traditional African settings like Zambia. The BMI framework starts with the premise that all great business models have three facets: an outstanding offer, the ability to monetize the request, and the ability to sustain it (Muehlhausen, 2013). Each business model is then dissected into eight key areas. The BMI Model wheel is broken down into eight key components. These eight components work together to give a practical, functional business model. Because of its practicability and functionality, it can assist in analyzing the complex reality of cattle business management, thus leading to the development of sustainable cattle business models in Zambia. It can be used to assess if all market players will benefit from the model to be developed (Ganguly, et al., 2017)

2.8.1 Justification for the Conceptual Framework Based on Muehlhausen's Business model.

In line with Herrero et al. (2013) and Kalapula and Mweemba (2018), this conceptual framework presented here reflects a realistic view of typical cattle farming among small scale farmers. Figure 2.2 below represents a combination of Muehlhauser's three components of a business model and cattle stock flows which are usually used to develop SD models. Cattle off takes represent economic flows, which are sales of live animals from different stages of growth. Other financial flows are depicted on the left-hand side of the sale of livestock products (e.g. milk and meat) and other economic services from the livestock (e.g. oxen draft power). The number of live animals and livestock products multiplied by their corresponding prices gives total revenue from livestock activities. The upper right part of the figure shows the costs and expenses of keeping livestock in different stages of development. Like other sectors, livestock production requires labour, land, and standard capital stock categories such as buildings, machinery, and equipment. The sum of these gives the total costs of livestock production activity. The difference between gross revenues and total costs yields the gross margin of keeping livestock.

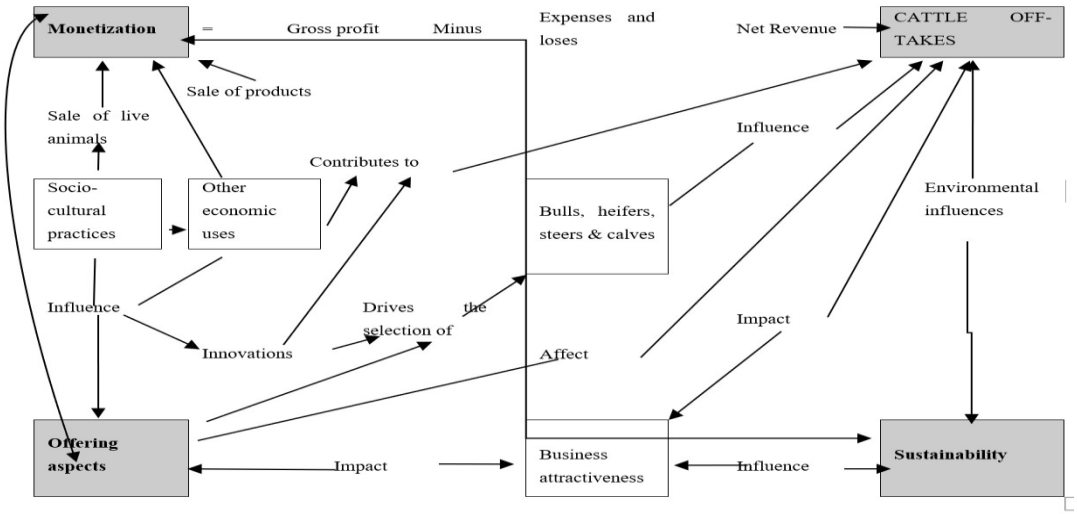


Figure 2.2: Conceptual Cattle Business Framework: adopted from Muehlhausen (2013; p80).

2.9.0 The Systems Dynamic (SD) Model

Systems thinking, also known as Systems Dynamic (SD), is an interdisciplinary problem-solving approach that provides a holistic framework for understanding complex systems and their properties by considering the interconnectedness of system components. It draws on insights from cognitive and social psychology, economics, and other social sciences, grounded in the theory of nonlinear dynamics and feedback control (Sterman, 2002; Sterman & Isenberg, 2000). A SD methodology combines qualitative and quantitative techniques, including surveys, interviews, computer programming, and simulation. It emphasizes stakeholder involvement to define mental representations within the system and encourages the use of nonlinear mental models to understand and describe problem dynamics (Kopainsky et al., 2011; Mumba et al., 2017). This approach has been successfully applied in addressing complex problems in agriculture and natural resources (Banson et al., 2016; Gerber, 2015; Turner et al., 2016).

The application of SD in sustainable cattle business practices among small-scale farmers typically follows a five-step process: problem articulation, polarity analysis, model formulation, model testing, and strategy design and analysis (Grillitsch et al., 2019). These steps involve stakeholder engagement, defining decision-making criteria and mental models, specifying system equations, and testing the model to understand its quantitative behaviour. The process combines elements of "soft systems" and "hard systems" methodologies, following an iterative approach (Arnold & Wade, 2015; Sterman & Isenberg, 2000; Turner et al., 2016).

Developing a sustainable cattle business model for small-scale farmers requires the involvement of all stakeholders and considering diverse solutions. Problem-structuring frameworks like Strategic Options Development and Analysis (SODA) can help structure complex problems and generate strategic evaluations based on diverse viewpoints (de Araujo et al., 2021; Eden et al., 1983; Kilgour & Colin Eden, 2020).

Islamic Development Bank (2020) stressed that systems dynamic theory and market systems approach, and The Triple Bottom Line (TBL) theory, stressed the interdependence

of the environment (Earth), economy (profit) and the society (people). Mumba et al. (2017) prostituted that the task for the public and private sectors is to develop policies that will instill sustainability now and, in the future given the fact that cattle farming businesses face sustainability challenges, including environmental impact, animal welfare, and social responsibility. Developing sustainable business models in this sector requires addressing these challenges while ensuring economic viability. Key arguments for sustainable business model development in cattle farming are:

2.9.1 Regenerative Agriculture

Cattle farming can play a role in environmental deterioration, but regenerative agricultural practices can help restore soil health, promote biodiversity, and sequester carbon. Practices such as rotational grazing, agroforestry, agricultural diversification, and cover cropping enhance ecosystem resilience and reduce greenhouse gas emissions (Morris, 2017; Savory et al., 2019). Holistic Planned Grazing, a component of regenerative agriculture, incorporates ecological restoration and land regeneration by managing livestock, crops, wildlife, and forests. It focuses on location, timing, and behaviour of livestock to optimise landscape design, capture sunlight, and align production cycles with natural processes (Savory et al., 1999; Ziestman, 2014).

2.9.2 Environmental Indicators

Addressing environmental effects of cattle farming involves considering six domains: climate change emissions, land use, biosphere integrity, water usage, pollution, and agricultural production. Strategies to minimise environmental impact include reducing greenhouse gas emissions, improving water and nutrient management, and adopting sustainable land management practices (Giller et al., 2021; Gliessman & de Wit Montenegro, 2021). Cattle farming needs to mitigate methane emissions from enteric fermentation and nitrate loss from dung and urine (Heiberg & Syse, 2020).

Sustainable business models in cattle farming aim to balance economic viability with environmental and social responsibility. Implementing regenerative agricultural practices

and addressing environmental indicators contribute to more sustainable and resilient cattle farming operations.

2.9.3 Animal Welfare

Animal welfare is a crucial aspect of sustainable cattle farming, with significant public interest in the effects of genetic modification on animal health and well-being. Poor animal welfare is associated with reduced life expectancy, stunted growth, decreased reproduction, physical harm, sickness, and abnormal behaviour (Broom, 1983). Implementing humane and ethical practices, providing adequate space, access to pasture, and proper veterinary care improves animal well-being and enhances the reputation and marketability of the business (Heerwagen et al., 2013).

Animal welfare is a multi-sectoral concern involving various stakeholders, including farmers, off-takers, transporters, and consumers (Schmitt et al., 2017). Support from sectors such as religion, police, traditional leadership, and cattle associations is critical for promoting and advancing animal welfare, especially considering the potential effects on human health during slaughter (Li et al., 2018).

However, there is a practical barrier to improving farm animal welfare due to the general public's unwillingness to translate their desire for high standards into a demand for high-welfare products (Webster, 2005). Factors such as lack of awareness, indifference, and uncertainty about identifying welfare standards contribute to this barrier. To overcome this, a strong quality assurance system that accurately evaluates animal welfare and addresses any identified issues is needed (Webster, 2005).

2.9.4 Stakeholder Involvement

Stakeholder engagement is crucial in cattle farming to foster transparency, build trust and promote sustainable practices. Engaging with stakeholders, including consumers, local communities, and regulatory bodies, allows organisations to communicate with and understand their opinions and concerns (Osobajo et al., 2023). This involvement aligns

with the definition of stakeholder engagement by Greenwood, emphasising the inclusion of stakeholders in project activities and decision-making (Osobajo et al., 2023).

The government of Zambia plays a crucial role in protecting natural habitats, promoting native vegetation, and implementing erosion control measures to ensure the sustainability of cattle farming operations and mitigate climate change and deforestation (Zambia Statistics Agency, 2022; Zambia Statistics Agency & Ministry of Fisheries and Livestock, 2022). However, challenges persist in maintaining range management, including issues such as overgrazing, soil erosion, and uncontrolled burning (Abubakar et al., 2021; Chidumayo, 2019). Addressing deforestation and promoting sustainable land management practices require concerted efforts from multiple stakeholders, including governments, farmers, and research institutions, to increase awareness, provide training, and develop supportive policies to ensure the long-term sustainability of cattle farming and protect natural resources.

To promote the adoption of climate-smart livestock operations, it is essential to address inefficiencies that hinder investment and foster the entrepreneurial skills needed to deploy innovative technologies and practices (Ngoma et al., 2023). Studies have shown positive associations between the adoption of sustainable intensification practices (SIPs) and improved production, crop diversity, and animal and human dietary diversity.

Bringing all the milk into the formal sector was suggested to enhance the sustainability of the dairy business, with a projected monetary value of $27.6 million annually among rural households in the research locations. Establishing new milk collection stations in potential areas could increase the processed milk volume by approximately 27%, generating nearly $5.7 million annually for rural farmers in those areas and creating around 2,400 farm jobs for young people (Nkadimeng et al., 2022). However, implementation requires government incentives and infrastructure improvements in remote areas. In addition, there’s a need to enhance the approach of farm information dissemination and skills transfer to mitigate farming challenges and improve productivity (Nkadimeng et al., 2022).

Active participation of smallholder farmers in profitable agricultural markets is crucial for realising these goals (Jobirov et al., 2022; Mayulu et al., 2022). In Botswana, the recently established Botswana Beef Producers Union (BNBPU) represents beef farmers from various veterinary camps across the country. The union advocates for greater transparency, accountability, and farmer participation, as it perceives that the Botswana Meat Commission (BMC) tends to favour large commercial farms over smallholders (Botswana Beef Producers Union (BNBPU), 2023). To enhance transparency and accountability and increase farmer participation, the Meat Industry Regulating Authority (MIRA) has requested the passage of a bill in parliament to establish a parastatal meat regulating body, like the Red Meat Industry Forum (RMIF) in South Africa, the Meat Board of Namibia, and Meat and Livestock Australia (MLA) (Botswana Beef Producers Union (BNBPU), 2023). These developments highlight the potential for the livestock industry's expansion in Botswana, which Zambia may also consider although the Zambian production system, problems, setup and environments are different. Since the privatization of the livestock sector, the beef and milk market has been left in the hands of the pure private sector in Zambia, yet in Botswana and Namibia, the meat commissions remain their business anchorage, unlike Zambia (Imakando,2015). The failure of cattle growth in Zambia could be partially due to a lack of harmonization between government and private livestock players. Therefore, the challenges facing Zambia could be different from those facing Botswana and Namibia because of the different business vehicles they have employed (Imakando,2015). The challenge above may not be like the Zambian situation because Botswana and Namibia have a well-established cattle marketing system that has evolved and improved with time because in agriculture there is cattle, and cattle is agriculture. Zambia needs a meat and or milk body that will advocate for a fair cattle marketing system.

2.9.5 Gaps in Previous Research Studies

Nkadimeng et al. (2022) assessed the current beef cattle farming practices and limiting factors for improved beef production in South African smallholder farmers. However, the study did not attempt to determine factors affecting cattle production, in terms of cattle herd size. Yaemkong et al. (2018) analysed the problem and obstacle of beef cattle production based on the factors of age of farmers, educational background, and farm size.

However, this study left out a number of explanatory variables to completely address the problem. This study also did not address production (herd size) but focused on factors affecting production practices like breeding and deeding practices. The study also had a relatively small sample that was purposively selected.

Busisiwe et al.'s (2019) study focused on determining socioeconomic factors that affected livestock numbers among smallholder cattle and sheep farmers in the Free State Province of South Africa. However, the study did not address the aspect of profitability and sustainability in the cattle business. Ekowati et al.'s (2018) study aimed at analysing the on-farm agribusiness subsystem approach at farm household, beef cattle production influencing factors and economic efficiency of beef cattle farming. The study had a small sample of 80 farmers, making it difficult to run a robust regression model with many variables, resulting in multicollinearity. Halala et al.'s (2020) study in Southern Ethiopia aimed at analysing factors that determine beef cattle production and value addition. However, the study focused on factors affecting access to veterinary services, access to feed and feed sources, and failed to establish factors affecting cattle herd size, profitability and sustainability of the cattle business. Kalangia et al. (2016) had a small sample, consisting of 89 beef cattle farmers raising, which made it challenging to generalise the findings.

Nigatu (2016) explored factors that are responsible for the drawbacks of the livestock sectors, however, the study did not assess factors affecting profitability and sustainability of the cattle business. Harahap and Supriana's (2021) study aimed at obtaining empirical evidence on the effect of simultaneous and partial variable feeder cattle, livestock feed costs, cage depreciation costs, medicine and vitamin costs, and labour costs on beef cattle farming. This research only had a small sample size of 73 respondents, which makes it difficult to generalise the findings. In addition to the highlighted gaps in the literature, past research studies did not develop a sustainable cattle business model nor the implementation framework.

A study by Molina et al. (2014) in Colombia reports that the country raises 1.73% of global livestock inventory. Key challenges of the sector are increasing animal production to nutritionally sustain the growing population and ensure rational use of natural resources for agricultural purposes, either combining criteria of economic sustainability and social equity, in Colombia development of rural areas comprised complex dynamics affected by low technological farming systems and conflicts over land use and ownership. Free trade and climate change also act on the system as exogenous variables. The researchers worked on the premise that modelling tools and methodologies, such as system thinking and system dynamics, could help manage rural development policies and could also be useful to stimulate a multidisciplinary focus on future development trends. The work qualitatively explained the main loops limiting and enhancing the development of the rural areas oriented to milk production in Colombia, using causal maps and conceptual diagrams. Three main components and their relationships were analyzed: Production and Economics, Environment and Social. They recommended that dairy farm management and rational land use supported by technical assistance were proposed alternatively to an extensive-extractive livestock system to reach economic, social and environmental benefits (Molina, et al., 2014).

In their desk research, Nguyen et al. (2013) hypothesized that systems thinking methodology could be used in agriculture to study the impacts of climate change on livestock production. They suggest that through the Causal Loop Diagrams (CLDs), the scientists, managers and policymakers can provide better adaptation and mitigations strategies toward the sustainable development of livestock production and agriculture in general.

In a related study, Mumba and colleagues studied how East Coast Fever affects traditional cattle farming in eastern and southern Zambia (Mumba, et al., 2017). This study aimed to analyze the durational variations in East Coast Fever (ECF) occurrences and provide a sustainable solution to government and farmers. The study used the soft systems approach (qualitative) to examine the influence of dynamic socio-economic, cultural, and ecological factors in the study regions. Using the system dynamics method to specify these dynamics

and the spatial group model building (SGMB) approach in participant selection, the research formed focus groups of beef value chain stakeholders in two distinct production systems. The SGMB process revealed policy leverage points in the beef cattle value chain that could be targeted to improve ECF control. However, the results obtained from an SGMB process also demonstrated that a one general approach model might not be evenly effective in policing ECF in the diverse agro-ecological zone due to the complex interactions of socio-ecological context with significant and often ignored spatial patterns.

Laibuni and Kirui's study in Kenya sought to investigate how livestock production can be transformed by linking feedback between the livestock sector and the rest of the Kenyan economy (Laibuni & Kirui, 2018; Sejian, et al., 2015). They conducted a series of interviews and workshops to identify the problematic situation of smallholder beef farming in West Pokot and Narok Counties of Kenya. The study focused on livestock production based on three modules, namely forage, marketing and disease, and developed causal loop diagrams showing relationships among various factors in each loop. The study concludes that boundaries should be clearly defined when studying a system. This is essential to identify the elements within the system of interest, so their interactions can be studied, and also to define what is beyond this system, as any system is part of a hierarchy, and essentially a sub-system of a more extensive system (Laibuni & Kirui, 2018).

Another study in Indonesia highlighted the steps involved in beef production. The study was undertaken in rural Central Java at two beef farmers groups. Semi-structured interviews followed by focus group discussions and in-depth interviews to clarify the findings were conducted involving a total of 50 respondent farmers (Setianto, et al., 2019). The study revealed operational processes which needed to be followed to undertake five steps of standard qualitative modelling practices, i.e., observing the everyday activities of the farming, problem identification, developing a conceptual framework, canvassing the maps of qualitative modelling using Causal Loop Diagram (CLD), and identifying the systems archetypes within the CLD. Qualitative maps of CLD describing the behaviour of the systems of smallholders beef farming were also developed, which showed interrelationships in the study's variables.

2.9.6 Chapter Summary

This literature chapter provided a review of the theoretical and empirical literature behind the systems thinking approach in cattle farming worldwide, with a focus in Zambia. The empirical review identified relevant study findings from researchers that help explain the factors behind the problem. Gaps in the generalizability and resultant focus area of this research study are confirmed.

Chapter Three will provide the research methodology, outlining methods and procedures used to carry out this research study in line with the philosophy and the designed strategy.

CHAPTER 3
METHODOLOGY

3.0 Introduction

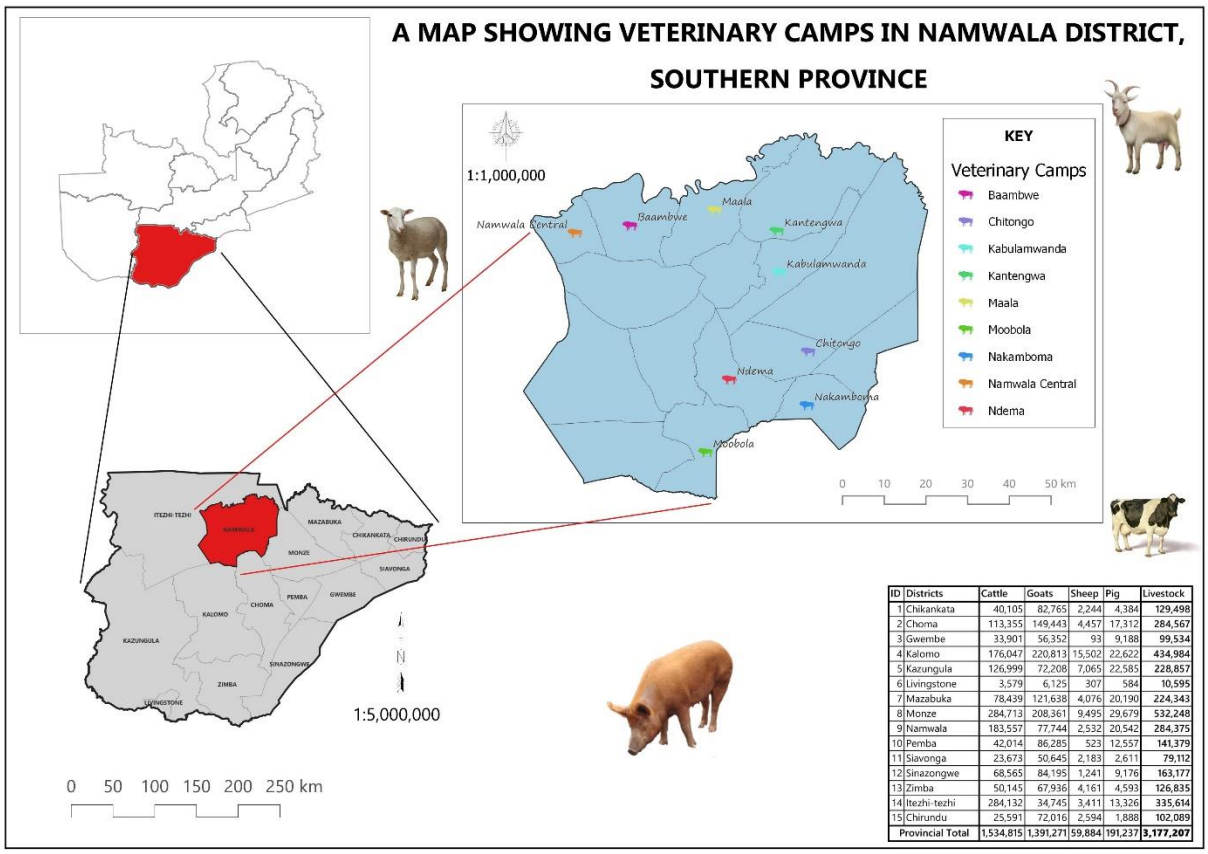
The research technique used in this research study is introduced in the chapter, along with how it influenced the construction of a strong business model and sampling, data gathering, analysis, and interpretation. It starts by outlining the context of the investigation before presenting two polar ontologies and epistemologies connected to inductive and abductive logic in a mixed-methods study.

3.1 Research Study Area

This research study was conducted in one of the districts with the highest density of cattle in Zambia's Southern Province. Consequently, Namwala is primarily a rural district located in the northwest of Zambia's Southern Province with 5,678 km² area situated at 1,037 metres above sea level and lies between latitudes of 15 and 17 degrees south, and longitudes of 25 and 27 degrees east of the equator. Because of its low level above sea level Namwala is prone to flash floods in most of the years when there are rains which affect both crops and livestock production. For example, the 2022 and 2023 Disaster Management and Mitigation Unit (DMMU) reports show Namwala had more people and animals affected by floods than any other district in the Southern Province or the country at large (Relief Web, 2023). The Ministry of Livestock and Fisheries reports that approximately 164,012 cattle (30% of total cattle in Namwala, Monze, and Mazabuka) have been exposed to flooding and associated risks such as animal diseases and reduced grazing land (Relief Web, 2023). In the further needs assessment report issued by the Zambian government through the Disaster Management and Mitigation Unit (DMMU) on 17th January 2022, Namwala district recorded the highest number of households affected with 3,219 coupled with 8,000 ha of field crops submerged by water, as well as houses and sanitation facilities around Chilumino, Nachuumba, Nakamboma, and Moomba (Relief Web, 2023).

In addition, it is the primary town of the Ila people, who are the inhabitants of the Namwala District, and it is home to the administrative offices of the Namwala District. They are

famous for their large herds of cattle with livestock farming, not surprisingly, their main economic activity. Its neighbors include the districts of Mazabuka on the east-south, Monze on the east, Kalomo and Mumbwa on the south, and Itezhi-Tezhi on the south-west. Namwala is a district that does not share a boundary with any of Zambia's eight surrounding nations, unlike Livingstone, Kazungula, Sinazongwe, Gwembe, Chirundu, and Siavonga. It is 169 kilometers from Choma town, the Southern Province provincial headquarter, 158 kilometers from Monze town, and 350 kilometers from Lusaka capital City. Figure 3.1 shows map of Namwala districts with Nine (9) veterinary camps serve the Namwala Central, Baambwe, Maala, Chitongo, Kantengwa, Katantila, Nakamboma, Ndema, and Muchila areas (IFRC, 2022). According to census data from 2010, Namwala had a total population of 102,866 inhabitants, with 51.3% of them being men and 48.7% being women (Chapoto & Subakanya, 2019). However, the 2022 census shows that Namwala district has 167,938 inhabitants, a 4.2% annual population growth from 2010 to 2022, and a population density of 29.57 per Km^2 (Zambia Statistics Agency, 2022). Cattle in Southern Province are raised in Namwala district, which produced 17 percent of the district's total agricultural cash earnings in 2022 from the sale of beef and calf sales. As a result, beef is the most valuable agricultural product in Namwala district, which is also the country's largest producer of beef. Disruptions in the cattle market have a direct impact on the Namwala district economy because of its large size and broad interconnectedness, as well as other important agricultural sectors (such the requirement for feed grains, forage, and fodder). The majority land use in the Namwala district is really pasture, which provides habitat for over 183,557 cattle heads. Indirect methods cannot even account for the thousands of animals, meat, and beef products that were exported in 2021. Because of their multifarious importance to the US agriculture industry, it is imperative to understand how beef markets adapt and deal with disturbances in the market. Therefore, in Namwala, the traditional smallholder cattle production system has been described as an intensive grazing system with three linked herding patterns: village resident herds (always in the village), transhumant herds (move between village and flood plains), and interface herds (permanently stay on the flood plains) Muma et al. ,2006; Munyeme et al.,2009).



ID	Districts	Cattle	Goats	Sheep	Pig	Livestock
1	Chikankata	40,105	82,765	2,244	4,384	**129,498**
2	Choma	113,355	149,443	4,457	17,312	**284,567**
3	Gwembe	33,901	56,352	93	9,188	**99,534**
4	Kalomo	176,047	220,813	15,502	22,622	**434,984**
5	Kazungula	126,999	72,208	7,065	22,585	**228,857**
6	Livingstone	3,579	6,125	307	584	**10,595**
7	Mazabuka	78,439	121,638	4,076	20,190	**224,343**
8	Monze	284,713	208,361	9,495	29,679	**532,248**
9	Namwala	183,557	77,744	2,532	20,542	**284,375**
10	Pemba	42,014	86,285	523	12,557	**141,379**
11	Siavonga	23,673	50,645	2,183	2,611	**79,112**
12	Sinazongwe	68,565	84,195	1,241	9,176	**163,177**
13	Zimba	50,145	67,936	4,161	4,593	**126,835**
14	Itezhi-tezhi	284,132	34,745	3,411	13,326	**335,614**
15	Chirundu	25,591	72,016	2,594	1,888	**102,089**
	Provincial Total	**1,534,815**	**1,391,271**	**59,884**	**191,237**	**3,177,207**

Figure 3.1: Map of Namwala District showing 9 veterinary camps: Source (Author, 2024).

3.2 Research Design Matrix and Research Strategy

The creation of the research matrix is followed by the development of a research design and research strategy. The matrix consistently identifies the logic(s) or study plan as well as the procedures chosen for sampling, data gathering, and analysis. Each research question's intended response is displayed in the study design matrix. Each research endeavor has associated goals that are epistemologically labelled. This pinpoints the best sample strategies, data collection instruments, and data processing methodologies.

Research methods are systematic and well-organised approaches to inquiry that are used to answer research questions and issues. In complex situations, it is advisable to unbundle the question to unlock the complexity to find lasting solutions (Zolfagharian et al., 2019). Zolfagharian et al. (2019) submitted that in emerging environments researchers have three general possibilities for the research approach while conducting an empirical study. They can first use qualitative research techniques including ethnography, action research,

grounded theory development, and narrative inquiry, which use narrative data sources and data analysis techniques. Typically, these approaches use idealist (relativist), subjectivist, deductive, value-bound research, and they offer ideographic understandings of the problems at hand. The second option is to employ quantitative research techniques, which make use of numerical data sources and analytical techniques including mathematics and statistical techniques. These approaches to studying the relevant phenomena are realist, objectivist, inductive, value-free, and nomothetic. Third, to gain a broad and deep understanding as well as confirmation, transition researchers can make use of mixed research methods, which combine various research strategies and methodological aspects such as using both qualitative and quantitative viewpoints and inference techniques according to Lezak and Thibodeau (2016). Since both qualitative and quantitative methods were used for data analysis, the research method was classified as mixed.

3.3 Paradigm

A paradigm is a system of core assumptions and beliefs that influence or direct technique choice (Zolfagharian et al., 2019). The positivist, critical realist, interpretivist, and pragmatic paradigms are all recognised as "options" in transition studies. The primary components of each paradigm are the researchers' assumptions about the nature and relationships of the pertinent realities on transitions based on ontological assumptions, the characteristics and boundaries of knowledge about transitions based on epistemological assumptions, and the significance of values and ethical considerations in the research processes related to transitions based on axiological assumptions according to Tashakkori and Teddlie (2015) and Csutora et al. (2021). It is noteworthy that each paradigm implies unique presumptions for researching transition difficulties, which may necessitate the use of various methodologies. The social sciences typically accept the four paradigms as "ideal kinds" (Zolfagharian et al., 2019). Empirical researchers have failed to formally define and explain their paradigmatic orientations (Tashakkori & Teddlie, 2015). The paradigmatic label for this research study came about because of an understanding of the ontology, epistemology, and axiology that have been applied, as well as details provided on the theoretical frameworks and research design matrix techniques used. From the ontology perspective, the study has outlined a number of concepts (factors) hypothesized to affect

cattle herd size, profitability and sustainability of the cattle business among small scale farmers. From the ontology, we move to the methods of measuring (epistemology) the relationship between the concepts (factors) and the dependent variables (cattle herd size, profitability and sustainability), these methods such as Multiple linear regression and binary logistic regression are explained in the data analysis methods used.

3.4 Positivity and Constructivist Positions of this Research Study

Research is a systematic process of inquiry to create new knowledge. Creswell et al. (2020) and Creswell (2019) describe two ways of knowing. Firstly, the positivist epistemological perspective assumes that reality can be described through objective measurement and quantification, emphasising the importance of reliability in research and the objective position of the researcher (Das et al., 2016; Mustafa & Bon, 2013; Tripp, 2008). Secondly, the constructivist perspective asserts that views of social phenomena and their meanings and knowledge are socially constructed, where different people can experience different realities (de Gooyert & Größler, 2018; Hafiz et al., 2013; Mustafa & Bon, 2013; Yigitcanlar & Dur, 2010). More succinctly, positivism entails a deductive approach towards the relationship between theory and research where, by contrast, constructivism emphasises the generation of a theory (Haq, 2016; Shenton, 2016).

This research study aimed at describing how monetization, cattle herd size, profitability, attractiveness of the cattle business offer and business sustainability patterns relate to each other and the wider implications for cattle business development along the livestock value chain in the vast but underperforming small scale cattle farming subsector. Since more than 80% of the cattle farming businesses are owned by small scale traditional farmers (Lubungu et al., 2015). Therefore, this study adopted the position that knowledge on cattle production is socially constructed.

3.5 Research Design

According to Creswell (2019) and Raymond and Knight (2013), using assumptions for creating social research, a case study strategy using inductive (qualitative realist logic), and adductive (qualitative idiographic logic) research strategies was deemed appropriate after

looking at the research design matrix. Regardless of the number of study locations or participants, both quantitative and qualitative research may employ a case study approach, which focuses the data analysis on one phenomenon that the researcher chooses to comprehend thoroughly (Raymond & Knight, 2013; Sekaran & Roger, 2016). In this example, traditional Namwala cattle producers were the phenomenon being examined because they had similar experiences. The purpose of using case study research was to develop a thorough grasp of the relevant phenomena in a practical situation. Ali-Toudert (2021) and Bosch (2014) claims that this is an intrinsic case study since Namwala exemplifies a certain characteristic or issue and the case itself is of great importance despite its particularity and ordinariness. Creswell and Plano (2017) advised that there are many different types of mixed methods research because of the different ways that quantitative and qualitative research can be integrated and how often this might happen.

Saunders et al. (2023) claimed that of great value are concurrent mixed research method (CMM), which is a single phase of data collection and analysis (referred to as a single-phase research design). In contrast to the usage of a mono technique design, this enables both sets of results to be evaluated collectively to produce a deeper and more thorough solution to the research issue (Saunders et al., 2023). A contemporaneous triangulation strategy is used when qualitative and quantitative data are collected during the same study phase to assess how these data sets support one another.

The second mixed method research is called a sequential mixed methods design that takes longer to complete and be less feasible to carry out than a concurrent mixed methods design, which should produce richer data than a mono method design. Sequential mixed methods studies collect and analyse data over several phases. To supplement or elaborate on the original set of findings, the researcher will utilise one method after another in the proposed design. A sequential exploratory research design (qualitative followed by quantitative) or a sequential explanatory research design are the two possible mixed methods research methodologies that result from a double phase research design (quantitative followed by qualitative). Mixed methods research will comprise numerous phases of data collection and analysis in a more complicated, sequential, multi-phase

design for example, qualitative followed by quantitative, then by a further phase of qualitative (Saunders et al., 2023).

Case study research, which is preferred if the research questions touch on the "what," "why," and "how" types of topics, was submitted by Creswell (2019). To incorporate place and temporal dynamics, other academics have added "where" and "when" (Sekaran & Roger, 2016). Therefore, to explain the complexity and nuance of a real business situation in Namwala district, the research issues needed to be thoroughly explored. According to Creswell (2019), it is crucial to examine phenomena in a case study from a variety of angles using systematic triangulation and data triangulation. According to Creswell, the complexity is unlocked by combining several people-based traits with data slices collected over time.

Not many studies have utilised a system dynamics (SD) approach to examine cattle farming business approaches and the development of cattle farming models based on systems thinking. Several studies have used the SD approach to examine dairy farming practices (Kamath et al., 2019; Lie & Rich, 2016), while others have focused on crop farming (Gerber, 2015; Morters et al., 2014). This exploratory research study uses a mixed-method research that used qualitative and quantitative data with the purpose SD model for traditional cattle farmers (Creswell, 2019; Tashakkori & Teddlie, 2015). For example, McKim (2017) conducted an explanatory mixed methods study aimed at investigating graduate students' perceptions of the worth of mixed methods research. The quantitative portion of the study examined how students' perceptions of the value of a passage were affected by its technique. According to the results, students valued the mixed methods passage more highly than either the quantitative or qualitative passage. Focus groups were used in the qualitative phase to better understand how students felt about the perceived benefits of mixed techniques. According to research, graduate students believe mixed methods passages provide a deeper understanding of the phenomenon and have more rigorous methodologies and a more recent history. The results also show that by exposing the value graduate students give to quantitative, qualitative, and mixed methods research, the study expanded the body of literature.

Through a review of previously published studies, past studies by Hurmerinta-Peltomaki and Nummela (2006) examined the value of mixed methods in the business world. By enhancing the findings' validity, guiding the acquisition of the second data source, and promoting knowledge development, they discovered that mixed techniques were valuable. According to the authors, investigations that employ both a quantitative and a qualitative approach are more likely to develop a deeper, more comprehensive understanding of the phenomenon. The use of mixed approaches in the research on health services was the subject of another study. Only 18% of the studies, it was discovered by researchers, used mixed methods according to McKim (2017). According to the researchers, the apparent deficiency of quantitative approaches is what motivates the employment of mixed methods. In another study in the business sector, researchers discovered that papers using mixed methods obtained more citations than those that did not, which they attributed to the greater value of mixed methods research (Magliocca et al., 2019). The element of integration that mixed approaches offer is another benefit. According to Schoonenboom and Johnson (2017), integration increases readers' trust in the findings and the inferences they make from the study. According to Jilcha Sileyew (2020), using mixed approaches also aids in the development of research ideas. Moreover, researchers assert that mixed-methods research is the only way to be certain of findings and interpretation (Lester et al., 2019; Tashakkori & Teddlie, 2015; Sweetman et al., 2010). Lenaghan and Heffern (2021) and Sovacool et al. (2018) have used mixed methods design in systems thinking approach in addressing the standards for grading a mixed methods study and realised that Creswell (2019) has already covered an evaluation of a mixed methods study in their research. Analysis shows that a thorough methodology, using both methodologies, and situating the work within philosophical presumptions were among the characteristics they listed. It is crucial to understand the perceived value of a mixed methods study in addition to having criteria by which to evaluate such studies.

This combination of two approaches is important because each approach is treated as a supplementary method to the other approach. When the methods are triangulated, the confirmation of the two different approaches gives way to greater completeness, validity,

and generalisability of findings than a single methodology, as supported by Chinen et al. (2017). Teddlie and Tashakkori (2015) assert that mixed methods are superior to single methods because they can answer research questions/problems that other approaches and methodologies fail, and their design provides better inferences with greater diversity. Since it is based on integrating qualitative and quantitative data, it yields additional insight beyond the information provided by quantitative or qualitative data alone (Creswell, 2019).

However, it is worth noting that central to the research and perhaps specially to mixed methods research, it is how to justify the selected mixed methods approach from a plethora of such methods. It is important when it comes to the question of mixing. There are three main options which could be available when deciding how and why to mix data in the following manner. It is therefore assumed that firstly data can be merged by transforming and or integrating two data types together. Secondly, one data type can be embedded within another or thirdly data can be presented separately and then connected to answer different aspects of research questions as advised by Creswell (2019) and such data are usually connected in the discussion section.

In this research study data collection methods, data analysis and data analysis and presentation of findings or results are presented separately because they answer different aspects of research questions. This has been done because data collected in this kind of mixed methods design cross paradigm sequentially. Further analysis shows that data from one phase or a paradigm especially quantitative in this case was used to select participants who could provide best new or specific and detailed information of concerns and not to verifying or augment study results from members of a defined population. This is to say that the quantitative data from software tools led to conducting the QUAL and generate final qualitative data which is the cornerstone of the inquiry.

The research philosophy or strategy for this research study is pragmatism. The pragmatic paradigm is suggested because it is philosophically and methodologically compatible with the use of mixed research methods (Loorbach, 2017; Tashakkori & Teddlie, 2015). Therefore, according to pragmatism research philosophy, the research question is the most

important determinant of the research philosophy, and in this case, the "how" question is superior to the "why" and "what" questions. A pragmatic viewpoint aims at finding solutions to the stated problem while relying on the supremacy of research questions and objectives using diverse approaches that combine objectivism and subjectivism of reality (Hardy & Kagy, 2021; Davis et al., 2010). This research study therefore combined both positivist and interpretivist positions within the scope of a single research question, according to the nature of the "how" research question. Unlike positivism and interpretivism research philosophies, pragmatism research philosophies can integrate more than one research approach and research strategy within the same study. Moreover, studies with pragmatism as a research philosophy can integrate the use of multiple research methods, such as qualitative, quantitative, and action research methods as shown in Figure3.2.

Therefore, characteristics of quantitative and qualitative research are combined in mixed methods research (Figure 3.2).

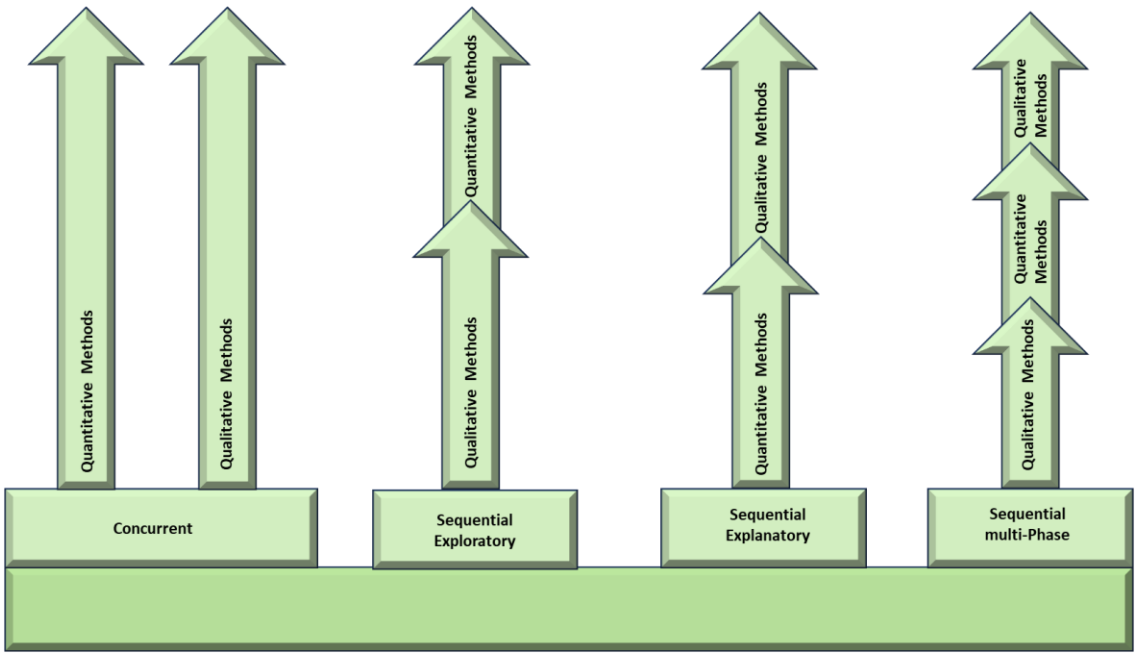


Figure 3.2 Mixed Methods Research Designs

(Source data: Saunders et al., 2023, p. 182)

In summary, the reasons behind the selection of pragmatism are: It offers an immediate and useful middle position both philosophically and methodologically; it provides hands-on, result-oriented methods of inquiry that are solution-based, which further eliminates doubts in the inquiry; and it also helps by offering methods for selecting methodological mixes that help researchers better answer many of their research questions (Creswell & Plano, 2017). It is exploratory in that few studies examining sustainable and dynamic cattle business models have been conducted, particularly in Zambia.

Table 3.1 Research Design Matrix

Research Objectives	**Research Questions**	**Research Approach**	**Sample Size**	**Data Analysis**
1. To describe the traditional cattle business practices used by traditional cattle farmers in the Namwala District of Zambia.	What traditional cattle business practices are used by traditional cattle farmers in Namwala District of Zambia?	Both; qualitative and quantitative	405	Descriptive and content analysis
To identify factors affecting cattle production, in terms of cattle herd size among traditional cattle farmers in Namwala.	What factors affect cattle production, in terms of cattle herd size among traditional cattle farmers in Namwala?	Quantitative approach	405	Statistical analysis. Multiple linear regression analysis
To determine factors affecting the profitability of the traditional cattle business system in Namwala District of Zambia	What are the factors affecting the profitability of the traditional cattle business system in Namwala District of Zambia?	Quantitative approach	405	Statistical analysis. Binary logistic regression analysis
To determine factors affecting sustainability of the traditional cattle business system in Namwala District of Zambia.	What are the factors affecting sustainability of the traditional cattle business system in Namwala District of Zambia?	Quantitative approach	405	Statistical analysis. Binary logistic regression analysis
To create a dynamic,	How can a dynamic cattle business model	Both; qualitative	405	Created based on the results

sustainable cattle business model and implementation framework for traditional cattle farmers in Zambia.	and implementation framework be developed to ensure business sustainability for traditional cattle farmers in Zambia	and quantitative		from content analysis, Statistical analysis. Multiple linear regression analysis

3.6 Research Study Population

The research study population is based on the number of small-scale cattle farmers in Zambia by household using the CSO 2017 post-harvest study. According to the CSO PHS (2017), there are currently 330,582 households raising cattle using traditional cattle management practices in Zambia (Kalapula & Mweemba, 2018a; Mumba et al., 2018). This study's prospective target group included stakeholders in livestock and assistant veterinary offices. A "target population" or "study population," according to Creswell and Plano (2017) is a group of people with certain common defining characteristics that the researcher can identify and study. Therefore, this study targeted several other key informants such as meat and milk processors, livestock and assistant veterinary office stakeholders.

3.7 Research Study Sample

The following formula: $n= N*X / (X + N – 1)$,

where,

$X = Z_{\alpha/2}^2 *p*(1-p) / MOE^2$, and $Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g., for a confidence level of 95%, α is 0.05, and the critical value is 1.96), MOE is the margin of error, p is the sample proportion, and N is the population size.

The above formula tallies well with Epitools (http://epitools.ausvet.com.au/) link when calculating the sample size.

Using the above formula to calculate the sample size, based on the stated population in CSO PHS for 2017 of 330,582 (CSO, 2019), this research study will target a total of 385

systematically selected traditional cattle farmers from the nine (9) veterinary camps found in Namwala namely: Namwala Central, Baambwe, Maala, Chitongo, Kantengwa, Katantila, Nakamboma, Ndema and Muchila. Anecdotal data supplied by the Namwala District Principal livestock Officer indicates that women head 10% of the district's small scale cattle farming households. Therefore, 10% (36) of the total sample size in this study will be female-headed cattle business entities.

The formula gives a confidence level of 95%, the estimated proportion of 50%, and the desired precision of 5%, the necessary sample size assuming random sampling. Each participating veterinary camp will contribute 43 randomly selected participants, of which 10% will be female-headed cattle farming households. In addition, 20 key informants working with the cattle industry in Namwala will participate in this research study as part of the Group Model Building (GMB) unit. Of the 20 key informants, 10% (2) will be females from government and public veterinary extension. Purposefully, 15 respondents were chosen for group focus discussions for each veterinary camp, making a total of 135 for in-depth discussion. However, the number increased to 150, of whom 15 were women. The number of respondents increased from 385 to 405. This is corroborated by Sekaran and Roger (2016), who suggested that the number of respondents could rise or fall by 10% during the actual data collection period.

3.8 Sampling Techniques

All traditional livestock farmers who own animals in the approved veterinary camps and have been rearing cattle in the area for not less than five years and are 18 years of age or above were eligible to participate in this research study. Farmers who own animals in the approved veterinary camps and have been rearing head cattle for less than five years and are below 18 years were not eligible to participate in this study.

This research study utilised two sampling schedules: a systematic random sampling approach and purposive sampling. First, each veterinary camp contributed approximately 45 traditional cattle farmers selected for one-on-one interviews using a systematic random procedure based on the district veterinary register of cattle ownership using a randomly

derived number. Thus, based on this approach, every 5th number drawn from the list's separate female and male register was selected until the target sample size was met. The Group Model Building unit comprised 20 purposively selected key stakeholders.

3.9 Primary Data Collection

For primary sources, data collection was gathered from the following interviews, surveys, workshops, and observations. In coding highly specific sources and procedures in one of the categories, codifying the data sources and collection techniques used in the publications were assessed. For instance, "narrative walks" and "informal discussions" were regarded as forms of interviews. Therefore, primary data was collected through semi-structured interviews and group model building participation.

A study is often guided by research question and boasted by the specific objectives (Zolfagharian et al., 2019). For the sake of this research study, a qualitative coding approach was employed to standardise the study questions according to Zolfagharian et al. (2019). Each review paper was assessed to collect data questionnaire papers to find and gather data regarding the research question(s) listed in the research design matrix. By contrasting and identifying common traits among study issues, the categories were able to take shape. Iterative in nature, this coding method ensured that sensible relationships between categories and data would develop. For instance, the researcher would go back to the previously read papers when a new prospective category was found to see whether there was any relevant evidence. When no new categories appeared, the coding process of category determination by continuous and iterative comparison was said to have reached saturation.

3.9.1 Semi-structured Survey Questionnaire

A Semi-structured survey questionnaire was administered to 405 farmers to collect data for key variables, including household socio-economic characteristics, farm characteristics, livestock dynamics in the five-year period 2016 to 2020, water, pasture, diseases, sources of incomes, expenditure, and climate shocks experienced in the last five years as shown in Table 3.2. The semi-structured survey aimed to respond to the research objectives.

Table 3.2: Distribution of small-scale cattle farmer respondents by vet camp

Vet Camp	Male	Female (10%)	Total 10
Baambwe	40	5	45
Chitongo	40	5	45
Kantengwa	40	5	45
Katantila (Kabulamwanda)	40	5	45
Maala	40	5	45
Muchila (Moobola)	40	5	45
Nakamboma	40	5	45
Namwala Central	40	50	45
Ndema	40	50	45
Total	360	45	385

3.9.2 Focus Group Discussion

Focus Group (FG) interviews were used in this research as one of the key research tools. According to Adeogun (2015) Focus Group interviews are used to collect in-depth group information from knowledgeable participants about a subject . Fatty et al. (2021) observes that the goal of a Focus Group interview is to produce several perceptions of a specific discussion. Both Adeogun (2015) and Fatty et al. (2021) have stated that Focus Group interviews enable the researcher to obtain detailed and valuable information in a short period.

The scholars propose any number between six and ten (Creswell, 2019; Sivarajah & Achchuthan, 2013). The FG interviews for this study were limited to six to ten participants to allow for effective engagement. A total of 150 participated in focus groups, of which 15 were women.

3.9.3 Group Model Building Unit

Two (2) ten-member Group Model Building participant focus groups were conducted to collect additional qualitative primary data to develop the SD model on traditional cattle farming business as shown in Table 3.3.

Table 3.3: Table of Group Model Building Market Players/members identified for this study.

GMB Unit members	Projected Number
Traditional cattle farmers	5
Vet extension (public)	2
Vet extension (private)	2
Beef processors	1
Abattoir operators	2
Traditional chiefs	3
Cattle traders	2
Milk processors	1
Farmers Union	2
Total	20

3.10 Validity and Reliability of the Research Instruments

When formulating a detailed tool, reliability and validity are two of the most important characteristics to be considered (Creswell, 2019; Creswell & Plano, 2017).

3.10.1 Validity

Validity refers to the degree to which evidence supports any inferences a researcher makes based on the information collected using the instrument (Lester et al., 2019; Sweetman et al., 2010). A further definition of validation given by Saunders et al. (2023) is the act of confirming research data, analysis, and interpretation to prove its validity, legitimacy, or authenticity.

In this research study, two types of validity were tested: face validity and content validity. Face validity refers to the likelihood that questions in an instrument will be understood. A pilot study was conducted to improve the face validity, after which responses to each item were scrutinised to identify any misunderstandings and ambiguity. Items that were found to be unclear or ambiguous were modified, improving face validity. Content validity refers to whether an instrument provides adequate coverage of the topic. Expert Opinions, literature searches and pre-testing of open-ended questions were used to improve the content validity used. The questions in the questionnaire were brainstormed with colleagues, and after that, corrections were made.

3.10.2 Reliability

Reliability refers to how the instrument yields the same results on replicated trials (Creswell, 2019). Crobanch Alpha was used to determine a reliability index. A Cronbach alpha of 0.7 and above is good for this study, and the data gave a Cronbach alpha of 0.81.

3.10.3 Triangulation

To ensure that research data, analysis, and interpretation are legitimate, credible, and authentic, a mixed study which involved qualitative and quantitative methods was employed in this research study. According to Saunders et al. (2023), this helped in exposing the "reality" in the data in a study built on positivist premises. This conclusion is contested by interpretivist scholars who believe that "reality" is socially constructed and complex when it comes to studies involving people's ideas, attitudes, and interpretations (Lester et al., 2019). Triangulation is valuable to interpretivists because it broadens, deepens, complicates, and enriches research results (Mills et al., 2021).

3.10.4 Instrument Piloting

Instrument piloting is a crucial element of a good study design. Therefore, the questionnaire in this research study were pre-tested through a pilot study based on 25 traditional farmers before actual data collection. This enabled the revision of the questionnaires before actual data collection in terms of their content. It was found that on average a questionnaire took

1 hour 45 minutes. Therefore, the number of repetitive questions were reduced to bring it to between 45 and 55 minutes.

3.11 Data Analysis

3.11.1 Quantitative Data

This data was collected through semi-structured questionnaires and available from previous research and existing reports. This type of data was used directly. Moreover, data context, meaning and relationship of data had to be understood to give correct formulation about variables' relation in the model. Selected socio-economic data from semi-structured questionnaires was analysed using descriptive statistics such as means, frequencies and percentages, and this research study specifically used Multiple Linear Regression Analysis to establish causal relationship between the outcome variable (cattle herd size) and a set of explanatory variables. The multiple linear regression model was specified as follows:

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 \ldots + b_jx_j$$

In this regression model, y is the dependent or outcome variable (cattle herd size). $b_0$is the constant in the model, and $x_1,\ x_2,\ x_3,\ x_4,\ x_5,\ x_6,\ x_7,\ x_8 \ldots x_j$ are the explanatory or independent variables: farm on title, supplementary feeding, after purchase services, extension services, regular dipping, adequacy of water, regular vaccination, savings and insurance, fenced communal land, open communal land, age, secondary education, number of workers, enough land, traditional ceremony participation, income.

In this model, $b_1,\ b_2,\ b_3,\ b_4,\ b_5,\ b_6,\ b_7,\ b_8 \ldots b_j$ are the coefficients for the independent variables.

This research study also used Logistic Regression Analysis to establish the relationship between business profitability and a set of explanatory variables. The model was specified as follows:

$$y_1 = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + a_6x_6 + a_7x_7 + a_8x_8 \ldots + a_jx_j$$

In this model, y_1 is the dependent variable (profitability), which is discrete variable (profitable or not profitable). $x_1,\ x_2,\ x_3,\ x_4,\ x_5,\ x_6,\ x_7,\ x_8 \ldots x_j$ are the explanatory variables; sold milk, manure, sold to processors, sold to traders, sold skin, sold hooves, business attractiveness, extension services, sold heifers, sold bulls, sold cows, sold calves, sold steers, affordability of costs, sold rainy season, price and number of cattle sold. a_0 is the constant, while $a_1,\ a_2,\ a_3,\ a_4,\ a_5,\ a_6,\ a_7,\ a_8 \ldots + a_j$ are the odds ratios.

This research study also statistically determined the factors affecting sustainability of the cattle business using logistic regression analysis model. The model was specified as follows:

$$y_2 = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + a_6x_6 + a_7x_7 + a_8x_8 \ldots + a_jx_j$$

In this model, y_2 is the dependent variable (sustainability), $x_1,\ x_2,\ x_3,\ x_4,\ x_5,\ x_6,\ x_7,\ x_8 \ldots x_j$ are the explanatory variables: Farm on title, supplementary feeding, after purchase services, business attractiveness, extension services, regular dipping, adequacy of water, regular vaccination, savings and insurance, fenced communal land, open communal land, and secondary education. . a_0 is the constant, while $a_1,\ a_2,\ a_3,\ a_4,\ a_5,\ a_6,\ a_7,\ a_8 \ldots + a_j$ are the odds ratios.

The data was analysed the data using Stata and SPSS package. Data was established and stored in a Microsoft Excel spread sheet for handling, cleaning, and visualisation. While SPSS statistics packages were applied, such as histograms, bar charts, pie charts, measures of data spread, and trends of central tendency. Stata was used to establish casual relationships between dependent variables and a set of explanatory variables.

3.11.2 Qualitative data

Qualitative data was used to construct the SD model structure. This type of data was collected through interview guides and was analysed using content analysis based on themes. This research study used a forward and back approach (iterative) to interpret the meaning from generated data and themes.

3.12 Ethical Considerations

Ethical Clearance was sought from the University of Zambia-Directorate of Research and Graduate Studies – Humanities and Social Sciences Research Ethics Committee (HSSREC). Ethical clearance issue reference HSSREC-20-SEP-005. This research study abides by the following research ethics:

3.12.1 Informed Consent, Confidentiality, and Anonymity

Participants of the survey and group model building were guaranteed confidentiality and anonymity through a coding system of the questionnaires and their positions or organisations they represent. Only the researcher had access to the data and not accessed by any third party. For the questionnaire survey, the objectives, details, and scope of the study were explained, and the authorisation and acceptance sought. Each participant farmer received a clear explanation of the research aims and the researcher's affiliations, and all explained their right to withhold or withdraw information at any time. For the interviews, participants were asked permission for the audio recording of the interview.

3.12.2 Respect and Due Diligence of Local cultural Practices and Social Institutions

Was always sought. The researcher never deliberately placed himself in a position of power and strived not to reinforce a notion of inequality through appropriate data collection techniques.

3.12.3 Access to Information and Dissemination of Findings

No information was withheld from participants or without good ethical reason. Information was made available online once published. However, no personal information of participants will be made available to others.

3.12.4 Location

The research was always conducted at the location of the participants such that the disturbance to the participant's daily activities was minimized.

3.13 Chapter Summary

This research methodology chapter outlined the methods and procedures used to carry out this research study in line with the philosophy and the designed strategy. Sampling, data collection and analysis approaches were discussed. Ethical considerations were discussed and confirmed.

This research study was conducted in one of the districts with the highest density of cattle in Zambia's Southern Province, Namwala. The research aimed to describe how monetisation, the attractiveness of the cattle business offer and business sustainability patterns relate to each other and the wider implications for cattle business development along the livestock value addition chain in the small-scale cattle farming subsector.

The research philosophy or strategy for this research study was pragmatism because it is philosophically and methodologically compatible with the use of mixed research methods. The research study population was 330,582, of which 405 were systemically selected from the traditional cattle farmers from fine veterinary camps for a semi-structured survey questionnaire, a further 150 for focus groups, and 20 for a Group Model Building. For each grouping, 10% were female headed cattle business entities. Selection parameters included being in business for no less than five years and being over the age of 18.

Validation was through triangulation and instrument piloting with 25 traditional farmers before actual data collection. This allowed for the reduction in repetitive questions, reducing the duration from 1 hour 45 minutes down to between 45 and 50 minutes.

Data analysis was through a mixed method of Multiple Linear Regression Analysis for quantitative data analysis to establish causal relationship between the outcome variable (cattle herd size) and a set of explanatory variables; Logistic Regression Analysis to establish the relationship between business profitability and a set of explanatory variables; and statistics to determine the factors affecting sustainability of the cattle business. Qualitative data was collected through interview guides and was analysed using content analysis based on themes.

CHAPTER 4
RESULTS

4.0 Introduction

This chapter presents the data analysis results, beginning with quantitative data results, and concluding with qualitative results. The quantitative results highlight "the nature of the current traditional cattle farming practices" among farmers in the Namwala District of Zambia from 2016 to 2020. Before that, the chapter begins with key descriptive statistics of the respondents who participated in the quantitative survey for this research study. This study comprised of 405 smallholder cattle farmers in Namwala, representing all the 9 veterinary camps, namely Namwala Central, Baambwe, Maala, Chitongo, Kantengwa, Katantila, Nakamboma, Ndema, and Muchila.

4.1 Participant Demographics

Key respondent descriptive statistics for this research study's quantitative survey is shown in Table 4.1.

Table 4.1 Participants' Background Information

Variables	Mean (Std. Dev) / Percent %
Gender	Male: 62.0% Female: 38.0%
Age	Mean: 46 years, Std. Dev: 9.684
Education	Primary: 55%, Secondary: 38.0%, College: 5.0%, University: 2.0%
Household size	Mean number: 12, Std. Dev: 5.672
Land holding	91.0%
Land holding category	Communal: 88.0%, Fenced communal: 41.5%, State: 4.0%
Income (annual)	Mean: ZMW 35,620.24, Std. Dev: 11248
Number of Workers employed	Hired: 1, family workers: 6
Number of years in farming	Mean: 16 years, Std. Dev: 4.225

The data analysis showed that the mean age of the respondents was 46 years, and that 62% were male, while 38% were female. Education wise, 55% had attained primary, 38% had earned secondary, and only 7% had tertiary education. The average household size of the respondents in the area was found to be 12 persons per household. This study found that 91% of the farmers own farmland; of these, 88% own open communal land, while 41.5% operate under fenced communal land and 4% state land. The household average income was ZMW 35,620.24. Maala has the highest household income with ZMW 60,800.00, while Baambwe reported the lowest at ZMW 12,571.11. Further analysis of household income revealed what forms the largest component of household income. Crop sales accounted for 39% of household earnings, followed by 36% of cattle sales. On average, each household had one (1) hired worker working with six (6) family members. However, the results do not vary very much when viewed at the camp level. All the camps have an average of 1 hired worker. This study found that on average, the number of years of experience by farmers in the farming business is 16 years.

4.1.1 Household Income Sources and diversification

A diversified source of income was experienced for Namwala cattle farmers. Crops sales scored the highest with 38.68%, followed by cattle sales with 36.39%, followed by other contributions (off farm business and remittances) with 8.13%, and the lowest was a folder crop with 0.81%. When viewed from the camp level, Muchila scored the highest with 74.00% on crop sales, while Maala scored the lowest with 11.80%. On cattle sales income, Maala scored the highest with 83.44%, while the lowest was Nakamboma with 13.56%. Milk sales are higher in Baambwe camp with 14.78%, followed by Nakamboma with 13.78%, and the least scored is Maala, recording no sales. The percentage of sales from other contributions is highest in Ndema at 17.73%, then in Katantila at 12.1%, and lowest in Maala at 0.67%.

4.2 Nature of Current Traditional Cattle Farming Practices of Smallholder Cattle Farmers in Namwala District of Zambia

From a base of understanding how and why farmers are drawn to cattle farming, key trends were then assessed. Across the five-year research study period of 2016 to 2020, an increase

in key positive trends and decrease in negative trends was experienced, with some variability as shown in the following section. These trends covered cattle numbers, production, input and output costs, and sales to name a few.

4.2.1 How Farmers get into Cattle Farming and the Reasons

This research study found that 42% of smallholder cattle farmers in the area started cattle farming as a result an inheritance, as is the cultural norm of the Tonga people of the Southern Province, who are traditional cattle farmers. Another variable of interest in this study was the reason for owning cattle, this study obtained that over 90% smallholder livestock farmers raise their cattle mainly for sale of live cattle and agriculture purposes (e.g. for ploughing), and a relatively small number (2.96%) of farmers indicated for food as the main reason.

4.2.2 Average Cattle Stock per Household

This research study delved into the growth of cattle stock in Namwala over a five-year period, from 2016 to 2020. Analysis showed a 37.27% growth in the average stock from 22.0 cattle per smallholder farmer in 2016 to an average of 30.2 cattle per smallholder farmer in 2020. Figure 4.1 below shows the change in cattle population in the various veterinary camps over the five years period and offers a general upward trend that cattle had increased in the period under review. From the results, in 2016, Baambwe had the lowest stock of an average of 9 cattle per household in the camp and Maala had the highest at 46 cattle per household. These figures increased in 2020, with the lowest camp Baambwe having 11.0 cattle per household and Maala the highest, having 67 per household.

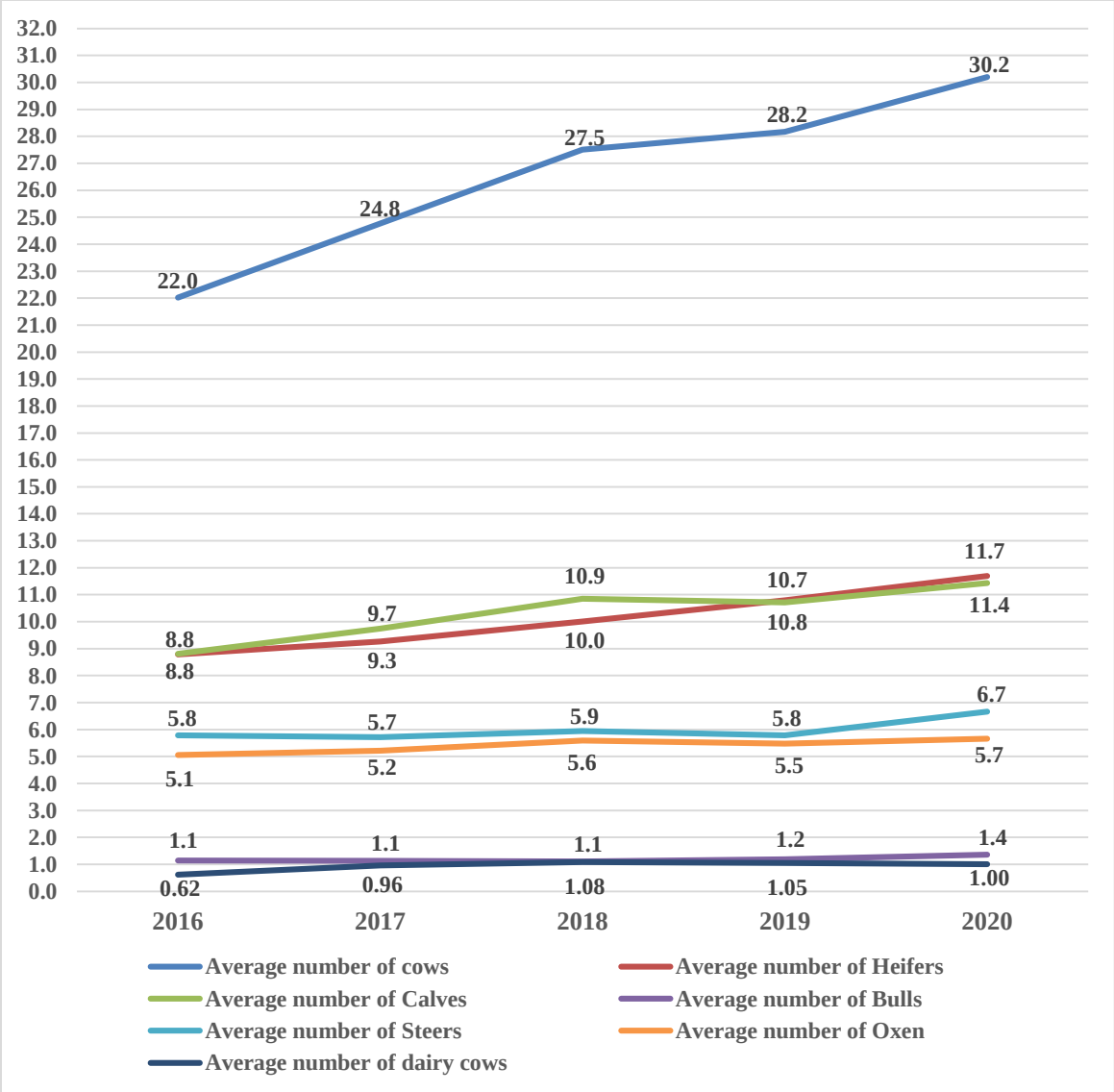


Figure 4.1 Average Numbers of Cattle Owned by Category Over the Five-Year Period 2016 to 2020

4.2.3 Cattle Stock over Five Years Period (2016 to 2020)

This research study results show a positive or upward trend in the average number of cattle owned by the smallholder cattle farmers of Namwala District, as depicted in Figure 4.2 below. The chart shows an increase of 23.04% of cattle owned by the farmers in the Namwala district between 2016 and 2020.

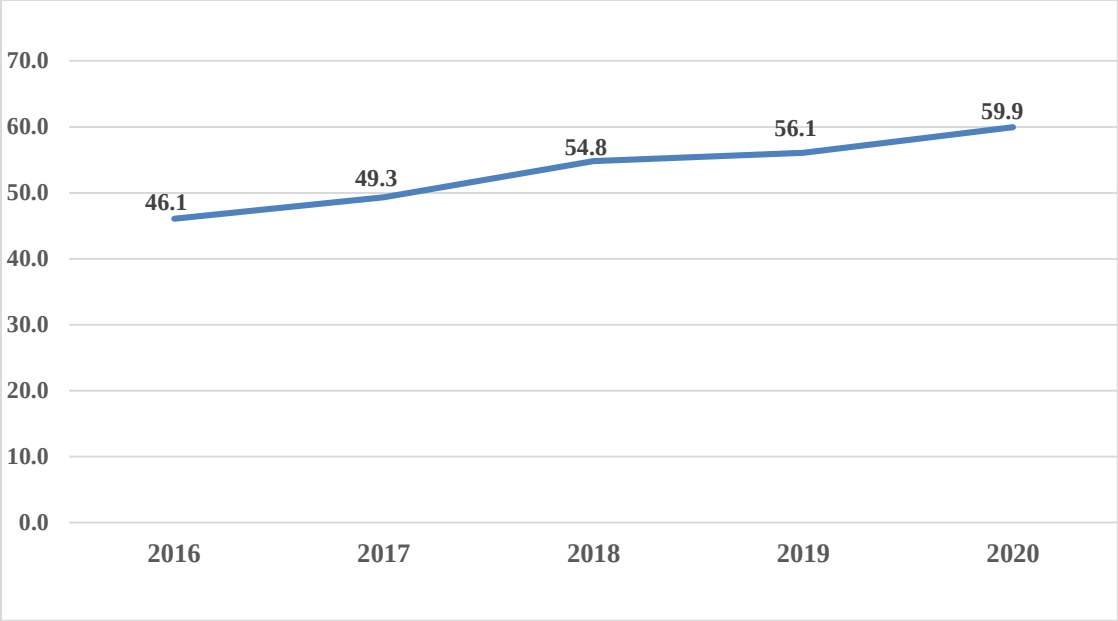


Figure 4.2 Average Number of Cattle

4.2.4 Age at Which Cattle is Sold

This research study found the age at which different categories of cattle is sold in Namwala district (Figure 4.3).

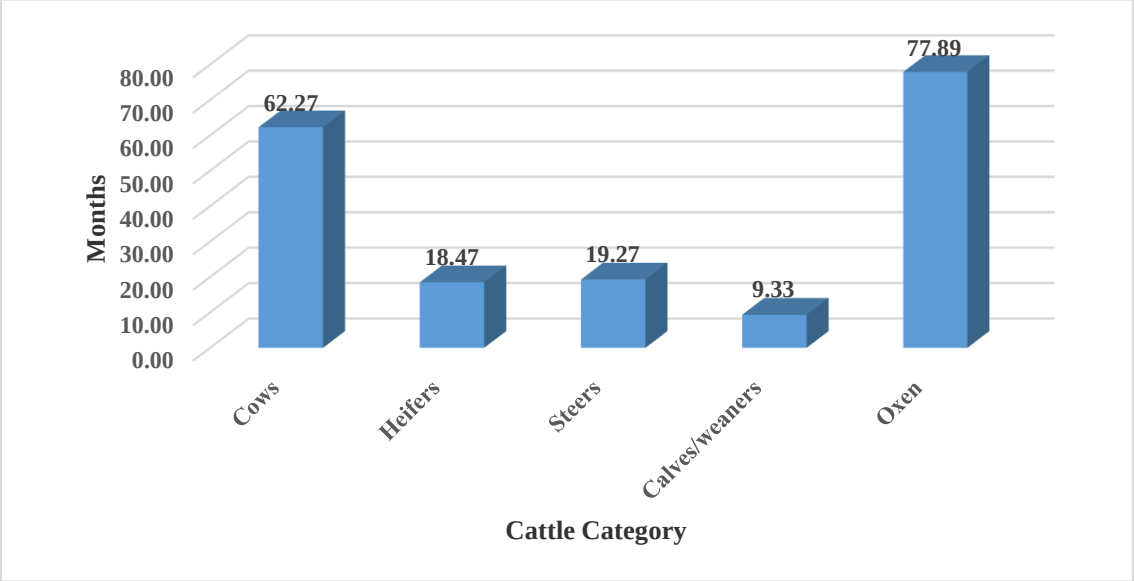


Figure 4.3 Average Age at Which Cattle is Sold (months)

The results indicate that cows are sold at the average age of 63 months, while heifers are sold at 19, steers at 20 months calves and weaners at 9 months, and oxen at 78 months.

4.2.5 Average Number of Cattle Sold Over the Five-Year Period 2016 to 2020

This research study found that cattle sales in Namwala dropped by 16.74% between 2016 and 2020, with the lowest number of cattle sold in a single year in the period under review recorded in 2018 with an average of about six cattle sold per smallholder farmer per annum as shown in Figure 4.4.

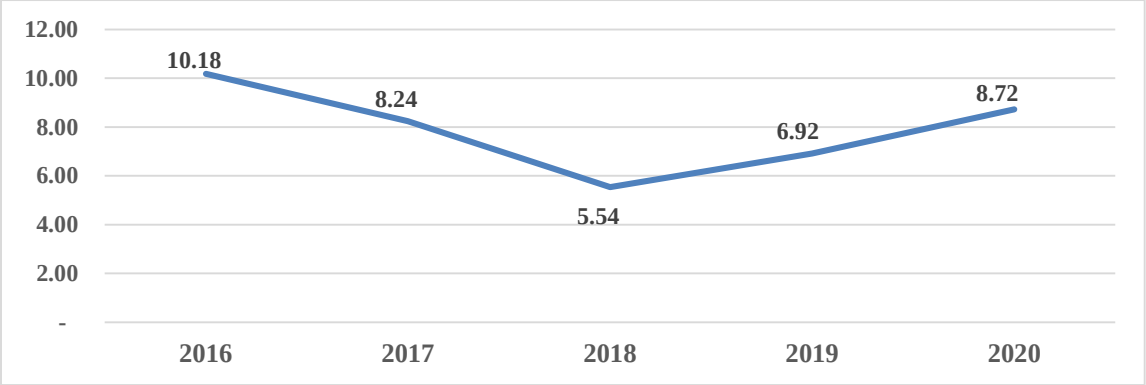


Figure 4.4 Average Number of Cattle Sold from 2016 to 2020

The analysis further extended to sales variation against cattle losses due to theft, disease, or gifting between 2016 and 2020. During the period under consideration, this study found that cattle losses due to disease dropped by approximately 20.5%, while cattle theft in the area decreased from an average of 0.71 cattle per annum to an average of 0.3 cattle per annum over the five years under review. In addition, the use of cattle for social payments such as bride price, debt, or any other payment declined by 17.98% between 2016 and 2020.

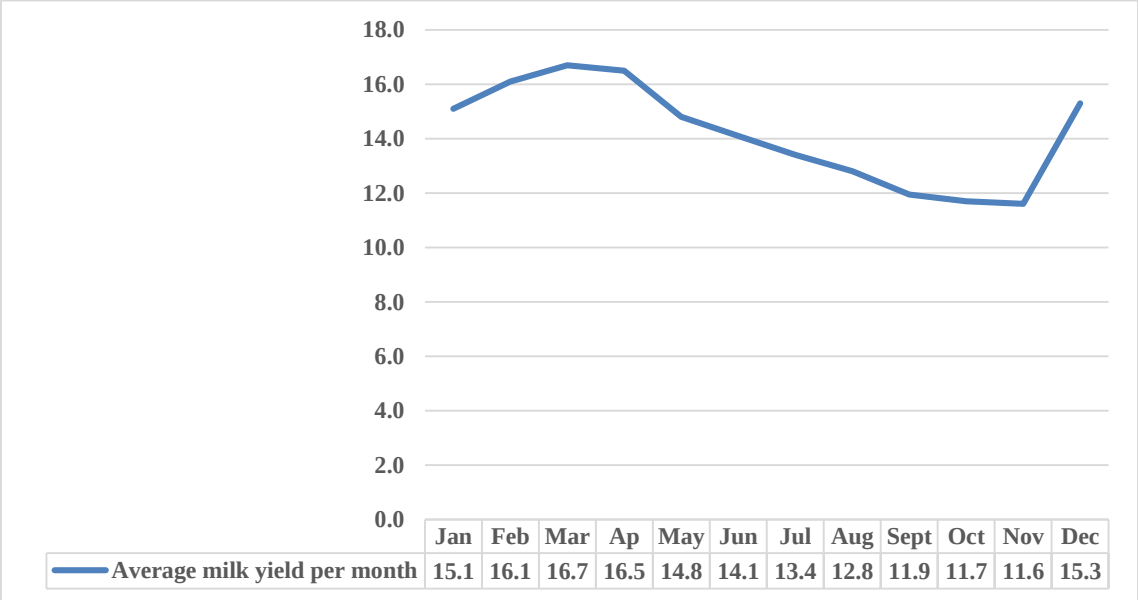
4.2.6 Price of Live Weight of the Animal per Kilogram (ZMW) and Price Determination

Using a 12-month recall period for 2020, this research study found that the price per kilogram of live weight increased by 52.63% between January 2020 and December 2020, from K19.34 to K28.91. Further, this study found that over 78.2% of cattle prices were

determined by the buyers, with only 21.8% of farmers indicating that they could set prices for their cattle.

4.2.7 Milk Yield

The results of the data analysis show that the peak milk yield for dairy animals is in March, with an average of 16.7 litres, followed by 16.5 litres in April, with an average of 15.3 litres in December, and May at an average yield of 14 litres per month. The lowest milk yield is observed between August (12.8l litres) and November (11.6 litres) and begins to rise in December. May to August are moderate months, falling in between, as Figure 4.5 below shows.



	Jan	Feb	Mar	Ap	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average milk yield per month	15.1	16.1	16.7	16.5	14.8	14.1	13.4	12.8	11.9	11.7	11.6	15.3

Figure 4.5 Average Milk Yield per Month in Litres

As observed in Figure 4.5, the average milk yield is a product of the veterinary camps that house the milk centres. According to Figure 4.6, Baambwe scored the highest average milk in litres per month with 21.8 litres, followed by Chitongo with 19.8 litres, then Ndema with 18.0 litres and the least on record was Muchila.

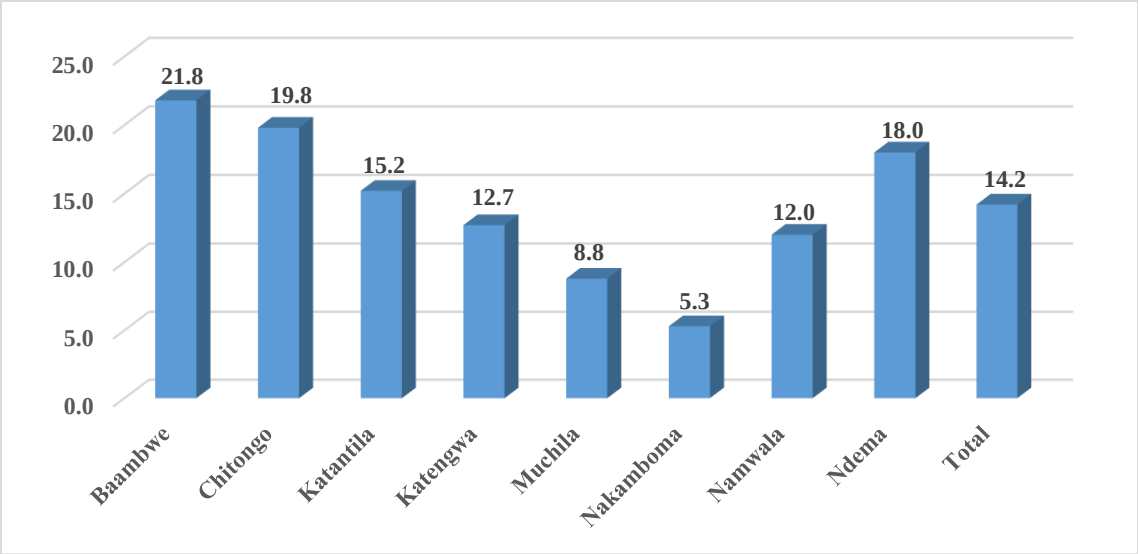


Figure 4.6 Average Milk Yield

Following the observed milk yield trend in Figure 4.6, the trend in price volatility shown in Figure 4.7 indicate that farmers get the highest milk price during August through November when milk yield is significantly low.

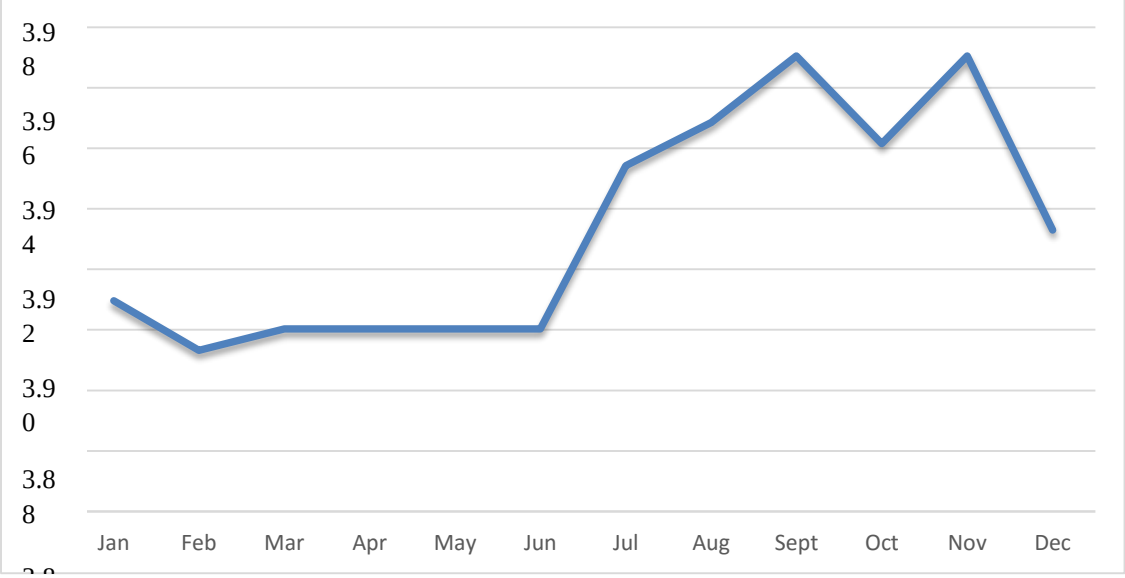


Figure 4.7 Average Price per Litre per Month (ZMW/Litre)

4.2.8 Water Sources

This research study found that 29% (n=158) of smallholder cattle farmers rely on rivers as the water source for their animals, while 26% (n=142) depend on boreholes sunk at the

farms or communal boreholes. In comparison, 14% (n=78) of water is sourced from dams, followed by 12% (n=66) from streams with 9% reporting scarcity of water and only 1% of the smallholder farmers reported accessing multiple water sources. Based on the findings for water availability in the region, most smallholder cattle farmers feed their animals off the plains, which accounted for 52% as a feed source.

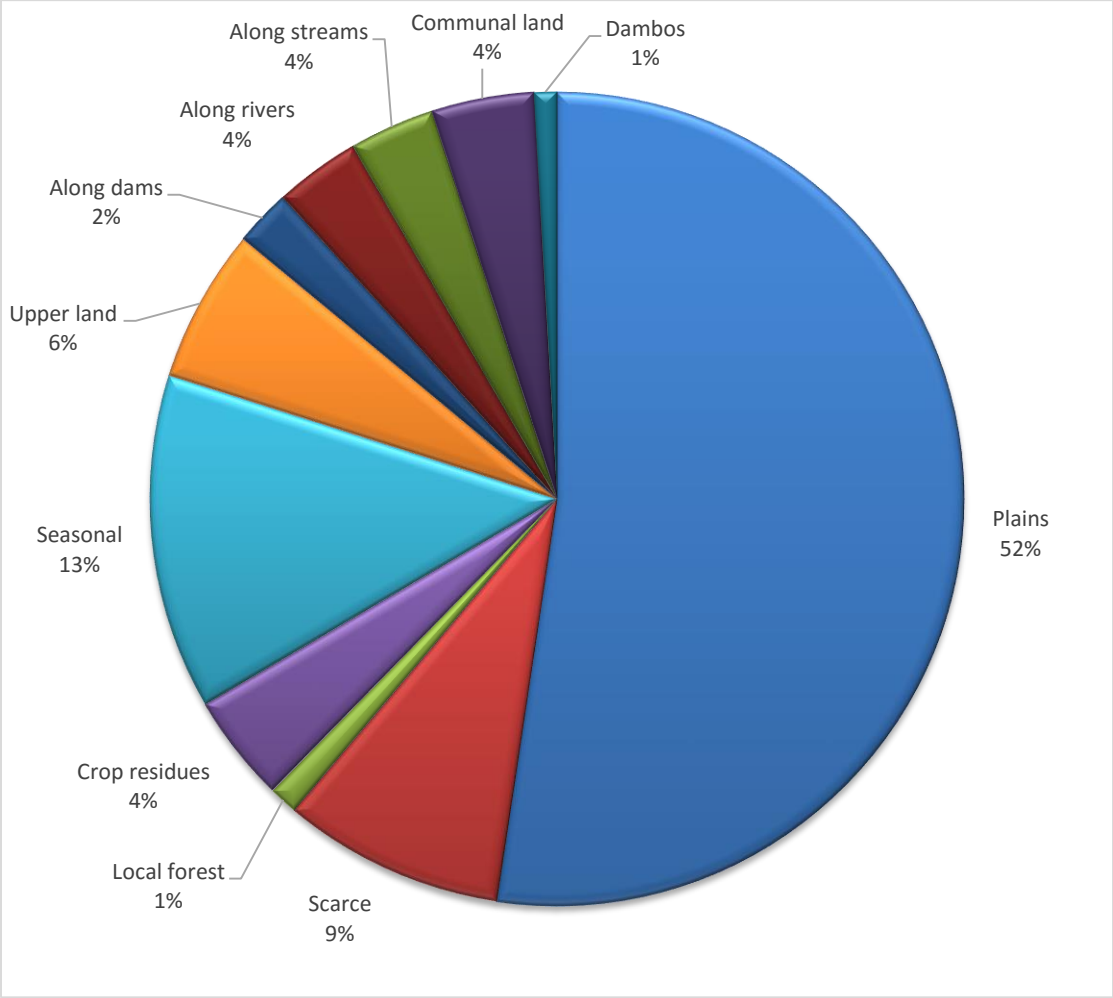


Figure 4.8 Feed Source/Availability

4.3 Business Offerings Available to Cattle Farmers in Namwala

This section shares the findings on the type of cattle business that farmers offer to their clients. During the interviews, the farmers shared thoughts about how attractive the cattle market is and how much value for business they offered to their clients.

4.3.1 Cattle Business Marketing

This research study found that 80% of smallholder cattle farmers in the Namwala District do not market their cattle to potential buyers, and only 20% reported engaging in the marketing of their cattle. Among the smallholder cattle farmers who market their cattle, 54% use mobile phones to search and reach out to potential buyers. Others sell from the farms (10%), taking to abattoirs (6%), taking to sales yard (17%), and other markets (13%) (e.g. border markets like Kasumbalesa, and to processors). This study also assessed the existence of farmer market associations in the area and the levels of participation from the farmers. Over 99% of respondents indicated that they did not belong to any cattle market associations. Farmers were asked to assess the attractiveness of local markets and how beneficial these are to their cattle farming business. On a scale of 1 to 10, with 1 being the lowest rank and 10 the highest rank, most farmers in the region had a rank above 5.

4.3.2 Local Cattle Trading Place

This research study further inquired about the existence of specific local cattle trading places for farmers, and it was discovered that 57% of veterinary camps do not have local trading areas, and only 43% reported having some form of cattle trading places. Of the 43% farmers that reported to have some form of cattle trading areas within the localities, only 19% of them reported regularly using such cattle trading places for both buying and selling of livestock. The analysis further considered how households use the local cattle market. From the results, 23% reported using the facilities every quarter, while 44% reported that they normally use the facilities less frequently.

Of those who often visit local markets, this study found that 62% do so for pressing or meeting school needs. However, the locals using the market to acquire veterinary services or dispose of sick animals accounted for 17% and 1%, respectively.

4.3.3 Attractiveness of the Cattle Market Rating

This research study narrowed the market attractiveness analysis to existing market association systems in the district. Using a scale of 1 to 10, with 1 being the least attractive and 10 being the most attractive market, the market offered by livestock veterinary

professionals in the area ranked the most attractive at 5.5, followed by that of meat processors at 5.4, as depicted in Figure 4.9 below. This study found that in Namwala, the market offered by the cattle market association is the least attractive at 2.2. This is a significant drop in attractiveness compared to the district farmers' ratings to livestock veterinary professional markets. The analysis indicates that the markets offered by veterinary professionals and meat processors are the most attractive markets preferred by smallholder cattle farmers in Namwala District.

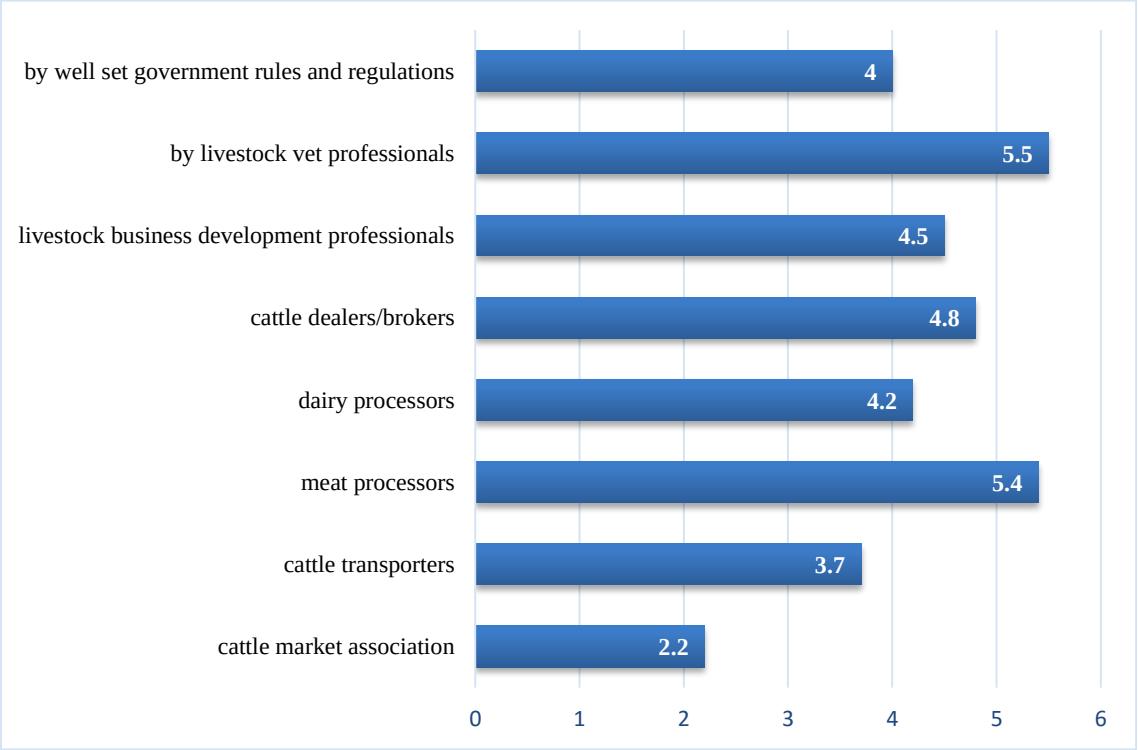


Figure 4.9 Assessment of Market Attractiveness Offered by Market Players

4.3.4 Traditional Cattle Market

This research study assessed the potential of traditional markets and whether they offered strategic partnerships for the preferred market. This study found that most of the farmers i.e., 90%, reported that the traditional markets did not offer any strategic partnerships for the development of cattle business in the area. Of the 10% that reported that traditional markets offered some form of strategic partnerships, most of them cited the effect of the traditional market on cattle market insurance and price discoveries, with 92% indicating

that traditional markets influenced price fluctuations and resulted in good prices in the markets. The analysis further involved a detailed analysis of how traditional markets affect the cattle market at the camp level. This study found that all the camps are affected by the traditional market leading to price fluctuations, with camp average ranging from 60.0% to 97.8%, good prices ranged from 5.7% to 33.33% and animal insurance by 2.58% to 11.11% among the camps.

4.3.5 Intermediaries (middle) or Cattle Brokers

This research study asked about intermediaries or registered brokers in the cattle business market, 82% of farmers revealed that they did not engage intermediaries or brokers in the business. The probing further revealed that intermediaries or brokers are side-lined in cattle transactions in the region as they are perceived to have a more negative impact on the cattle business, such as prolonging business processes, tending to offer lower prices, and increasing business operational costs, compared to having positive impacts such as increasing market prices of animal and linking buyers and sellers in the market.

4.3.6 Unique Value Proposition of Traditional Cattle Business

This study assessed what value advantages the traditional cattle farming business offered to cattle market players in the district., traditional cattle markets were considered advantageous due to proximity (50.0%), providing quality livestock (13.0%), offering better prices (12.0%), and ease of access (11.0%), business advisory services (9.0%) among others.

4.3.7 Preferred Market Players

Over 90% of the cattle farmers preferred the local market. Of those that had some preferred market players, local chain stores such as Pick n’ Pay, Shoprite Checkers, and Choppies Supermarket were the most preferred market players, followed by border markets such as Kasumbalesa market - which was ranked higher than the capital city market of Lusaka and major cities such as Kitwe and Ndola. This study found that on a scale of 1 to 10, cattle retailers/dealers and cattle transporters are the major players in the cattle business in the

district, offering the best deals to farmers with average scores of 5.7 and 5.5, respectively. On the other hand, meat/ food processors ranked third with an average score of 4.8.

This study further probed the features that farmers in the area considered for making the cattle business and services unique and attractive. Mixed livestock sales were ranked the highest common advantageous feature in the region, followed by coordinated livestock collection, availability of mobile communication facilities enabling mobile phone services in the district, and availability of veterinary services facilities such as dip tanks. Farmers also pointed out the existence of specialist slaughtering and cold storage/butchery facilities as among the services that raised the cattle farming business profile in Namwala District. This is shown in figure 4.10 below.

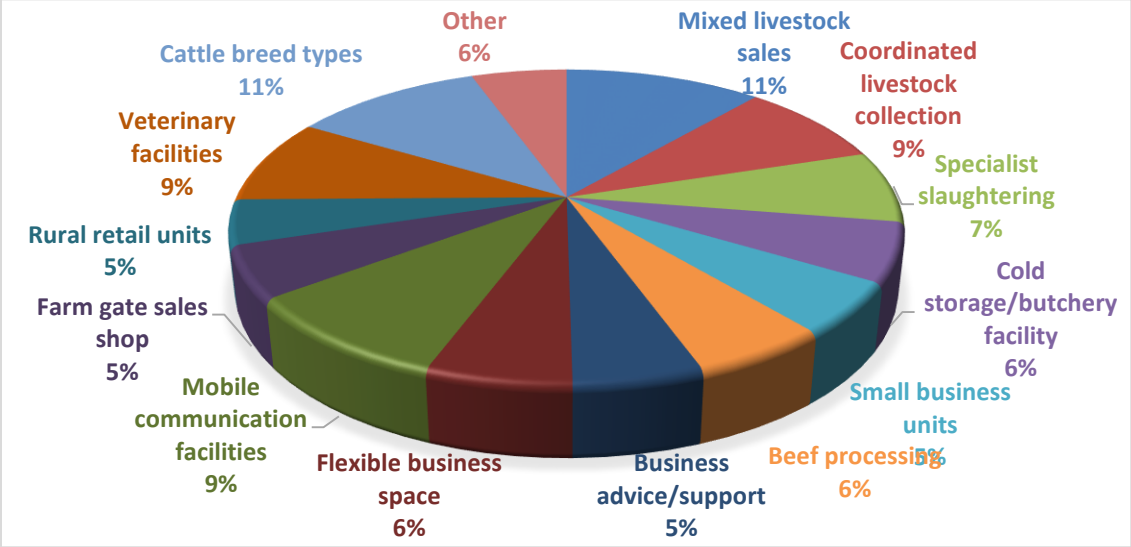


Figure 4.10 Uniqueness and Attractiveness of the Cattle Business and Services

4.4 Factors that Influence Cattle Sales

This research study found that several factors influence the sale of cattle in the area, such as the age of the animal, body condition, prevailing market demand and supply, and seasonality, as depicted in Figure 4.11.

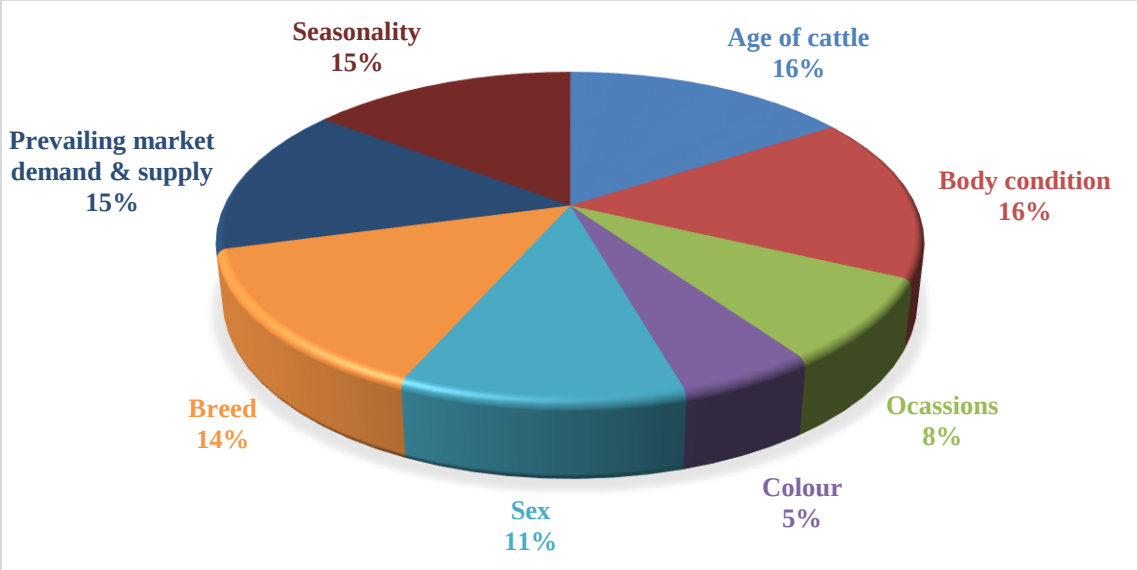
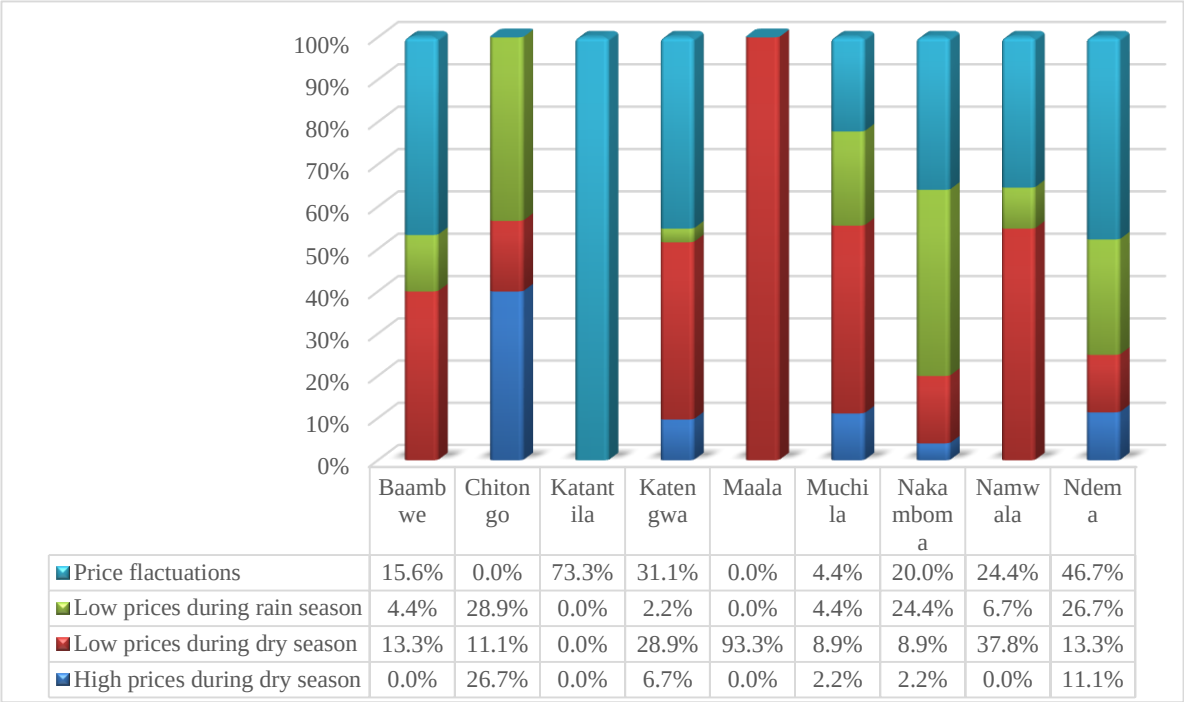


Figure 4.11 Factors Influencing Cattle Sales

4.5 Effects of Seasonality on Cattle Sales in the District

Price fluctuations affected cattle sales, with high prices during the rainy season calling for major sales demand. As shown in Figure 4.12, Katantila showed significant price fluctuations while Maala camp had a record high of low pricing during dry seasons. The high price during the rainy season can be attributed to increased demand for draught animals and for meat during festive season.



	Baambwe	Chitongo	Katantila	Katengwa	Maala	Muchila	Nakambomba	Namwala	Ndema
Price flactuations	15.6%	0.0%	73.3%	31.1%	0.0%	4.4%	20.0%	24.4%	46.7%
Low prices during rain season	4.4%	28.9%	0.0%	2.2%	0.0%	4.4%	24.4%	6.7%	26.7%
Low prices during dry season	13.3%	11.1%	0.0%	28.9%	93.3%	8.9%	8.9%	37.8%	13.3%
High prices during dry season	0.0%	26.7%	0.0%	6.7%	0.0%	2.2%	2.2%	0.0%	11.1%

Figure 4.12 How Seasonal Variations Affects Sales

4.6 Monetisation

This section brings out results on how well the Namwala district's smallholder cattle farmers' business is performing in terms of profits, sales performance, and business expenses.

This research study determined the cost structure of the cattle business, that is, the total costs involved in raising cattle to the point of sale (Table 4.2). This study estimated the cost for Calf/Weaners to be K910, K1480 for Steers, K1530 for Heifers-empty, K1655 for Heifer-incalf, the cost for raising a cow was estimated to be K2955, K3420 for oxens, and K3470 for bulls. Labour cost had the highest portion of the cost structure, followed by feed supplements, and then Vaccines/Dewormers/ dipping/ treatments.

Table 4.2 Cattle Business Cost Structure

Cattle Category	Feed cost (K)	Feed supplement cost (K)	Vaccines/ Dewormers/ dipping/ Treatments (K)	Labour (K)	Other Costs involved (K)	Total (K)
Calf/Weaners	0	200	20	670	20	910
Steers	0	250	45	1,160	25	1,480
Heifers-empty	0	300	45	1,160	25	1,530
Heifer-in calf	0	300	70	1,260	25	1,655
Cows	0	450	325	2,100	80	2,955
Bulls	0	600	400	2,300	120	3,420
Oxen	0	650	400	2,300	120	3,470

Concerning the income structure, as shown in Table 4.3, of the cattle business, this study found that the income from the sale of calf/weaner is K3200, K7000 for Steers, K7000 for Heifers-empty, K8600 for Heifers-incalf, K10,000 for Cows, K15,000 for Bulls, and K10,000 for Oxen. Farmers were not earning income from selling of manure and other animal products. Income from the sale of milk was also found to be very little. In addition, farmers were not earning income from labour services using bulls and oxen.

Table 4.3 Cattle Business Income Structure

Cattle Category	Whole animal sale	Milk	services	Manure	Other revenue	Total
Calf/weaner	3,200			0	0	3,200
Steers	7,000			0	0	7,000
Heifers-Empty	7,000			0	0	7,000
Heifer-in calf	8,600			0	0	8,600
Cows	10,000	K60		0	0	10,060
Bulls	15,000			0	0	15,000
Oxen	10,000		0	0	0	10,000

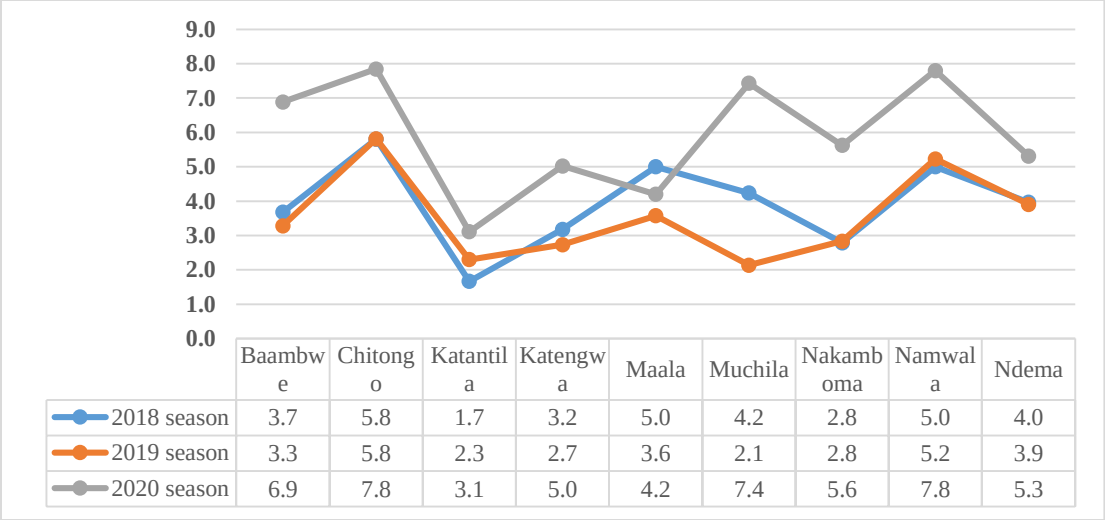
Cost-benefit analysis was conducted to determine the profitability of the cattle business among the farmers (Table 4.4). This study obtained a cost-benefit ratio of 3.52 for Calf/Weaner, a ratio of 4.73 for Steers, 4.58 for Heifers-empty, 5.20 for Heifer-in calf, 3.38 for Cows, 4.39 for Bulls, and 2.88 for oxen. The ratios indicate that cattle business is profitable. After adjusting the costs by an increase of 10%, this study still obtained the cost-benefit ratios ranging from 2.6 to 4.7, indicating that the cattle business is a profitable business venture.

Table 4.4 Cost-Benefit Analysis of the Cattle Business

Cattle Category	Cost ZMW	Income ZMW	Benefit/Cost Ratio	10% Cost Increase	Benefit/Cost Ratio @10% Cost increase
Calf/Weaner	910	3,200	3.52	1,001.0	3.20
Steers	1,480	7,000	4.73	1,628.0	4.30
Heifers-Empty	1,530	7,000	4.58	1,683.0	4.16
Heifer-in calf	1,655	8,600	5.20	1,820.5	4.72
Cows	2,955	10,000	3.38	3,250.5	3.08
Bulls	3,420	15,000	4.39	3,762.0	3.99
Oxen	3,470	10,000	2.88	3,817.0	2.62

4.7 Profitability of Cattle Business

The annual average profitability of cattle business per camp for the three years period: 2018, 2019, and 2020 are presented in Figure 4.13 below. 2020 was generally a better year in revenue earnings for farmers across all camps. There was no significant change in profits between 2019 and 2018, except for the Maala camp which recorded higher revenue earnings in 2018 which was better than was recorded in 2020, while Katantila reported the lowest revenue earnings in 2019.



	Baambwe	Chitongo	Katantila	Katengwa	Maala	Muchila	Nakamboma	Namwala	Ndema
2018 season	3.7	5.8	1.7	3.2	5.0	4.2	2.8	5.0	4.0
2019 season	3.3	5.8	2.3	2.7	3.6	2.1	2.8	5.2	3.9
2020 season	6.9	7.8	3.1	5.0	4.2	7.4	5.6	7.8	5.3

Figure 4.13 Revenue Rating in Cattle Business Over Three Years

Most of the farmers cited higher prices as better returns in particular years. Only farmers in Maala, 77.8%, reported high demand as a possible reason for the high revenue recorded in 2019. This research study further explored why the farmers had poor returns in the cattle business for certain years. Among the reasons given by the farmers in the camps, this study found that low animal prices were the main major reason (54%) for recorded low profitability especially in 2019, then significant drought rates (12%) from the 2018/2019 rain season in Southern Province, livestock diseases (9.0%), cost of materials (13.0%) and other factors.

This research study further probed whether farmers had a choice on selling cattle or its products and services as they wanted. The majority of the farmers indicated that the local market did not offer them the choice to choose between selling cattle or its by-products and services as they wanted. This study found that reasons such as limited number of buyers, and buyers dictating market prices limit choices in what form to sell their cattle, either as a whole or slaughtered with its by-products.

4.8 Effect of Household Size on Cattle Business Profitability

This research study sought to understand whether the household size had any impact on the profitability of the cattle business and found that 64% of farmers indicated that household size did not affect cattle business profitability. The 36% of the farmers that felt

that household size had an impact on the profit levels of the cattle business cited the increased household labour due to large household size having a positive impact on the business. However, at the same time, some of them indicated that increased household expenses due to large household size negatively affected the business.

4.9 Effect of Cultural Practices on Cattle Business

This research study also explored the effect of cultural practices on the cattle business in the district. The statistical results in Figure 4.14 below show that 48% reported that funerals affected business operations, and 25% said marriages were also an effective cultural practice that affected business. In addition, 10% of the farmers also indicated that traditional ceremonies were a significant factor in the growth of the cattle business in the district.

At the camp level, the results are widely dispersed, in Nakamboma camp, traditional ceremonies had a significant impact on cattle business. In Baambwe and Maala camp prestige of cattle, ownership was considered the most significant. Maala also scored high on marriage impact on the business. The other significant factor affecting disposing off of cattle was funerals.

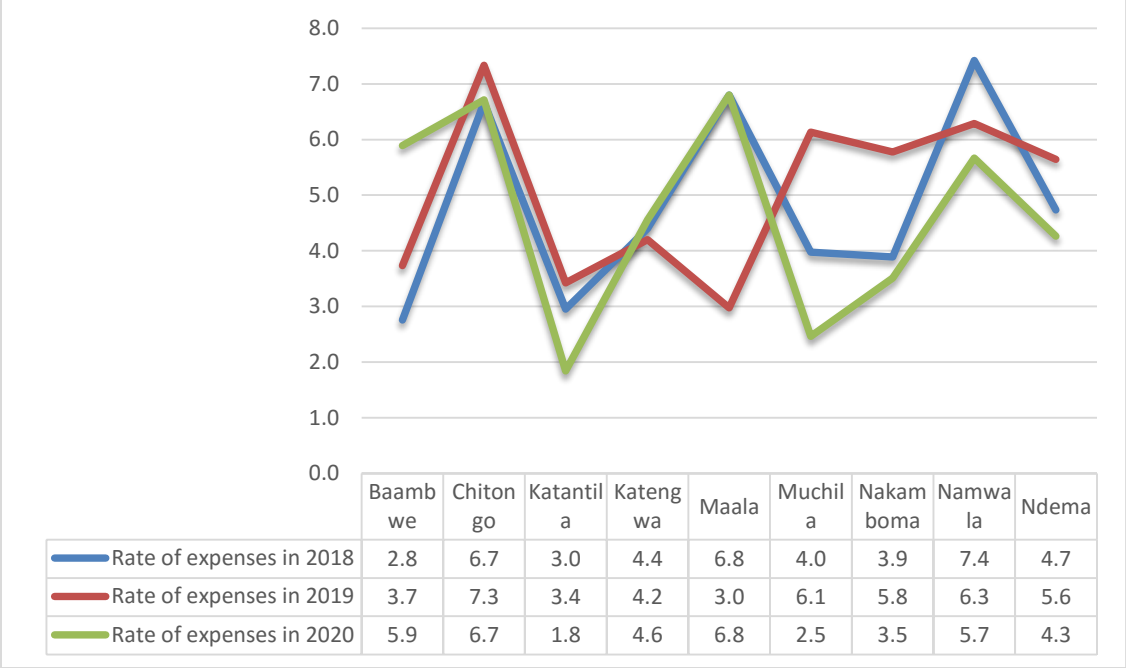
Figure 4.14 Cultural Practices Impacting Cattle Business

4.10 Cattle Business Cost Structure

This research study sought to establish the cost structure of the cattle business in Namwala district. Several items contributed to the cost; veterinary services cost accounted for 19%, followed by local taxes at 17%, water at 14%, transport 13% and loading offloading fees at 11%. On the other hand, wages for cattle attendants accounted for the least at 8%, and feed at 8.0%.

4.10.1 Expenses in the last three seasons of cattle business

This study further conducted a cost structure analysis, as presented in Figure 4.15 below, over the last three years for the period under review with 2019 ranking highest in expenses, except Maala Camp, solidifying the reason why 2019 was also ranked the lowest profitable year among the three as early discussed in this section.



	Baambwe	Chitongo	Katantila	Katengwa	Maala	Muchila	Nakamboma	Namwala	Ndema
Rate of expenses in 2018	2.8	6.7	3.0	4.4	6.8	4.0	3.9	7.4	4.7
Rate of expenses in 2019	3.7	7.3	3.4	4.2	3.0	6.1	5.8	6.3	5.6
Rate of expenses in 2020	5.9	6.7	1.8	4.6	6.8	2.5	3.5	5.7	4.3

Figure 4.15 Expenses in the Last Three Seasons of Cattle Business

4.11 Access to Finance

This research study sought to find out whether farmers had access to financial services from financial intuitions such as financial Banks, Insurance companies, and Government/Families. The results revealed that the majority had no access to financial

services and products; 286 (70.62%) respondents had no financial access from the bank, while 119 (29.4%) had financial access; 396 (97.78%) had no financial access from insurance companies and only 9 (2.22%) had access, 385 (95.06%) had no financial access from the government, only 20 (4.94%) had access. Access to finances from family stood at 23 (5.7%), 382 (94.32%) farmers had no financial access from family, as shown in Figure 4.16. However, it should be noted that banks have been wishing harder to penetrate the market compared to insurance companies and government. The results clearly indicate a huge gap in financial access.

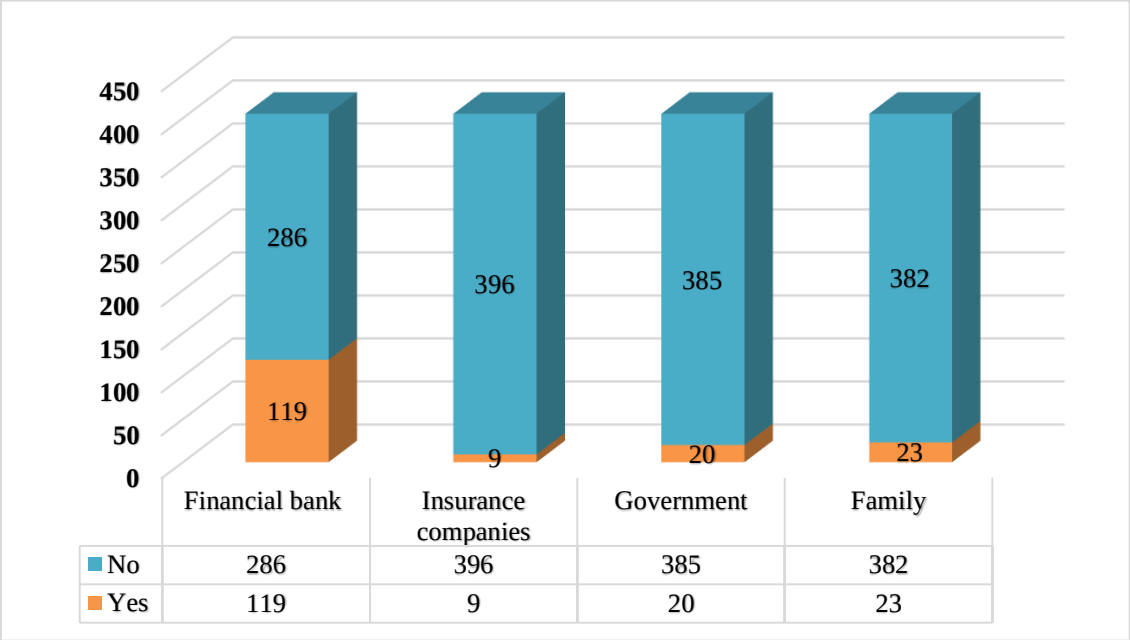


Figure 4.16 Access to Financial Services Through Various Institutions

4.12 Revenue from By-Products

This research study sought to find out whether farmer household businesses source revenue from the by-products such as milk, hooves, hides, and dung. The results showed that of the 405 respondents, 78% (316) of the farmers do not source any formal revenues out of the by-products while 22% (89) do so as shown in figure 4.17. Further analysis shows that of those 78% that indicated that they do not source revenue from by-products, 379 farmers are those who don't benefit from hide sales as the highest, followed by 346 from hooves losses, followed by 291 from dung losses and the least is from 248 from milk losses. However, of the 22% that secure revenue from the sales of by-products, 157 farmers source

revenue from milk sales, 114 farmers from manure or dung sales, followed by 58 farmers from the sale of hooves, and the least 25 famers from hide sales.

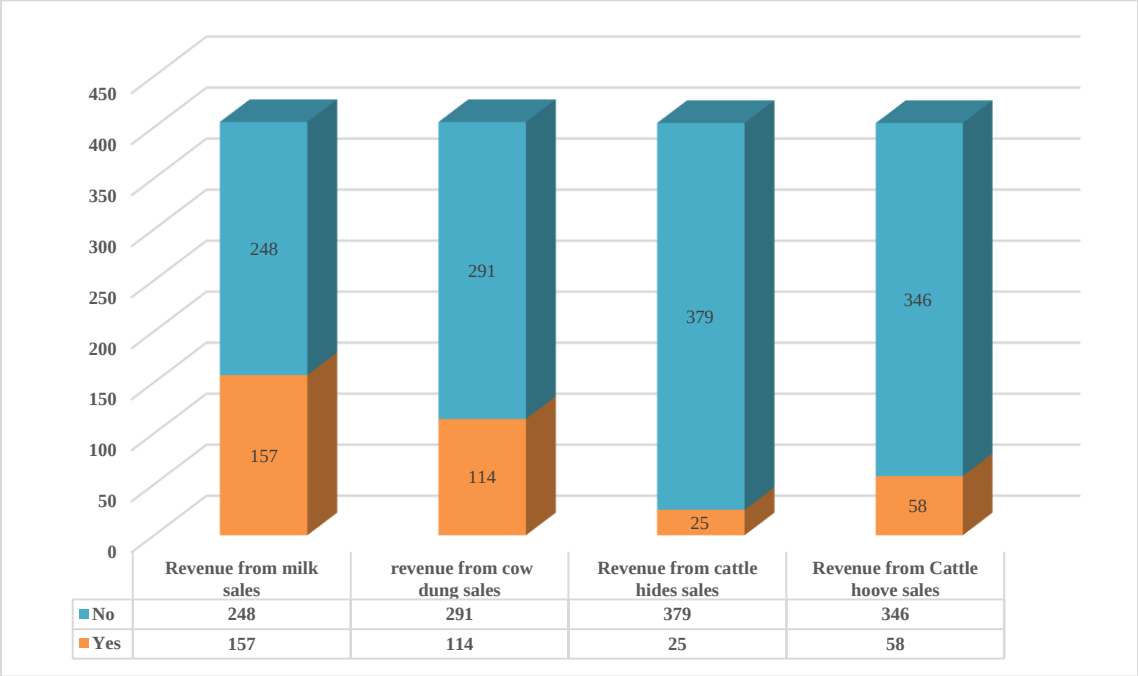


Figure 4.17 Revenue from Products

Camp level analysis showed that some camps such as Maala reported zero earnings from milk, and the maximum was Baambwe camp where 73.3% of farmers were earning revenue from selling milk. Maala camp also reported zero revenue earning from dung, highest earning was in Nakamboma camp with 55.6% of farmers earning from selling dung. Maala and Muchila camps had no revenue earnings from selling cattle hides, the highest was in Ndema camp where 15.6% of farmers reported earning revenue from selling hides. Maala, Muchila and Baambwe camps reported not earning revenue from selling cattle hooves. Chitongo camp reported the highest number of farmers (51.1%) selling cattle hooves. This clearly shows the need to develop the market for cattle by-products.

4.13 Batter System or In-kind Trade Practices

This research study sought to understand the in-kind trade practices in the area and established that majority of the farmers were equally split between never engaged in in-kind trading of cattle with other merchandise or commodities and those that sometimes practised the barter system. This study found that 48% of farmers sometimes engage in

barter system, 48.0% have never engaged in batter system, and 4.0% of the farmers always engage in batter system.

4.14 General Business Assessment

This research study inquired on the general perception of the cattle business in the district, majority 77.28% (313) of the farmers reported a fair performance while 17.28% (70) farmers indicated that the business was very adequate and 5.19% (21) reported it was not adequate, as depicted in Figure 4.18 below.

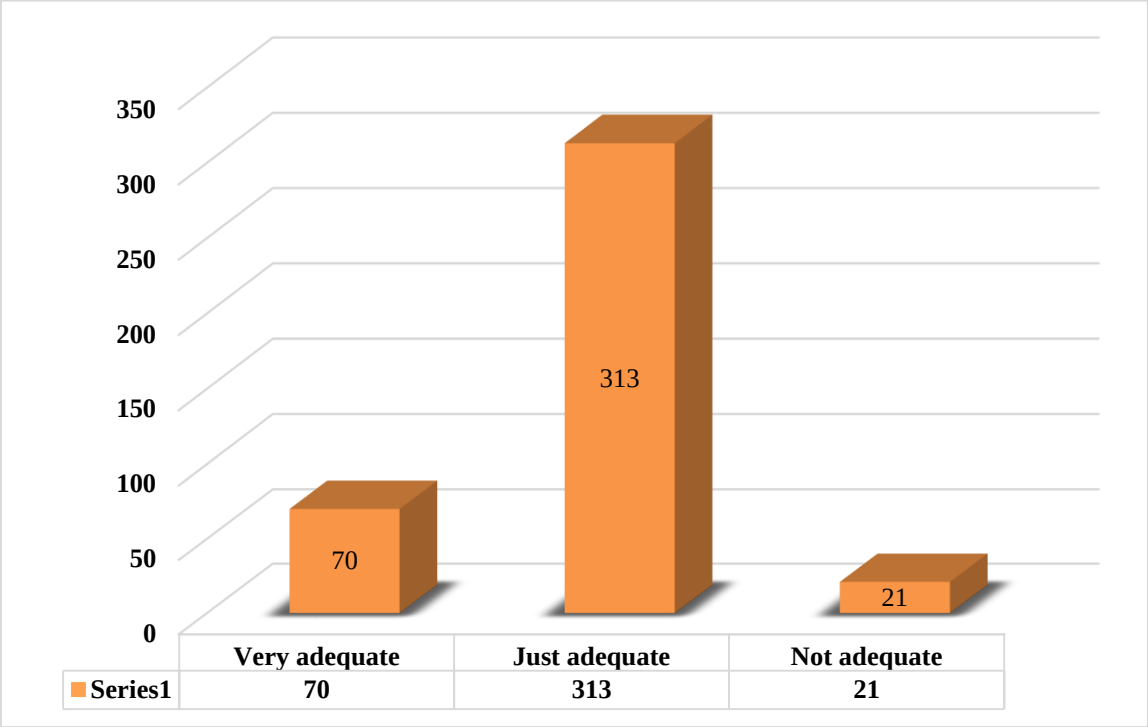


Figure 4.18 General Assessment Picture of Cattle Business in Namwala District

4.15 Sustainability of the Smallholder Cattle Business

This section presents how short- and long-term sustainable the smallholder cattle business is. The section focuses on the competitiveness of business, how well smallholder cattle farmers adopt newer cattle business practices, and the business exit strategy to ensure the business remains viable and profitable.

4.15.1 Ongoing Competitive Advantage Systems

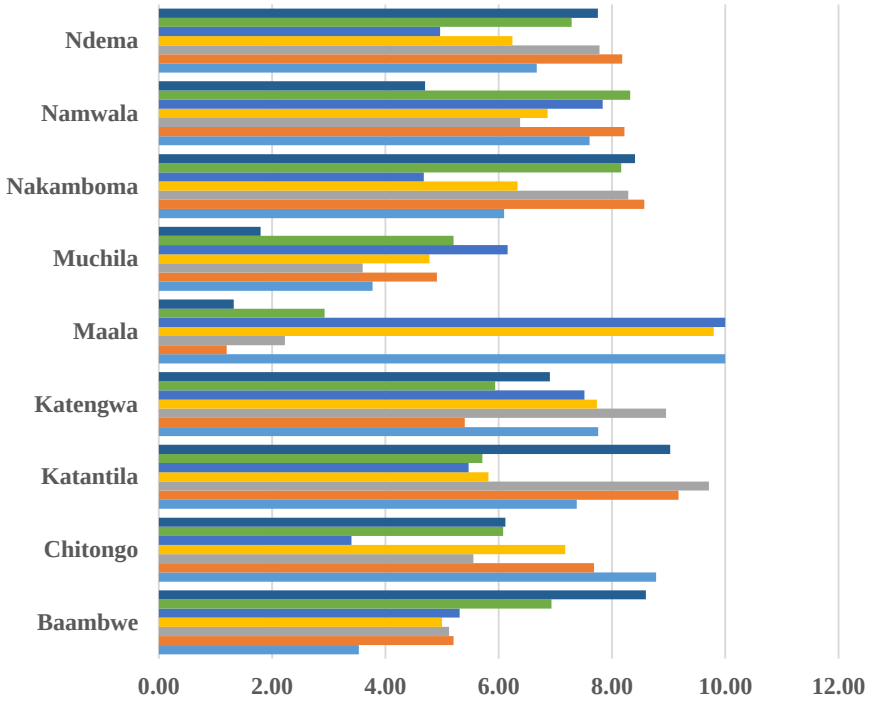
This research study found that using a rating score of 1 to 10, with 1 being disagreed and 10 agree, the smallholder cattle farmers in Namwala felt that, with an average score of 6.70, traditional cattle rearing had lower costs; have access to resources and allows players to maintain and grow their businesses. Asked about their perception of how traditional ceremonies affected business growth in the area, farmers rank was 6.64, thus agree. Figure 4.19 below shows the statistical ratings at the camp level for the various business insights.

4.15.2 Willingness to Adopt New Technologies

This research study found that 93% of smallholder cattle farmers are willing to adopt new technologies (e.g., planting pasture, grazing plant residue, record system, breeding planning) to improve their cattle business. In addition, this study found that 76% of the smallholder cattle farmers in the district had already adopted at least one or more innovations.

4.15.3 Adopted innovations - Adopted Cattle Management

This research study found that the most adopted management practice was grazing plant residues, accounting for 48% of the cattle management innovations. This implies that farmers in Namwala no longer burn crop residue in their fields, but rather preserve or leave them in the field for their animals to feed on; that is a sustainable agricultural practice (Figure 4.20).



	Baambwe	Chitongo	Katantila	Katengwa	Maala	Muchila	Nakamboma	Namwala	Ndema
Partnerships are being entered into by cattle farmers and other key market player	8.60	6.12	9.03	6.90	1.32	1.80	8.41	4.70	7.75
The bargaining power of buyers is increasing	6.93	6.08	5.71	5.94	2.93	5.20	8.16	8.32	7.29
Transhumas or Kuwila grazing systems influence the decision to sell animals	5.31	3.40	5.47	7.51	10.00	6.16	4.68	7.84	4.97
Annual ceremonies such as Shikaumpa/Shimunenga help to grow the traditional cattle business	5.00	7.18	5.82	7.73	9.80	4.78	6.33	6.87	6.24
The current traditional approaches to cattle farming allows players to maintain and grow their business	5.13	5.56	9.71	8.96	2.23	3.60	8.29	6.38	7.78
Traditional cattle farmers have access to cattle rearing resources	5.20	7.68	9.18	5.40	1.20	4.91	8.57	8.22	8.18
Traditional cattle farming business has lower cattle rearing costs compared to others	3.53	8.78	7.38	7.76	10.00	3.77	6.10	7.60	6.68

Figure 4.19 Ongoing Competitive Advantage Systems

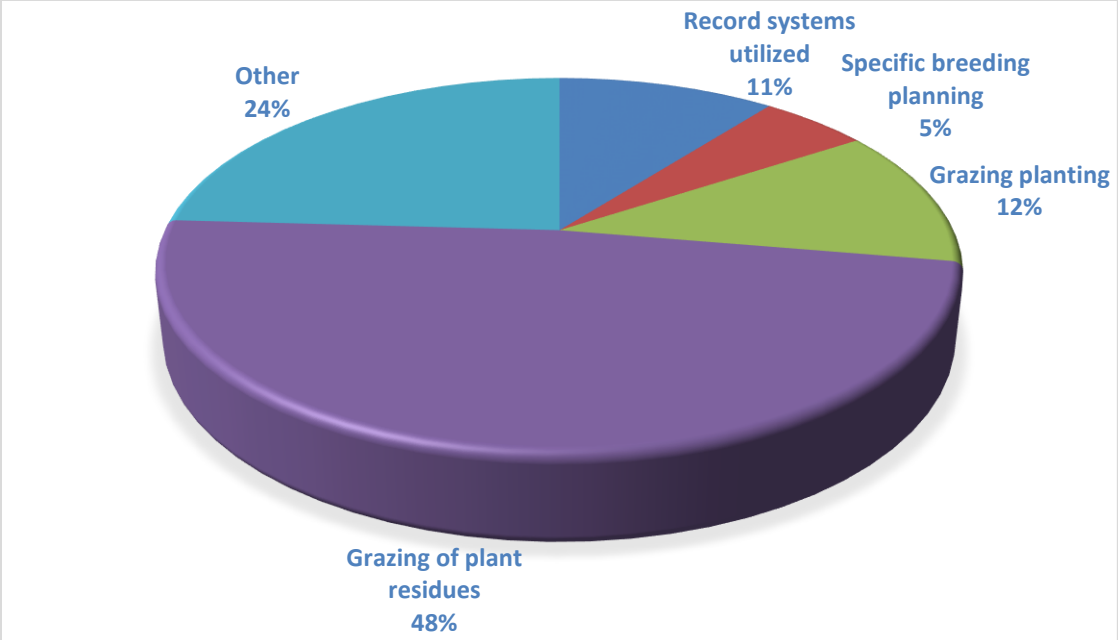


Figure 4.20 Adopted Innovations-Cattle Management.

Analysis of data for camp level showed Muchila with the highest number (19.3%) of farmers using grazing of plant residues. At the same time, Baambwe scored highest in terms of farmers implementing grazing planning (32.0%), specific breeding planning (31.8%) and record system utilisation (40.9%).

4.15.4 Adopted Innovations-Feeding

This research study found that 48% of smallholder farmers used vitamins to improve animal feeding while molasses/urea and silage accounted for 12% and 11%, respectively. Only 5% of the farmers were using processed feed, 24% of farmers indicated feeding cattle other feed supplements (e.g. sunflower cake, cotton cake, soya bean cake), as depicted in Figure 4.21 below.

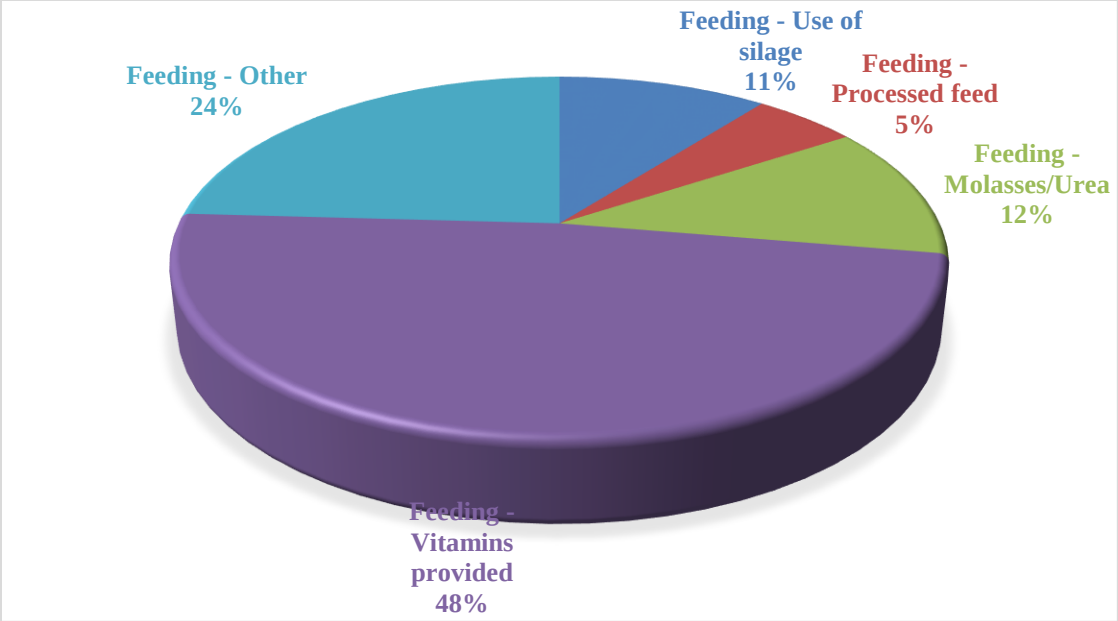


Figure 4.21 Adopted Innovation-Animal Feeding

At camp level, Baambwe had the highest adoption rates for the use of molasses, processed feed, and silage to feed animals while the smallholder cattle farmers in Muchila used more vitamins in feeding programs.

4.15.5 Adopted Innovations-Breeding

This research study found that crossbreeding was the most widely adopted among the novel breeding initiatives available at 30%, followed by calving selection and female breed incorporated at 22% and 20% respectively. In addition, 16% of the farmers indicated using male breeds only for cross breeding, 12% for other breeding systems as shown in Figure 4.22 below.

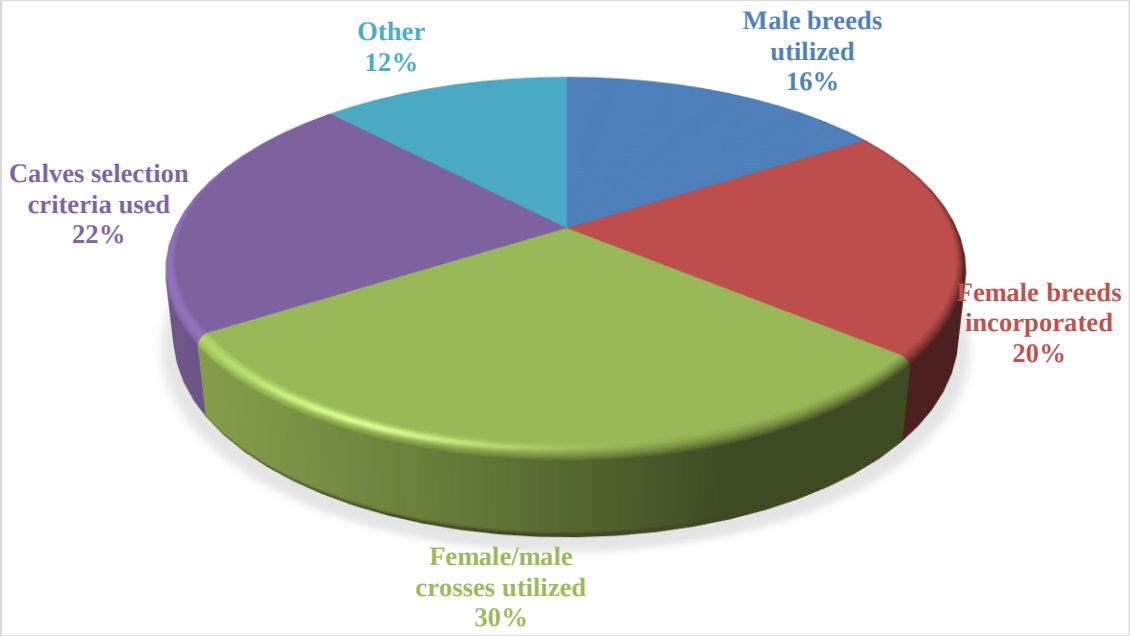


Figure 4.22 Adopted Innovation -Animal Breeding

At camp level, Maala scored highest in utilising improved female breeds, using female/male crossbreeds, and selecting calves, while Baambwe scored highest in adopting improved male breeds.

4.15.6 Adopted Innovations-Reproduction

Figure 4.23 below shows that 35% of farmers still used continuous mating for reproduction among their cattle stock, with only 22% employing controlled mating. In addition, 19% of smallholder farmers conducted cow body condition analysis to assess readiness for mating of the cows, while 17% conducted a bull evaluation to improve mating success.

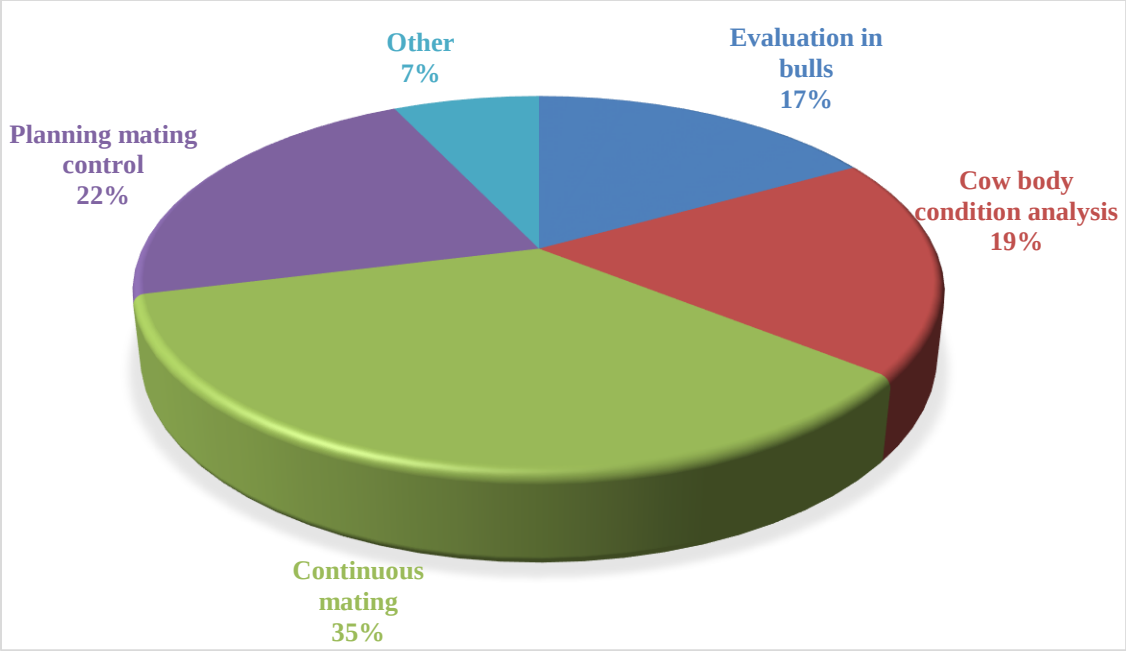


Figure 4.23 Adopted Innovations-Reproduction System

The data analysis at the camp level for the adoption rates of the various reproduction initiatives in Namwala district showed that Maala was leading in all technologies.

4.15.7 Adopted Innovation-Animal Health

This research study found that farmers have adopted several health innovations such as deworming, spraying and dipping, vaccines, and parasitic disease diagnosis, as depicted in Figure 4.24 below.

Camp level analysis found that Maala scored the highest adoption rates in spraying and dipping (12.9%), deworming control (12.8%), and parasite diagnosis (18.7%), while farmers in Ndema and Nakamboma scored the highest adoption rates for vaccinations (15.6%) and animal health planning (17.7%) respectively.

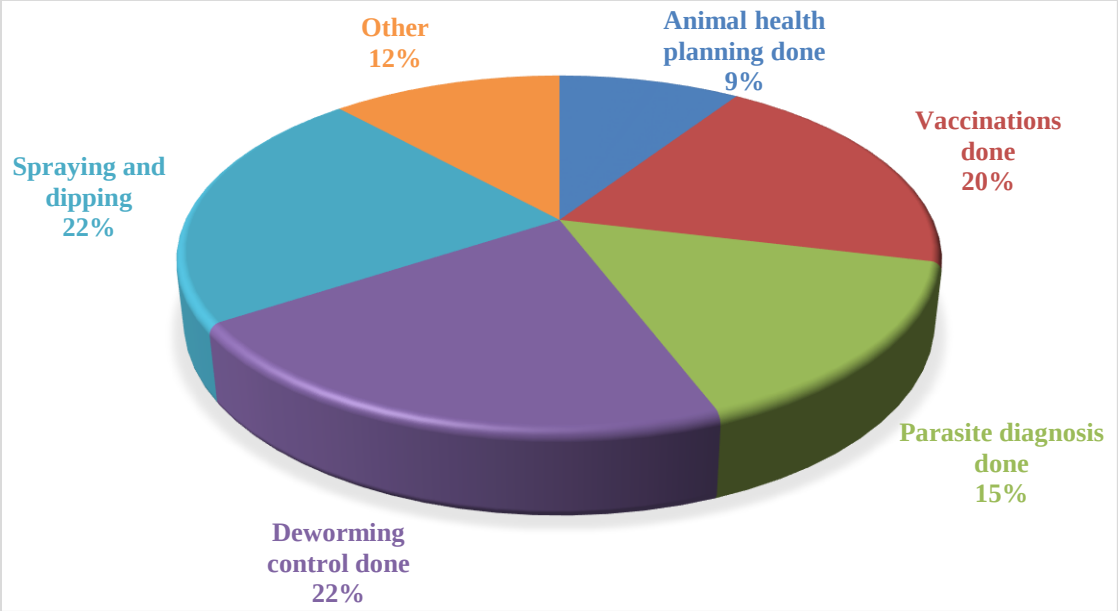


Figure 4.24 Adopted Innovation Animal Health

4.15.8 Adopted Technology-Parasite Control

This research study found that the most widely employed parasite control method is knapsack sprayer accounting for 38%, followed by dip tanks and spray races at 29% and 24% respectively, while other technologies account for 9%; as shown in Figure 4.25 below.

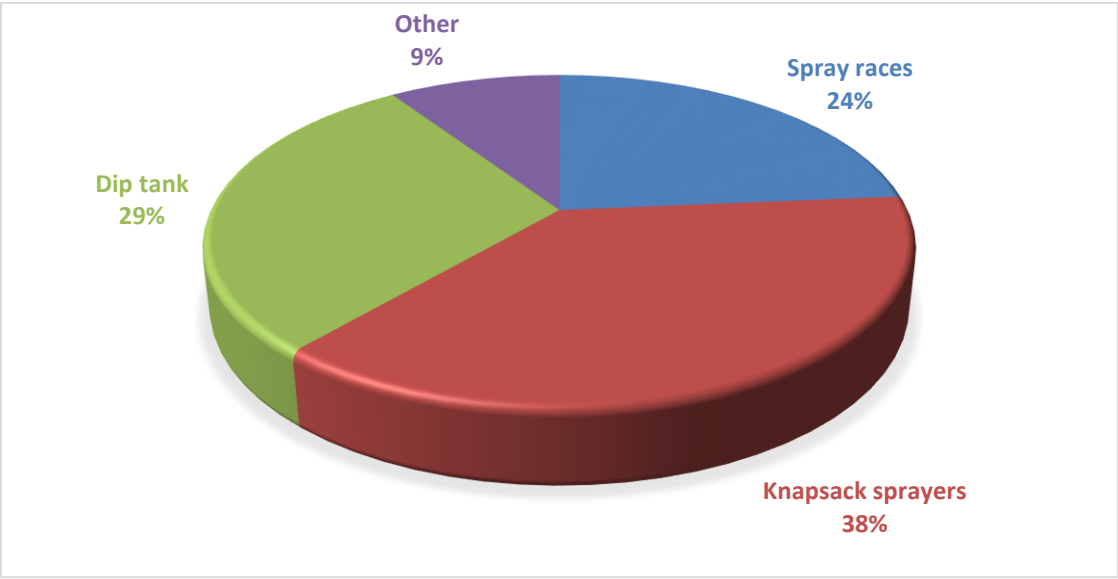


Figure 4.25 Adopted Innovations-Parasite Control

In terms of parasite control measures employed at the camp level, Maala scored the highest adoption rates for dip tanks (17.1%) and knapsack sprayers (16.5%) while Baambwe employed more spray races (21.8%).

4.16 Possible Barriers that may Impact the Cattle Farming Business

This research study found that limited capital, cost of veterinary services and drugs, and climate change effects are critical factors inhibiting entry into the cattle farming business, as depicted in Figure 4.26 below.

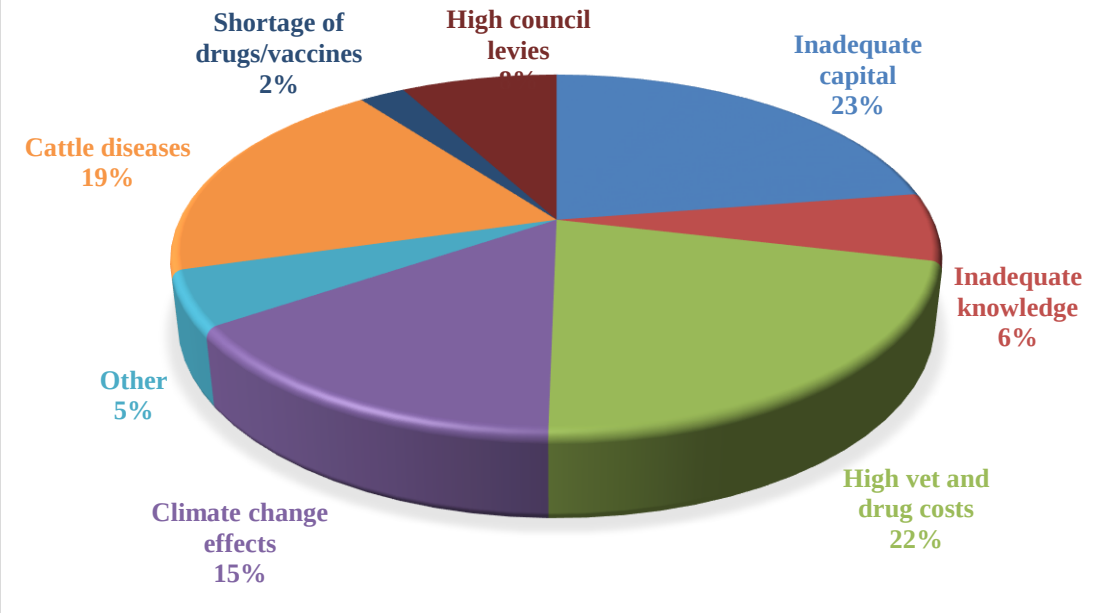
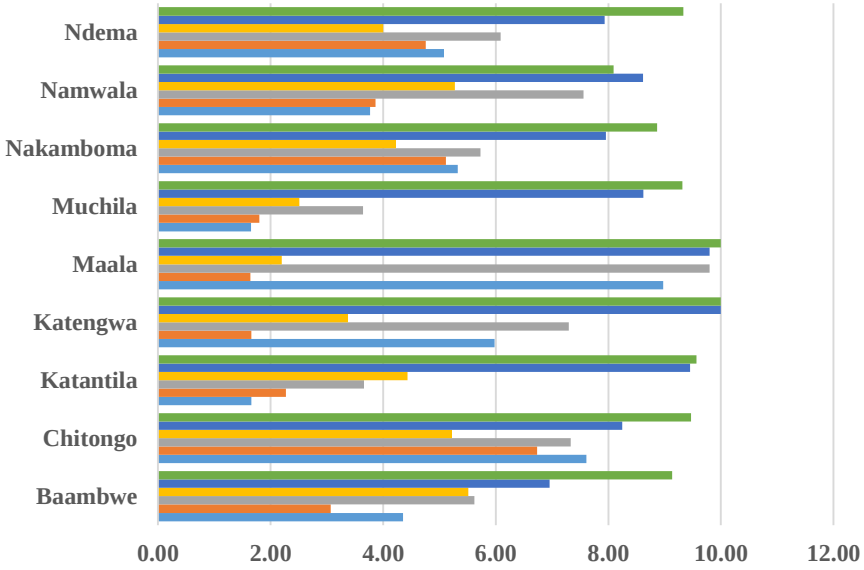


Figure 4.26 Barriers to Cattle Business

At the camp level, the results were widely dispersed: Maala reported high council levies (58.5%) and high veterinary and drug costs (36.6%) as critical barriers. While Baambwe reported shortage of drugs and vaccines (66.7%), inadequate knowledge (43.8%), and climate change effects (29.1%) as their main challenges. While Nakamboma and Chitongo reported cattle diseases (24.0%) and inadequate capital (26.5%) respectively.

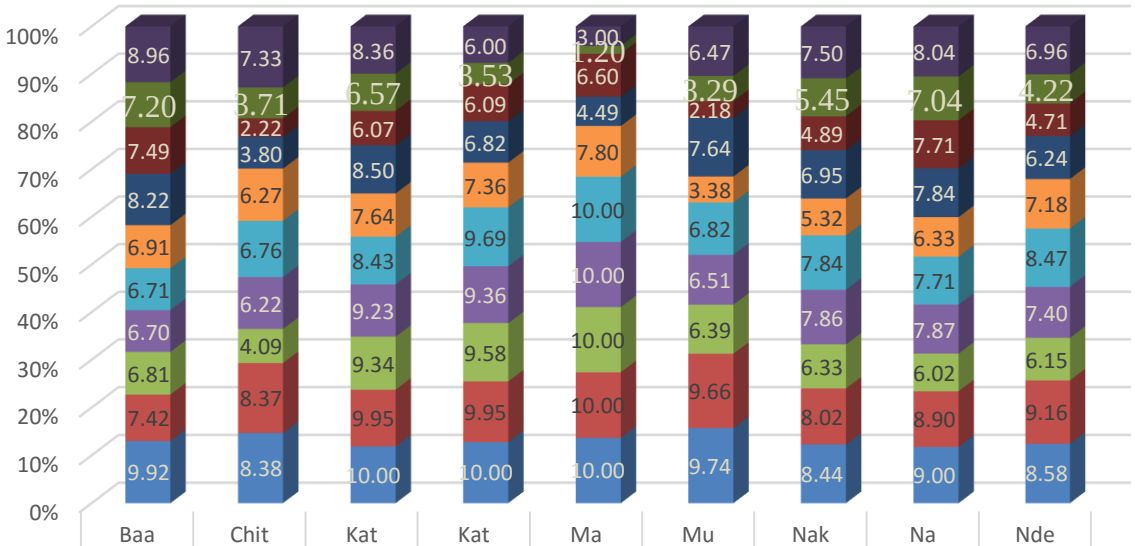
4.17 Corrective Measures to Barriers/Challenges of Cattle Farming Business

An analysis of some of the critical policy interventions, conditions, and factors impacting the cattle farming business in Namwala is presented in Figure 4.27 below. The scores are dispersed across the camps, showing proactive actions adopted to correct the challenges.



	Baambwe	Chitongo	Katantila	Katengwa	Maala	Muchila	Nakambomba	Namwala	Ndema
There are enough customers in the cattle industry	9.13	9.47	9.57	10.00	10.00	9.32	8.86	8.09	9.33
Climatic and environmental changes in the recent past affect cattle farming business	6.96	8.24	9.45	10.00	9.80	8.62	7.95	8.61	7.93
Cultural and traditional rules and regulations affect the daily operations and running of the smallholder market players	5.51	5.22	4.43	3.38	2.20	2.51	4.23	5.27	4.00
Governmental regulations and rules, affect the smallholder cattle business players	5.62	7.33	3.66	7.30	9.80	3.64	5.73	7.56	6.09
Support service market systems for small scale cattle farmers are operating adequately	3.07	6.73	2.27	1.66	1.64	1.80	5.11	3.87	4.76
Agricultural support services market system players fully support all the players in the cattle smallholder business	4.35	7.61	1.66	5.98	8.98	1.65	5.33	3.77	5.08

Figure 4.27 Corrective Measures-Rating of Statements



	Baambwe	Chitongo	Katantila	Katengwa	Mala	Muchila	Nakamboma	Namwala	Ndema
My successor should have the skills and knowledge to be the owner of the business	8.96	7.33	8.36	6.00	3.00	6.47	7.50	8.04	6.96
My business is free from family succession concerns	7.20	3.71	6.57	3.53	1.20	3.29	5.45	7.04	4.22
We have already a succession plan for our cattle business	7.49	2.22	6.07	6.09	6.60	2.18	4.89	7.71	4.71
It is good to transfer the cattle business to any family members that has sufficient business knowledge	8.22	3.80	8.50	6.82	4.49	7.64	6.95	7.84	6.24
The non-financial characteristics that make the company/enterprise valuable to potential buyers are clearly understood	6.91	6.27	7.64	7.36	7.80	3.38	5.32	6.33	7.18
There is growth strategy for the cattle business	6.71	6.76	8.43	9.69	10.00	6.82	7.84	7.71	8.47
Key employees are incentivized, compensated, and motivated to increase the value of the cattle business	6.70	6.22	9.23	9.36	10.00	6.51	7.86	7.87	7.40

Figure 4.28 Sustainability Measures for Business Continuity

4.18 Smallholder Cattle Business Exit Strategy

This research study also investigated sustainability business continuity measures that smallholder farmers employed. Statistics at the camp level show various farmers' strategies, as shown in Figure 4.28 above.

4.19 Determination of Factors Affecting Cattle Business

4.19.1 Heard Size

This research study conducted a multiple regression analysis to statistically determine factors affecting cattle herd size among the farmers (Table 4.5).

Table 4.5 Factors Affecting Cattle Herd Size Among the Farmers in Namwala District

			Number of obs = 405			
			F (16, 251) = 3.45			
			Prob > F = 0.0000			
			R-squared = 0.1986			
			Root MSE = 98.1470			
Cattle Herd Size	**Coef.**	**Robust SE.**	**t**	**P>t**	**[95% Conf.**	**Interval]**
Farm on title	-14.6944	13.3014	-1.1	0.270	-40.8909	11.5021
Supplementary feeding	104.9827	43.4448	2.42	0.016	19.4200	190.5455
after purchase services	-25.3307	22.0367	-1.15	0.251	-68.7311	18.0697
Extension services access	32.4067	18.3522	1.77	0.079	-3.7372	68.5505
Regular dipping	-44.9118	22.1470	-2.03	0.044	-88.5294	-1.2943
Adequacy of water	68.8253	34.2129	2.01	0.045	1.4443	136.2063
Regular vaccination	-30.5141	12.5172	-2.44	0.015	-55.1661	-5.8620
Savings and Insurance	-0.4209	7.2733	-0.06	0.954	-14.7454	13.9035
Fenced communal land	-21.1423	16.2695	-1.3	0.195	-53.1844	10.8998
Open communal land	22.7433	10.0229	2.27	0.024	3.0036	42.4829
Age	0.5531	0.5011	1.1	0.271	-0.4339	1.5400
secondary education	28.2503	11.7794	2.4	0.017	5.0512	51.4494
No. workers	0.6839	1.3711	0.5	0.618	-2.0165	3.3843
enough_land	-21.2866	11.9761	-1.78	0.077	-44.8730	2.2998
ceremony	40.5776	20.7479	1.96	0.052	-0.2844	81.4397
log_income	4.3786	3.5316	1.24	0.216	-2.5767	11.3340
_cons	9.2943	66.5519	0.14	0.889	-121.7769	140.3655

This study found that supplementary feeding had a significant positive impact on cattle herd size, statistically significant at 0.016 p-value. Increasing supplementary feeding will increase the size of cattle owned. Access to extension services was also found to have a significant positive impact on cattle herd size, statistically significant at 0.079 p-value. An improvement in extension services will increase cattle herd size.

Regular dipping of animals was found to be negatively impacting cattle herd size, this could be due to the high costs involved in dipping of animals, thereby reducing cattle herd size, statistically significant at 0.044 p-value. Adequacy of water has a significant positive impact on cattle herd size. Availability of water is key to improving cattle herd size, statistically significant at 0.045 p-value.

Regular vaccination was also found to have a significant negative impact on cattle head size, and this is due to the high costs of vaccines required. The results were significant at 0.015 p-value. Farmers' access to open communal land was found to have a significant positive impact on cattle herd size, statistically significant at 0.024 p-value. Secondary education was also found to be statistically significant, positively impacting on cattle herd size. Farmers with secondary level of education and higher were seen to have a higher cattle herd size, statistically significant at 0.017p-value.

Land adequacy was found to have a negative significant impact on cattle herd size, statistically significant at 0.077 p-value. Farmers with inadequate land had a smaller cattle herd size than farmers with a bigger land size or farms.

Traditional ceremony (Shimunenga) was found to have a significant positive impact on cattle herd size. Farmers who participate in Shimunenga ceremony have a higher cattle herd size than those who don't. The ceremony is a great encouragement to farmers to increase their cattle herd size. The results were statistically significant at 0.052 p-value.

4.19.2 Profitability

This research study conducted a logistic regression analysis to determine the factors affecting the cattle business profitability (Table 4.6).

Table 4.6 Factors Affecting Profitability of the Cattle Business

			Number of obs = 405			
			LR chi2(17) = 118.67			
			Prob > chi2 = 0.0000			
Log likelihood = -127.63123			Pseudo R2 = 0.3174			
Profitability	**Odds Ratio**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
Milk	3.9598	1.7634	3.09	0.002	1.6543	9.4782
Sold manure	1.3613	1.3796	0.3	0.761	0.1868	9.9224
Sold to Processors	2.9454	1.0898	2.92	0.004	1.4263	6.0826
Sold to traders	1.1776	0.5686	0.34	0.735	0.4571	3.0337
Sold skin	0.8516	0.8204	-0.17	0.868	0.1289	5.6272
Sold hooves	1.2193	0.4725	0.51	0.609	0.5705	2.6057
Business Attractiveness	1.8273	0.4038	1.53	0.038	0.5587	2.2749
Extension services	0.6593	0.2268	-1.21	0.226	0.3359	1.2938
Sold heifers	0.5542	0.4628	-0.71	0.480	0.1079	2.8473
Sold bulls	1.9154	0.8703	1.43	0.153	0.7861	4.6666
Sold cows	0.5490	0.4674	-0.7	0.481	0.1035	2.9130
Sold calf	36.3935	20.0004	6.54	0.000	12.3948	106.8586
Sold steers	2.0840	0.6799	2.25	0.024	1.0996	3.9499
Affordability of costs	0.9560	0.3092	-0.14	0.889	0.5071	1.8020
Sold rainy season	1.0919	0.3716	0.26	0.796	0.5603	2.1276
Price	1.1803	0.3800	0.51	0.007	0.6279	2.2185
Cattle sold	0.9317	0.0327	-2.02	0.044	0.8698	0.9981
Cons	0.0487	0.0570	-2.58	0.010	0.0049	0.4823

This study found that milk selling had a significant impact on profitability, statistically significant at 0.002 p-value. Farmers who sell milk are more likely to earn profits than those who don't sell milk. Selling to processors had a significant positive impact on the profitability of the business. Farmers who sell to processors are more likely to earn profits than those who don't sell to processors, statistically significant at 0.004 p-value.

Business attractiveness was found to have a significant positive impact on cattle business profitability. Farmers who find the business to be attractive are more likely to earn profits than those who don't. Selling calves was found to have a significant positive impact on cattle business profitability, statistically significant at 0.0001 p-value.

Farmers who sold calves were more likely to find business profitability than those who didn't. Selling steers was also found to have statistically positive impact on cattle profitability, significant at 0.024 p-value. Price was found to have a significant positive impact on cattle business profitability, significant at 0.007 p-value. The number of cattle sold was found to have a negative impact on profitability, statistically significant at 0.044 p-value. Selling many cattle at once may result in price discounts that result in less profitability for the cattle business.

4.19.3 Futures Sustainability

This research study assessed the factors that can affect the future sustainability of the cattle business in Namwala District of Southern (Table 4.7). Future cattle herd size was used as a proxy for sustainability. Respondents were asked if they expect cattle herd size to reduce, increase or remain the same.

Table 4.7 Factors Affecting Sustainability of Cattle Business Among Farmers in Namwala.

			Number of obs = 405			
			LR chi2(12) = 82.64			
			Prob > chi2 = 0.0000			
			Pseudo R2 = 0.2225			
Herd size expectation	**Odds Ratio**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
Farm on title	0.6278	0.3555	-0.82	0.411	0.2069	1.9049
Supplementary feeding	18.1056	20.7521	2.53	0.012	1.9151	171.1728
After purchase services	1.0912	0.3850	0.25	0.805	0.5465	2.1788
Attractiveness of Business	0.5758	0.1778	-1.79	0.074	0.3143	1.0549
Extension services access	5.7523	2.1953	4.58	0.000	2.7226	12.1534
Regular dipping	0.3211	0.1473	-2.48	0.013	0.1307	0.7889
Adequacy of water	15.7182	16.9577	2.55	0.011	1.8971	130.2347
Regular vaccination	0.3657	0.1729	-2.13	0.033	0.1448	0.9237
Profitability	7.2081	12.6110	2.69	0.036	2.4522	15.4718
Savings and insurance	0.6116	0.1333	-2.26	0.024	0.3990	0.9375
Fenced Communal Land	0.3796	0.4337	-0.85	0.397	0.0405	3.5625
Open communal Land	1.6899	0.5153	1.72	0.085	0.9297	3.0719
Secondary education	1.2963	0.3959	0.85	0.396	0.7124	2.3587
Cons	8.4490	20.1292	0.9	0.370	0.0792	901.0430

Among the factors affecting sustainability, supplementary feeding was found to have a significant positive impact on sustainability of cattle business, statistically significant at 0.012 p-value. Farmers who supplement feeding animals are more likely to sustain their cattle business than those who don't. The attractiveness of the cattle business was found to have a significant negative impact on sustainability of the cattle business. This shows that the business is less attractive (this could be in terms of costs, prices and buyers) which can discourage farmers from future production. The results were statistically significant at 0.074 p-value.

Access to extension services was found to have a significant positive impact on sustainability. Accessing extension services encourages farmers for cattle production, statistically significant at 0.0001 p-value. Regular dipping of animals was found to have a negative significant impact on sustainability of the cattle business. This is due to the costs of drugs involved in dipping of animals, discouraging farmers for production, statistically significant at 0.013 p-value.

Adequacy of water has a significant positive impact on cattle business sustainability, statistically significant at 0.011 p-value. Therefore, it's important to ensure that farmers have access to fresh clean water for their animals if the cattle business is to be sustainable. Regular vaccination was found to have a negative impact on cattle business sustainability, this is due to the costs of drugs involved, and it's important to ensure that drugs are more affordable if the businesses are to continue. The results were statistically significant at 0.033 p-value.

Profitability was found to have a significant positive impact on cattle business sustainability, the more profitable the business venture is, the more farmers are likely to continue production. Savings and insurance were found to have a significant negative impact on sustainability, farmers who have no access to savings and insurance are less likely to continue cattle business production especially in an event there's disease outbreak.

Access to open communal land was found to have a positive significant impact on cattle business sustainability, statistically significant at 0.085 p-value. Therefore, open communal land must be preserved for cattle grazing if the businesses are to be sustainable.

4.20 Chapter Summary

This findings chapter provided comprehensive findings and analysis of the research data collected, beginning with quantitative data results, and concluding with qualitative results. The quantitative results highlight the nature of the current traditional cattle farming practices among farmers in the Namwala District of Zambia from 2016 to 2020. This study comprised of 405 smallholder cattle farmers in Namwala, representing all the 9 veterinary camps. Initial interpretation is also provided for each point of analysis.

CHAPTER 5
DISCUSISON

5.0 Introduction

This chapter discusses the data analysis results in the light of existing literature, along with presenting the cattle business model and framework developed for implementation. The focus is on the traditional cattle business practices used by traditional cattle farmers in the Namwala District of Zambia from 2016 to 2020, gaining a more in-depth insight into the determinant factors of the current traditional cattle business model. The chapter culminates in the development of a cattle business module and dynamic framework for a sustainable cattle business model for traditional cattle farmers in the Namwala District of Zambia.

5.1 Discussion of Research Results of the Traditional Cattle Business Practices used by Traditional Cattle Farmers in Namwala District of Zambia

5.1.1 Landholding Category for Respondents

This research study investigated whether the farmer owns the piece of land for their livestock farming, this study went a step further to understand the type of land ownership. This study found that 91% of the farmers own farmland and 9% never indicated if they owned land, and of these, 88% use open communal land (mainly the plains via transhumances system), while 41.5% operate under fenced communal land and 4% state land.

Land, just like labour, is a valuable factor of production. Community shared land accounts for 88% of land used for livestock grazing across the district. However, Namwala district has seen a rise in the fencing of land because farmers have also engaged in crop farming. This is acting as a deterrent to crop damage by stray animals. In this community, stray animals are allowed, and it is up to the owner to protect his land through wire fencing.

The fencing of land is an indicator that cattle farmers have now started investing in confining animals for different management factors such as feeding, dipping and spray. Fencing is also one way of promoting ownership and security. In many of these communities and countries, secure access to land has always been a challenge such that land conflicts have been the talk of the day (Bekele et al., 2021). Studies have stated that 94% of land in Zambia is under customary tenure based on informal agreements, and the number of farmers with formal title is small, with women and the poor more disadvantaged (Chapoto & Subakanya, 2019; Subakanya & Chapoto, 2020). Without a recognised deed, title or lease, the poor cannot use their land to gain access to capital.

According to Malik (2022) land tenure security is crucial for improving the lives of the poor via economic growth, agricultural production and food security. Saleem et al.'s (2022) study revealed that land ownership is related to educational level, and wealth. In Sub-Saharan African nations, women own only 19% of agricultural land.

5.1.2 Number of Workers Employed

Results indicated that most of the farmers in the camps use their family for their livestock farming activities. Considerable literature on the role of agriculture in rural employment note that over 90% of the labour is from family labour as supported by Abay et al. (2021) and Dorosh and Mellor (2013). Graeub et al. (2016) also state that family members contribute significantly to a global agricultural industry valued at around $US2.2 trillion, with labour included.

5.1.3 Farmers Experience in Livestock Production

The result shows that most of the farmers have 12 to 20 years of experience, or a mean of 16 years in livestock farming. Karki et al. (2020) state that farmers who have been farming for many years are reluctant to change their old ways of doing business while the new entrant has embraced innovation to better their business. Ainembabazi and Mugisha (2014) show that agricultural experience is beneficial in the early stages of technology adoption.

5.1.4 How Smallholder Farmers Enter into Cattle Farming

Of the 405 respondents, 170 (42%) indicated that they went into cattle farming through inheritance. These results align with the cultural norm of the Tonga people of Southern Province. Allen et al. (2019) assumed that family-owned businesses are the world's oldest and most dominant form of business organisation. However, gender biases in generational transfer that favour first-born males over daughters may be the cause of the challenges women face in inheriting family enterprises and land (Rios et al., 2023).

5.1.5 Average Cattle Stock Per Household

This research study delved into the growth of the cattle stock in Namwala over the five-year period between 2016 and 2020. Analysis at district level showed a 37.27% growth in the average stock from 22.0 cattle per smallholder farmer in 2016 to an average of 30.2 cattle per smallholder farmer in 2020. Farmers during the focus group discussions indicated that the 2015/2016 season was a period of drought and many farmers had limited cattle growth due to limited pastures and water. Pastures were not enough to sustain the growth of the animals during that season.

The growth noticed in 2020 was because of good rains and water along the flood plains. Focus group participants also submitted that the Itezhi Tezhi dam was opened to flow water downstream, giving life to the wild animals and cattle. Furthermore, the farmers indicated that they have seen an increased supply of agricultural inputs in the district such as drug and veterinary products in recent years at competitive prices. According to Chaabila (2012) and Kalapula and Mweemba (2018a) climate change has had an impact on the growth of livestock sector in Namwala district over the past years. Siankwilimba (2019a) reported that 2015/2016 season presented itself as one of the worst drought years, which affected production in Namwala district.

5.1.6 Household Income Levels

From the data analysis, smallholder cattle farmers of Namwala district secured an average household gross income of ZMW 35,620.24 per annum. Maala had the highest household income with ZMW 60,800.00, followed by Katantila with ZMW 55,579.78 while Muchila

and Baambwe reported the lowest at ZMW 13,988.89 and ZMW 12,571.11 respectively. Further analysis shows that from the average household gross income Maala gained by ZMW 25,179.76 while Baambwe fell below by ZMW 23,049.13 from the average household gross income per annum.

These statistics agree with the findings by Mumba et al. (2018), Chaabila Kalapula (2017) and Sikamwaya and Guiyu (2020), that Maala has continued to lead in the sales of cattle in Namwala district posting increased income levels compared to other veterinary camps. This can be seen from the number of cattle population and breed the veterinary camp hosts, which has seen an improved breed. According to Kuntashula et al. (2014) incomes determine the poverty level of the household. The higher the gross income, the less poverty, and the less the household is subject to hunger. Cattle and milk sales remain the major contributor to Namwala farmers' income. Maala stands at 84%, followed by Katengwa at 61%, Baambwe at 39%, Chitongo at 36% and the least is Muchila with 14%, as found in this study. A study by Sikamwaya and Guiyu (2020) suggest that milk has added many dynamics to the people of Namwala's economic livelihood.

One of the key respondent stakeholders submitted that the milk business has improved the livelihood of smallholder farmers. You can imagine that 7,998,620 litres of milk have been produced and supplied to milk processors by 5 milk collection centres in Namwala district since 2016 valued at ZWK41,347,503 (US$2.4m) after Musika injected a catalytic of US$199,732 total investment. This has created employment for youths who are milk traders or agents.

5.1.7 Cattle Trading: Age at which Cattle are sold.

The results indicate that all the animals are sold at an average age of 38 months, of which cows are sold at the average age of 63 months, while heifers are sold at 19 months, steers at 20 months, calves and weaners at 9 months, and oxen at 78 months. Further analysis suggests that oxen and cows stay longer in the herd before they are sold compared to the other categories. From these results, the cost of maintaining cows and oxen before they are sold are higher, which could be the source of low profitability. However, the analysis

indicates that heifers, steers, and weaners/calves are sold in their acceptable age which grants reduced cost of production.

Studies indicate that the average age for heifers to ready for bulling is 18 months or when they attain the weight of 250kg liveweight, depending on the breed and nutrition and health status (Rodríguez-Sánchez et al., 2018; Wathes et al., 2014). While age is critical in the sale of animals at the farmer and buyer level, weight has been used mainly when selling (Mukutu, 2019, p. 17).

5.1.7.1 Average Number of Cattle Sold over the Five Years Period 2016 to 2020

This study found that cattle sales in Namwala dropped by 16.74% between 2016 and 2020, with the lowest number of cattle sold in a single year in the period under review recorded in 2018 with an average of about (6) six cattle sold per smallholder farmer per annum. The highest number was recorded in 2019, an average of 13 cattle sold per annum. Using a 12-month recall period for 2020, this study found that the price per one kilogram of live weight increased by 52.63% between January 2016 (ZMK16.37) and December 2020 (ZMK35.38). Mumba et al. (2017)and Lubungu et al.(2012) in their research indicated that livestock sales variations are mainly affected by price, animal type, drought, disease prevalence and the number of beef buyers competing for off taking of the animals.

For milk production, the results show that the peak milk yield for dairy animals is in December through to March, rising from 11.7 litres in November to 14.8 litres in March and, after that, begins to fall, with April at 14.7 litres per animal per month. The lowest milk yield is observed between August to early November, at 11.7 litres per cow per month. A recent review studies by Simuunza (2022) and Wezi et al. (2023) and past study by Mumba et al. (2013) agree to these dynamic milk findings which has remained unchanged over many years. Further, these studies blame smallholder farmers for adopting cultural practices in milk which is obtaining in their beef management practices.

5.1.8 Supplement Feeding of Animals

Farmers were asked why they are not supplementing feeding their animals. The response was that it was costly to supplement beef cows because the output remains very low, even when they were to do so. Additionally, farmers indicated that during the dry season of the drought year (2015–2016, 2019), there is not enough water or pasture available for the animals in the plain to support their body formation. As a result, some of the animals died in large numbers because the farmers did not try to supplement feeding them. However, farmers working for Lactalis, World vision, government Vet24 Agro services, and the government have started an artificial insemination program to cross breed the beef and dairy bull. This is one way of introducing genetics that will have relatively high milk yields compared to using beef animals. Research by Mumba (2021) on dairy business in Western Province found that beef animals have low milk yields, producing about 2 litres per day. This is due to poor nutrition and low milk production genetic potential, compared to dairy cow with production at 16-20 litres per day. Supplementary feeding may help boost milk production.

5.1.8.1 Water Sources and Livestock Development

This study found that 29% (n=158) of smallholder cattle farmers rely on rivers as the water source for their animals, while 26% (n=142) depend on boreholes sunk at the farms or communal boreholes. In comparison, 14% (n=78) of water is sourced from dams, followed by 12% (n=66) from streams with 9% reporting scarcity of water, and only 1% of the smallholder farmers reported accessing multiple water sources. Water is critical in the cattle faring business and the easier the access to clean water the healthier the animals and the people are. Water determines the movement of animals from one grazing area to another just as pastures do. Water sources and availability and quantities determine the number and quality of animals for a farmer and a district at large. During the drought year, farmers lose livestock as the water levels drop, leaving massive mud tracks on the side of reservoirs and water sources. This was discussed in focus groups. Most animals get caught in the mud and are unable to escape because mud and weaker animal bodies go together. Cattle herders reported numerous cases between September and November, prior to the start of the rainy season, it was discovered.

5.1.8.2 Feed/Pasture Sources and Availability

Based on the findings for water availability in the region, most smallholder cattle farmers feed their animals off the plains, which accounted for 52% of their feed source. It was also discovered that pasture and feed is more seasonal, and very scarce in dry season.

According to Namwala district veterinary office there are about 152,440 (2021) cattle in Namwala, up from 141,911 (2020), indicating that a 7.42% growth which is putting pressure on both water and pastures. This therefore calls for supplementary feeding of animals for good growth. The study carried out by Mumba et al. (2018) on traditional beef cattle practices and management shows farmers take their animals into their Kafue plains under the annual rotation system as a source of supplementary grazing.

5.1.9 Business Offerings Available to Cattle Farmers in Namwala

This research study found that 80% (324) of smallholder cattle farmers in the Namwala District do not market their cattle to potential buyers, and only 43% reported having some form of cattle trading places within the localities. Interrogating as to whether the smallholder livestock market offer after purchase or sales services to the clients, 93% of the farmers showed that they are not sure if such services existed.

This study also assessed the existence of farmer market associations in the area and the levels of participation from the farmers. Over 99% of respondents indicated that they did not belong to any cattle market associations. Many researchers have, over the years, indicated that traditional cattle farmers do not market their services and products (Gwiriri et al., 2019; Mumba et al., 2017) to their customers as it has been proven by these results. Lack of commercial acumen has been an associated description of the traditional cattle farmers who barely spend to attract customers to their businesses. Abattoirs remain one of the channels farmers use to promote and sell their animals, and Namwala District has seen an increase in the construction of abattoirs. Although this channel has transformed into trade centres, some farmers argue that these abattoirs have become the centre of cattle rustling for other farmers. Usually, people who buy animals take them to official centres whereas cattle thieves tend to quickly sell stolen animals. It was also argued that due to

poor hygiene practices at these centres, it is not advisable to buy an animal from these centres to avoid contaminated with other livestock diseases that could spread to clen kraals and households.

Brokers and transporters are also a source of marketing channels. Transporters and brokers usually transport and buy animals on behalf of many buyers from farmers. Although these channels are used by the farmers in these areas, they have been criticised for aiding cattle theft, spreading of animal diseases, and suppressing the market prices per kg due to the commission they demand from both the sellers and the buyers. Nevertheless, brokers play a significant role in facilitating information flows, connecting partners, articulating demands, communicating needs, facilitating links, and other activities associated with innovation processes (Warriach et al., 2022).

Lubungu and Birner (2021) in their study of gender dynamics indicated that women have low participation in market because of many traditional cultural barriers in place. These factors limit the commercialisation of the livestock market development in many cases. Kebebe (2019) submitted that poor adoption of proposed technology that goes with market development in the livestock sector is weakened by low entrepreneurship, information transfer, market development, and policy lobbying, and these factors hamper farmers' participation in the new structured market in place. Study findings by Adenuga et al. (2022) revealed that dairy Business Development Groups (BDG) membership had a statistically significant impact on participating farmers' gross margin. When compared to farmers who are not members of the BDGs, dairy producers who are members of the BDGs boosted their gross margin by £117 per head.

According to key informants, the animal market is very attractive to buyers and other key stakeholders in Namwala district because they can aggregate the required numbers in a short time for their business. Input suppliers and service providers, such as animal drugs and chemical suppliers, have increased in numbers selling their products to the farmers who tend to buy in bulk. For example, government stocking program has been cited as one

of the schemes that have bought animals from Namwala district farmers for redistribution within the Southern Province and other districts across Zambia.

Market attractiveness provided by meat professional processors such as Zambeef, Termites, Star butcheries was rated just average. Although they are the second attractive markets, they have been blamed for failure of adjusting their beef prices upwards to benefit the farmers for many years. Furthermore, the community of farmers also lamented that the meat processors, unlike the milk processors, are unable to provide improved extension services to improve the quality and quantity of the animals they buy from the farmers.

This study assessed the potential of traditional markets and whether they offered strategic partnerships for the preferred market. Ninety percent of the farmers reported that the traditional markets did not offer any strategic partnerships for the development of cattle business in the area/district. Many studies agree that smallholder farmers are underdeveloped because they work in isolation and/or 'silos' in most cases (Hermans et al., 2019). Todaro and Smith (2015) argue in the same vein, low levels of partnership in the least developing countries hinder the technological and innovation transfer from private sector players to the rural farmers. Mutambara (2015) agrees that majority of the smallholder farmers continue in poverty because market systems work in isolation to benefit more of the elites.

5.1.10 Access to Insurance Financing Services

Over 99% of farmers had no insurance cover for their cattle in the district. Focus group discussions indicated that age, gender, number of animals owned, and design of insurance cover instruments and period of payment have a significant impact on the uptake of cattle insurance. It was discovered that the indicators had a big impact on people's decisions to buy cattle insurance. Furthermore, those who keep animals for others (agist) had a lower likelihood of purchasing a cattle insurance policy. Although owners of cattle had a favorable likelihood to secure insurance, it was also affected by cultural factors. It has also been discovered that prior cattle loss experience influences the decision to buy cattle insurance favorably. Access to climate risk insurance services, according to Munkombwe

et al. (2022), is an important tool for coping with and adapting to the financial repercussions of climate change.

Risks facing livestock producers in Zambia can be divided into market related-such as uncompetitive prices, lack of guaranteed markets and non-market related risks such as diseases, theft, drought, and drowning. This low rate of insurance coverage emphasises the need for more awareness-raising and educational initiatives to persuade farmers of Namwala District and other seismically active areas of the Zambia who have little to no livestock insurance to get cattle loss insurance. If drought and theft cause catastrophic losses, this will make it possible for locals to safeguard their animal possessions and means of subsistence. These findings are in line with Ng'ombe and his colleagues on the earthquake insurance using digital machine to monitor activities (Ng'ombe et al., 2023). Ng'ombe et al. (2023) state that disseminating information about the availability and salient features of disaster risk financing instruments, as well as discussing the anticipated distribution of disaster expenses, including who bears responsibility for them, may help increase public and farmers awareness of the significance of financial readiness. Thus, it is advised that decision-makers and interested parties take proactive steps to raise knowledge of the value of cattle insurance and endeavor to develop laws that incentivise more locals to get coverage.

5.2 Cattle Business Performance: Business Expenses, Sales, and Profits

5.2.1 Profitability of Cattle Business

The annual average profitability of cattle business per camp for the three years: 2018, 2019 and 2020 was 4.4. 2020 had a rating of 5.9, which is slightly above the long-term average rate of 5, and was generally a better year in revenue earnings for farmers across all camps compared to other two (2) years (2018 at 3.9 and 2019 at 3.5). As such between 2018 and 2020 there was a revenue increase of 33.40% while between 2018 to 2019 there was a decrease in revenue of 11.43%, while between 2019 to 2020 there was increase of 40.68%. This shows that there was no significant change in profits between 2019 and 2018 at district level except when viewed from camp level where it was noticed that Maala camp recorded

higher revenue earnings in 2019 that was even better than 2020, while Katantila reported 2019 as the lowest revenue earnings.

Therefore, in aggregate earnings, Chitongo was reported having the highest average revenues of 6.5, followed by Namwala central with average of 6, followed by Baambwe and Muchila sharing 4.6, then followed by Ndema at 4.4, and the least was Katantila at 2.4 rating. Critical analysis showed that 2019 was generally a difficult year for farmers to make profit from their cattle sales compared to the years 2020 and 2018. Asked to rate the most profitable year for the period between 2016 to 2020, the respondents have various responses. Of the 405, 319 respondents indicated that 2020 was the most profitable followed by 39 who portrayed that none of the years were profitable, followed by 18 who showed that all the years were profitable whereas 12 and 14 respondents suggested that 2018 and 2019 were profitable for them respectively. However, 1 respondent said that 2016 was profitable and 2 argued 2017 was their profitable year. Some key reasons why certain years gave farmers higher profits were due to higher prices and high demand for animals. It was revealed that farmers can transport their animals to any buyer who offers a slightly higher price without considering transport costs in their planning. Although the distance to the market matters, for the farmer the price is the king and game charger in their decision-making process systems. Higher prices triggered more sales and high demand also helped to increase profits of the cattle business.

This study further explored why the farmers had poor returns in the cattle business for certain years. Low profitability was attributed to livestock movement ban, livestock diseases, hunger and high cost of maintaining livestock, few animals sold, low animal prices, and excessive drought from the 2018/2019 rain season in Southern Province, which reduced the health of animals and in some cases caused major nutritional and disease problems to animals (Siankwilimba, 2019a).

When viewed from the meat processor point of view, for example, one of the key informants dealing with beef off taking indicated that 2020 was the lowest profitable year in terms of cattle buying from the farmers from Namwala district despite having offered them the highest buying prices. In 2020 the company bought about 7,185 animals followed

by 2017 with 13,372, then 2016 with 14,103 while the highest was 2018 with 17,0171 animals. The drop in animals bought at processor level in 2020 was attributed to offset of COVID-19 which trigged the drop from 17,071 in 2018 to 14,681 in 2019 and then lowering to 7,185, a reduction of 137.59%. Another reason that has been advanced is that the onset of COVID-19 mitigation measures such as import restrictions triggered the setting on of two (2) abattoirs in Namwala, increasing competition to key informant market share. One of the companies that gave old key informant competition is the new entrants also dealing in beef processing. However, this competition benefited the farmers as they had a range of choices of clients to whom they could sell their animals to and give them relatively better profits. According to ZAMBEEF Products PLC, efficient revenue management allowed it to generate a gross profit of K1.8 billion in 2023, a 12.9 percent year-over-year gain. In addition, the Company said that it generated an operational profit of K361.4 million, a notable rise of 108.1 percent in kwacha when compared to K173.7 million the previous year. The company's success in 2023 demonstrated its ability to adapt to a constantly changing market and reinforced the strength of its vertically integrated business strategy according to Radio Phoenix new (2023). This study found that reasons such as buyers dictating market prices limit choices in what form to sell their cattle, either as a whole or slaughtered with its by-products.

5.2.2 Effect of Household Size on Cattle Business Profitability

This research study sought to understand whether the household size had any impact on the profitability of the cattle business and found that 64% of farmers indicated that household size did not affect cattle business profitability, while 36% submitted that the household size affected the cattle business profitability. Farmers indicated that household size increases the household labour to attend to cattle, thereby ensuring good nutrition for animals and profitability. However, the other category pointed out that increased household expenses due to large household size negatively affected the business. It was submitted that most of the families that have failed to excel in cattle business have failed to use their family labour in a profitable manner that benefits the business. Often, family labour is not paid accordingly and sometimes they are underpaid or overpaid, and not according to the rules and norms of the business.

5.2.3 Cattle Business Cost Structure

This study established the cost structure of the cattle business in Namwala district. The major costs indicated by the farmers were veterinary services cost, local taxes, transport cost, water, and feed supplement. In smallholder cattle business, veterinary services appear to the major costs farmers face to grow their business. These services are provided by the public and private veterinary personnel. Council taxes are unvoiced by farmers that are buying and selling animals and, as such, differ from one council to another.

The costs associated with watering the animals are significant requiring the farmers to drill boreholes, which is costly to the farmers. The cost of transporting animals from the production point to the market cannot be overemphasised, and these go with offloading and loading fees. Animal feed and labour towards herding is significant and plays a critical role in the production and productivity of cattle herds and security respectively.

The health and security of the animal is dependent on animal nutrition-feeds and human monitoring and evaluation hourly, daily and yearly without compromise. It was supported that most traditional cattle farmers have the propensity of wanting to reduce production costs on the expense of quality and quantity attainment. It is unclear that as they want to reduce costs, they also want their poorly produced product to fetch premium prices which is inversely unrelated.

5.2.4 Access to Finance Services from Different Financial Institutions

This study sought to find out whether farmers had access to financial services from financial intuitions such as the Banks, Insurance companies, and Government/Families. The results revealed that the majority had no access to financial services and products. However, it should be noted that that the financial banks have been working hard to penetrate the rural market compared to insurance companies and government. The bank and insurance companies need to design inclusive products that will help to mitigate the issues of climate change and poverty the rural community is faced with in it struggle with financial inclusion. Unavailability of these instruments further impends the farmers from sustainable growth in their livelihoods. Further discussions indicated that banks are not

willing to lend to farmers, banks are not willing to use the animals as collateral for farmers to access credit, but they would encourage a farmer to sell the animals. The RALS 2019 indicates that less than 1% of male farmers and 0.3% of female farmers have borrowed money from financial institutions for agricultural purposes and 16% of farmers accessed input credit of any form, with most of this credit being informal or through suppliers (Subakanya & Chapoto, 2020). According to Lubungu (2018), limited access to credit continues to be a significant concern for smallholder farmers and as such found that only approximately 13% of Zambia's smallholder farmers had access to credit while 87% didn't have during the 2010–2011 growing season.

Access to finance is power which can be defined as "power to," "power inside," "power with," and "power over" (Patilkale et al., 2019). In low- and middle-income nations, credit constraints are frequently cited as one of the major obstacles to the adoption of new agricultural technologies and low agricultural production (Balana et al., 2022; Balana & Oyeyemi, 2022). Previous studies and a large portion of the policy debate link supply-side variables like restricted access to credit sources or high borrowing costs with agricultural credit limitations. But demand-side elements like risk aversion and lack of financial knowledge among borrowers may also have an impact on the rationing of loans to smallholder agricultural households (Balana et al., 2022).

Patilkale et al. (2019) claim that financial empowerment can be measured on several levels, including individual, familial, and collective. According to Fowowe (2020), credit availability supports the purchasing of inputs, the hiring of labour, and the use of other productivity-improving technologies. Samboko et al. (2018) found that a lack of access to agricultural credit facility is leading to lack of modern agricultural technologies which is one of the major causes of Low productivity in emerging countries such as Zambia's agriculture industry.

Many studies have suggested that stakeholders should start focusing on improving the functionality of multiple levels in the agricultural supply chain through building business management capacity, upgrading management systems, integrating digital solutions and

improving access to financial products and services for key actors in the agricultural market (Guilmi & Fujiwara, 2022; Malesios et al., 2018).

According to results obtained on whether households have access to financial products and services from insurance companies, this study found that 98% had no access while only 2% had access to these products and services from insurance companies. This shows how vulnerable the cattle business ventures in rural areas are to shocks such as climate change, economic and social impact. During focus group discussions, it was revealed that Africa Pride Insurance was marketing their livestock indemnity insurance cover among the cattle farmers of Namwala district, but the buy in from farmers were very low. The company has been finding it difficult to make pay-outs for farmers who suffer losses.

Further analysis was conducted to determine whether households had access to financial products and services from the government and/or families. Results indicated that 385 farmers had no access to financial products and services from the government. It was revealed that government banking systems like ZANACO and Natsave have not promoted their financial services and products reach to the livestock cattle farmers in Namwala district. A study by Munkombwe et al. (2022) on access and adoption of insurance products among smallholder farmers indicated that there is very low access and showed that the farmers only access these products in limited places and times of the year due to no promotion and marketing by private companies. Further, it was revealed that the weather index insurance policy is only made accessible to the farmers twice a year at the time of pay out and at the time of collecting premium by the insurance companies.

5.2.5 Revenue from By-Products and Milk

This research study sought to find out as to whether household businesses achieve revenue from the by-products such as milk, hooves, hides, and dung. The results showed that of the 405 respondents, 78% (316) do not get any formal revenues out of the by-products.

This study explored the potential of dairy farming in the district and found that 61% (248) of farmers did not earn significant revenue from milk. This study revealed that Namwala

district has six milk collection centres. Looking at how vast the district is, these milk collections are not enough to service all the camps in Namwala. It was revealed that many farmers travel 35km and more to access the milk collection services.

Lie and Rich (2016) advanced that the quantity of milk produced by small-scale farmers is usually low, characterised by high seasonal fluctuations in availability, with reduced production levels during the dry season. Ng'ombe et al. (2022) revealed that preferences for milk sales in contract farming are highly influenced by the gender and marital status of the household head, household size, and delayed payment. It was submitted that over the years, Namwala MCC had a lot of operational challenges that led to closure of the business, which reduced the flow of milk to the centres and to the milk processor Parmalat. This affected the flow of revenues to the collection centres and the farmers in real terms. This study found that the total revenue earned from MCC was amounting to ZMW 41,347,503.00 of which 2021 had the highest revenue of ZMW 17,759,464.00 dispersed, of which ZMW 5,463,675 from Mbeza was the highest, followed by Niko MCC with ZMW 4,176,602, then Chitongo with ZMW 3,143,837, while the least was from Nchole with ZMW1,088,278. The year 2018 was second with ZMW 3,643,741.00, of which Chitongo scored the highest revenue of about ZMW 1,100,692.69, followed by Mungaila MCC with ZMW 891,026.62, and the lowest revenue came from Namwala MCC with ZMW 307,675.44, while nothing was recorded for Mbeza MCC because it had not started being operational. The results further indicate that 2015 followed with a total revenue of ZMW 3,382,543, of which Mungaila MCC had the highest at ZMW 832,697, followed by Niko MCC with ZMW 772,645.00, then Chitongo with 717,940.00.

5.2.6 Revenue from Cow Dung

A significant proportion, about 28%, of farmers reported deriving some revenue from the sale of cow dung to their neighbours who utilises it as manure for applying into their crop fields. The proportion of 72% not making any earnings out of manure amidst the skyrocketing prices of fertilizers globally, it disheartening to see these losses in earning at smallholder farmer's level. Many researchers have contended that with the rising cost of inputs such as fertilizer, especially in the face of COVID-19 and the war in Ukraine,

Zambia and many developing countries would do well to process manure and use it for fertilization of their crops.

Manure can be used to replace synthetic fertilizers since it contains nitrogen (N), phosphorous (P), potassium (K), and micronutrients that are needed for crop productivity. Manure, unlike synthetic fertilizers, includes organic matter that improves soil tilth, structure, aeration, and water retention capacity (Agula et al., 2018). Manure is well known to improve crop production and productivity since it is a low input cost and has the ability to improve soil structure and texture compared to synthetic fertilizers (Adegbeye et al., 2019; Garrity et al., 2010; Lal, 2010). Therefore, farmers need to be helped on how best they can earn revenue from the sale of cow dung. Training on value proposition in their business will be required (Siankwilimba et al., 2023b).

5.2.7 Revenue from cattle hides

This research study found that 93.5% of smallholder cattle farmers in the Namwala district indicated that they did not earn revenue from cattle hides. This study found that most cattle buyers do not pay premium price for skin despite the hides or animal skin being valuable input for processing industry. Farmers indicated that for many years they have lost revenue on this component. The current business model offered by the buyers deprive the farmers from earning revenue from the hides and does not allow them to resale the hides to another buyers. Similarly, a study conducted in Ethiopia found that hides and skins fail to fetch premium prices because most of them that come from smallholder farmers are of low quality (Kahsay et al., 2015). Kahsay et al. (2015) found the following defects on the skins: scratches, cockle, wounds or scars, lesions from pox or lumpy skin disease. The value of the hides and skins depreciates because of these flaws or defects.

5.2.8 Revenue from Cattle Hooves

This research study found that only 14.3% of the Namwala district smallholder cattle farmers reported earning revenue from the sale of cattle hooves. It was submitted that animal hooves fetch less earning for Namwala farmers despite being useful ingredients in the manufacturing and food and feed industry.

A survey study by Goni et al. (2009) found that hooves and horns are more profitable businesses where market players are willing to pay a premium price to the livestock farmers. It was found that well labelled and packed hooves in super and chain market were attracting more consumers than any grade of beef (Doughty et al., 2009). Gachango et al. (2017) found that the fish feed industry in developed countries have resorted in the use of hooves in their feed formulation as one of the ingredients and fish farmers were willing to buy and utilise the feed stuff. Most farmers fail to benefit from the current market because of the nature the market operates.

Studies have claimed that Namwala still stands out as being one of the districts that have a large number of animals and stakeholders in livestock services and products have invested in for a long time (Mwasinga et al., 2021; Lubungu et al., 2015). The presence of the number of players is a key indication that the district has a business offering that is sustainable and conducive. According to the survey, it was also observed that power connectivity has been instrumental in developing the cattle sector in many camps of Namwala. Power is said to unlock economic and social transformational development (Saleem et al., 2022; Ali et al., 2016).

5.2.9 Average Age of Sale of Cattle Stock (in months)

This research study found that farmers disposed of their cattle at an average age of 41.6 month. The late disposal of animals is still being practiced, which has been reported in studies. This shows that farmers in Namwala are still clinging to traditional management of their cattle wealth (Mumba et al., 2017). However, studies suggested market channels determine the age at which to sell the animal. Usually, the informal market is mainly visual while the formal market thrives on weight based.

Scare et al. (2018) stated that age is key to access market that ultimately determine the small-scale sector's shift to commercial business. According to Musemwa et al. (2007), insufficient marketing infrastructure, a lack of marketing herd size, high transaction costs, and low buyer purchasing power all contribute to inefficient cattle marketing generally. Further, this study found that farmers are price takers who simply accept the prevailing

market price for cattle in the area. In addition, this study found that on a scale of 1 to 10, cattle retailers/dealers and cattle transporters are the major players in the cattle business in the district, offering the best deals to farmers with average scores of 5.7 and 5.5, respectively. On the other hand, meat/food processors ranked third with an average score of 4.8. Past studies have also recognised the role of these players in the district (Mwila et al., 2021; Peel, 2021; Jones et al., 2015; Malama et al., 2014; Lubungu & Mofya-Mukuka, 2012).

5.2.10 Effects of Seasonality on Cattle Sales in the District

This research study found that price fluctuations affected cattle sales, with high prices during rainy season calling for major sales demand. Seasonality has an effect on cattle sales change. Studies have documented seasonality as one of the factors that affect the development of market systems and, as such, farmers tend to sell their animals when prices are at peak while buyers want to buy animals when the prices are depressed so as to maximise profits for the daily running of their business (Bolon et al., 2019; Mumba et al., 2013; Pegram et al., 1986).

In addition to this seasonality, scholars have added disease outbreak as another trigger to seasonality in relations to the cattle season (van Dijk et al., 2021; Van Dijk et al., 2010). This study sought to understand the in-kind trade practices in the area and established that majority of the farmers were equally split between never engaged in in-kind trading of cattle with other merchandise or commodities and those that sometimes practised the barter system. A study by Kadohira and Samui (2002) found that some cattle farmers bought motorbikes, cars and television sets, either in cash or through the barter system in exchange for cattle. At farmer level, the barter system does not require any governing body to regulate and is incredibly versatile as all it requires is the double coincidence of wants (Samuel et al., 2021).

5.2.11 Cultural Practices Effect on Cattle Business

This research study also explored the effect of cultural practices on the cattle business in the district. This study found that 48% reported that funerals affected business operations,

and 25% said marriages were also an effective cultural practice that affected business. In addition, 10% of the farmers also indicated that traditional ceremonies were a significant factor in the growth of cattle business in the district. Cultural practices play a significant role in cattle business in Zambia and particularly for the people of Namwala district of Southern Province. According to Taylor (2006), Africans regard culture as essential to their lives and future development as such culture embodies people's philosophy, worldview, behaviours patterns, arts, and institutions.

This survey suggested that funerals play a significant role in cattle business in Namwala districts. It was discovered that funerals can reduce the number of animals family rear because depending on who has died, a certain number of animals must be killed to feed the mourners at the funeral. The marriage system helps to grow the cattle sector in Namwala from generation to generation in an accumulative manner. This is another justification that women and youths in Namwala own animals tied in the fibric of the family system, even though studies portray that they are being discriminated against (Machina & Lubungu, 2019). Their ownership is hidden in the iceberg system under the water with only men seen on the tip of the iceberg. These traditional systems have been there for generations and have been misunderstood by many researchers who come from outside the community (Muma, 2018; Taylor, 2006).

Further, traditional ceremonies have been cited as other factors contributing to cattle business in Namwala. It was posted that Namwala has two traditional ceremonies that have significance on cattle development. These are Shikaumpa and Shimunenga practiced by Chief Mukobela of Baambwe and chief Mungaila of Maala areas. Both ceremonies are celebrated annually and are centred on cattle ownership and growth according to studies revealed by key informants and surveys. Farmers compete and cooperate for herd growth, quality, quantity and to a larger extent breed types and category of animals. Consequently, the two ceremonies are recognised countrywide, and now attract commercial agriculture players that display and offer different products and services needed by farmers for daily and beef cattle management.

Shimunenga and Shikaumpa ceremonies cannot be separated from our daily management and growth of livestock in the district. Much as the ceremony is based on paying homage to our ancestral spirit, it is also a branding tool for our animals and farmers. It is an annual agricultural exposition because farmers competitively show off their number of cattle in their different categories or types. It is an annual livestock show for us, and it is our economic, social, and environmental pride.

According to the survey results Namwala farmers rarely sell calves in their business. Five percent of the respondents found themselves selling calves and regarded it as an insignificant factor. It was clear that calves are sold with their mothers in rare situations when one wants to make more money. Therefore, it is not an impactful factor in the cattle rearing business for Namwala farmers. The only cited occasion where people are seen selling calves is when weaners are used in bride wealth payment traditionally.

5.2.12 Livestock diseases and Management

It was revealed that illness of animal is the least factor to consider during the cattle farming business by majority farmers. Surprising, this sits well with research, indicating that Namwala has reduced the rate of animal death in the past six years, such that, farmers no longer fear illness of animals as they used to in previous years. It was heard that in the past, before farmers had known how to treat and control corridor and other related diseases lethal to their animals, they lost a significant number of cattle.

This development was attributed to improved uptake of various productive technologies by smallholders from various supplies of products and services. Research indicate that Namwala has received a myriad of research in Zambia as far as the cattle business is concerned in the country. Some examples of FMD outbreak were given, but only a few farmers lost the animals, all due to disease hygiene. In the real sense, the survey revealed that farmers can invest in a lot of preventive control measures to fight animal diseases. Furthermore, it was heard that farmers have now incorporated and integrated indigenous knowledge with modern scientific knowledge to manage their livestock as opposed in the old times when indigenous knowledge outweigh the scientific practices as it was recognised in the livestock policy by the government of Zambia (Ministry of Fisheries and Livestock, 2020).

5.3 Sustainability of the Smallholder Cattle Business

5.3.1 Ongoing Competitive Advantage Systems

This research study found that using a rating score of 1 to 10, 1 being disagreed and 10 agree, the smallholder cattle farmers in Namwala felt that, with an average score of 6.70, traditional cattle rearing had lower costs, have access to resources, and allows players to maintain and grow their businesses. Asked on their perception of how traditional ceremonies affected business growth in the area, farmers rank was 6.64, thus agree. One of the attributed factors that have been rated highly is that cattle business has lower costs due to availability of natural resources at their disposal. According to respondent score of averaging rating of 7.6, it shows that farmers in traditional cattle system have less spending on the growth of the cattle especially when it comes to feeding and nutrition at district level.

Traditional cattle farming business has lower cattle rearing costs compared to commercial and intensification raising cattle business systems. It was agreed that natural pastures and water have been the prime mover for sustaining the growth of the livestock in Namwala district among livestock farmers. Unlike other districts in Southern Province, this district prides itself of siting on huge wetlands along the Kafue flood plains which act as a source of water and grazing hotspot in Zambia. Namwala has one of the largest grazing areas for animals in the Southern Provinces which accommodate over 300,000 herd of cattle (Kalapula & Mweemba, 2017).

Despite that, farmers still spend on dairy, bulls and in-calf cows and heifer to maintain their production though at lower costs compared to commercial farmers (News24, 2023; Schärrer et al., 2014). One of the activities that they spend low is the extension services as in most developing countries, government subsidises the activities (Siankwilimba et al., 2021, 2022). However, studies indicate that private service providers have embedded these costs in the products such as seed, drugs and chemical which they sell to the farmers (Yeniaras et al., 2020). It was also heard that the traditional leadership is inspirational in driving the growth of smallholder cattle business in Namwala district. This study also

found that traditional ceremonies contribute to the growth and sustainability of the cattle business via annual traditional marketing strategies.

Concerning the entering into partnerships, this study found that Namwala people have been a source of inclusiveness and partnership in the cattle industry for many years. It is clear that partnership indicates a growth of business and firms and partnership have come together to fight industry or district-based challenges. This gives the players a commercial competitive edge compared to single handling of challenges which could their chances of success (Pawłowski et al., 2021). According to key informants, partnerships are key to the introduction of improved genetics and other technology for growth and sustainability.

5.3.2 Willingness to Adopt New Technologies

This research study found that 93% of smallholder cattle farmers are willing to adopt new technologies to improve their cattle business. In addition, this study found that 76% of the smallholder cattle farmers in the district had already adopted at least one or more innovations. One of the factors that have led Namwala farmers to lead in the cattle growth is the ability to embrace technology to advance their cattle business. The survey found that these farmers rely on their animals for their livelihoods and, as such, they have wanted to invest in technology to improve their cattle business.

Willingness to adopt technologies was found to be inclined to cultural norms within the community (Vaidya et al., 2018). Study findings by Zegeye et al. (2022) revealed that education, regional heterogeneity, remittance income, extension visits, credit access, off-farm activity, soil quality, farm size, tropical livestock unit, distance, plot's potential wetness, and ownership certification all influence the decision to adopt alternative agricultural technologies. Ruzzante et al. (2021) advanced that technological change is never neutral because it has substantial social, economic, and environmental ramifications and directional innovation in nature.

5.3.3 Adopted Innovations - Adopted Cattle Management

This research study found that the most adopted management practice was grazing plant residues, accounting for 48% of the cattle management innovations. This study found that Namwala farmers have integrated mixed crop farming to sustain their livestock management in recent times. The crop residues are a source of grazing natural feed for animals. It was submitted that farmers in Namwala no longer burn crop residue in their fields, rather preserve or leave it in the field for their animals to feed on as a sustainable agricultural practice. It was further revealed that cattle farmers have also started growing maize crops in the plain to take advantage of the alluvial rich soils, with stalks used for animal grazing after harvesting.

Debating on whether crop residues should be left to enrich the soil fertility to increase its future productivity against feeding the animals, farmers indicated that they would rather use the animal manure after the animals have fed on the crop residues. Results from key informants have unveiled a serious concern that farmers who are farming along in the Kafue plains are causing unwarranted soil degradation because of soil erosion. This situation is increasing the silt in the Kafue and Namwala rivers, threatening the ecosystems on which human and animal life depend one. Duncan et al. (2016) claims that the failure to return biomass to soils has implications for soil quality and the capability of soils to maintain long-term productivity, hence this demand for livestock feeds has ramifications for the long-term sustainability of such systems.

Ziestman (2014) contends that to achieve high productivity for cattle under natural veld, selective grazing tied to crop residue is paramount for a low stocking rate. Crop residue grazing is among factors that contribute to a favourable environment for the achievement of market, bulling, and productivity weight for cattle. Farmers also indicated that they have adopted buying molasses and hay being sold by their fellow farmers and other businessmen as feed supplement. Local leadership has called on all farmers and fish mongers to desist from burning the grass which is meant for cattle and other livestock in the region.

Studies that revealed that agroforestry systems are frequently seen as a crucial part of climate-smart agriculture (CSA) (Rose et al., 2017), as they not only assist agriculture absorb carbon and adapt to climate change while also increasing agricultural production and producing more food supplies (FAO, 2022c). According to FAO (2022b), the use of supplemental fodder trees boosts dairy cow weight gains and milk production, while the use of fertilizer trees in cropping systems boosts soil fertility and structure as well as residue retention, all of which increase productivity FAO (2022b). According to FAO (2013, p. 26) legumes in pastures also boost forage yield and minimise forest pressure without increasing fertilizer use.

This study also found that farmers apply grazing planning, specific breeding planning and record system utilisation. Farmers were using phones to enhance communication in their cattle management. According to the World Bank (2020), connecting Zambia to rural places has enhanced the reduction in poverty and contributed to inclusion in financial growth and other specialised services.

5.3.4 Adopted Innovations-Feeding

This research study found that 48% of smallholder farmers used vitamins to improve animal feeding while molasses/urea and silage accounted for 12% and 11%, respectively, while the rest didn't specify the other methods, they employed to feed their animals. To boost the animals' immunity, stand, farmers find it easier to administer injectable and oral vitamins as opposed to supplementing them with molasses and extra silage which could require continuous feeding till the rainy season sets. Farmers and key informants indicated that vitamins are given to the animals at the same time when the animals are being dewormed either through drenching or dosing. Vitamins are administered to replace the minerals and vitamins that have been lost with the drying of pastures in dry season.

According to Curry et al. (2021), low technology adoption has long been a major impediment to increasing agricultural productivity, income, and yields, particularly in developing countries. Buyinza et al. (2022) argue that smallholder farmers are hesitant to adopt innovations because of an underlying culture of financial expectation.

5.3.5 Adopted Innovations-Breeding

This research study found that crossbreeding was the most widely adopted among the novel breeding initiatives available at 30%, followed by calving selection at 22%, and female breed incorporated 20%. Most respondents indicated they no longer rear Tonga and Ila breeds in their business as they have adopted new breeds such as Brahman, Boran and some dairy animals. Furthermore, they submitted that the Ila breed was not a pure breed but a cross between the Tonga and the Barotse breed.

Studies by Mwaanga and Pares-Casanova (2017) and Simuunza (2022) further argue that Namwala no longer contains indigenous Ila breeds as is the case for the Valley Tongas of Southern Province. According to FAO (2022a), 29% of native cattle breeds are now classified as being at risk of extinction, up from 26% in 2019. This research found that some model farmers have been instrumental in driving the crossbreeding in Namwala. These early adopters accessed improved breeds from the commercial ranchers. Fridman et al. (2021) and Makina et al. (2014) reported that many African cattle breeds are being eroded at a faster rate and replaced with exotic breeds that are susceptible to tropical disease, making it very expensive for farmers to manage and make a profit towards fighting their food and income poverty.

5.3.6 Adopted Innovations-Reproduction

According to Mukutu (2019, p. 14), every cow needs to give birth to a calf every year or every other year for the beef herd to remain productive. The cow must exhibit heat at least 60 days after calving to accomplish this, and she must become pregnant within 80 days and the postpartum anoestrus period, however, in beef cattle typically lasts for more than 60 days (Mukutu, 2019, p.14). Research has revealed that it is also influenced by the calf's suckling stimulus and the absence of bulls in the herd, and this is true even though nutrition and the condition of the cow are factors. However, this research found that only 22% employ controlled mating.

This study found that 35% of cattle farmers allow the bulls to run with breeding cows and heifers throughout the year. It was reported that continuous mating is allowed so that the

bulls do not miss the oestrus circle of the cows to have high conception production. Although farmers advocate for continuous mating in their herd, past research indicate that bulls are accustomed to the females such that they get tired and miss the period of the females which in some cases cause low conception due to low fertility by the bulls (Fernandez-Novo et al., 2020). Key informants indicated that bulls that run with cows and heifers throughout the year often do not stay in one herd but would move from one kraal to another in search of cows on heat to mount, and in doing so, the bulls would easily pick sexually transmitted disease which are passed on to the herd where it belongs.

Of the interviewed farmers, 19% of smallholder farmers conducted cow body condition analysis to assess readiness for mating of the cows. It was submitted that these farmers would consider the body condition of both the bulls and the females before allowed to mate. This resonates with the findings by Sitali et al. (2017) who claimed that bull's physical body condition and outlook are a critical success factor during selection of the bulls and mating period. Other research studies have gone further to include genetic makeup and fertility testing as an important factor when choosing the bulls and heifer for breeding (Szyszka & Kyriazakis, 2013; Tonussi et al., 2017).

Other studies have revealed that cow body condition is a measure of nutritional status, and when combined with body weight change, it can be a valuable tool for determining reproductive potential (Baruselli et al., 2017). Rasby and Funston (2016) emphasise that the most critical factor determining pregnancy rate in beef females is body energy reserve at calving. Breed type, suckling status, age, dystocia, calorie and protein supplements before and after calving, and BCS before and after calving are all factors that affect the postpartum interval to estrus and pregnancy rate (Sitali et al., 2017).

Of the total number of farmers interviewed, around 17% have underscored the importance of evaluation of the bull as a critical innovation factor in cattle management and development. When asked who does the evaluation for the bull soundness for breeding entail, farmers said that they still use the camp extension workers and the district vet office.

However, they also indicated that they would want to reach the commercial level where they could hire performance evaluators to test them using semen from sperms.

The bull breeding soundness evaluation (BSE) is a process that decreases risk while also improving strategic bull utilisation and herd fertility. The breeding soundness evaluation (BSE) is a method for determining a bull's ability to serve as a herd's sire. Bull BSE is a simple, inexpensive, and necessary tool for the cow-calf enterprise. Accurate semen assessment is one of the most important aspects of achieving sustainable growth in the livestock breeding system. By effectively performing BSE, a field practitioner can play a key role in realising its full potential (Chenoweth et al., 2010). It was found that product of calf crops is higher when using bulls with >70% normal spermatozoa and lowest when using bulls with 50% normal spermatozoa, implying that sperm quality, specifically normal spermatozoa percentage, was consistently associated to calf output (Lone, 2017).

This study found that the majority of farmers maintain productive cows for longer periods of time from calving to culling at an average age of ten years, whereas infertile cows are culled at a younger average age of three years. Furthermore, breeding cows are allowed by some to age before being culled for as long as they have good mothering ability. A study by Ansari-Lari et al. (2012) found the reasons for culling to be infertility and mastitis, and animals were culled at an average age of six years. Sitali et al. (2017) and Haine et al. (2017) advised that critical variables of culling must be considered, such as the age at culling and the time between calving and culling as these are part of livestock herd management. Haine et al. (2017) advised that management tactics should be better directed to prevent involuntary culling and maximise herd profit by determining how these factors may put an animal at an elevated risk of being prematurely removed from the herd. Bulls that are infertile should quickly be identified and culled if they cannot be treated to correct their fertility.

Artificial insemination was reported as one factor that influence the reproduction in the traditional cattle farming management. It was heard that some farmers are practicing artificial insemination for both beef and dairy animals. The activity is more pronounced in

dairy animals where the farmers want to acquire the genetics to increase the milk quality and amount to supply. Artificial insemination was found to be an easier way of acquiring dairy animals when faced with escalating accessibility and affordability of live ones. Generally, there are traces of artificial insemination especially around Katengwa, Maala, Chitongo, Namwala and Baambwe vet camps. These results agree with Mumba et al. (2018), whose findings stated that the majority of Namwala farmers [65% (95% CI: 59.3–71.1)] were affected by transhumant herding strategy in adopting some reproductive innovations such as artificial insemination.

One of the farmers deduced that Transhumance, or Kuwila, is an important undertaking for Ila cattle farmers. It encamps supplementary feeding for us. While on the plateau, spending money on buying feed for animals, an Ila treks his animals to the plain and camps there for 6 to 8 months. The animals rarely lose their weight compared to the cattle farmers on the plateau. Hence, our heifers and steers grow faster than those farmers who do not take their animals for transhumance. Without Kuwila or transhumance, farmers would lose their herd size because they could not manage to supplement and feed them.

Rehman and colleagues argue that best reproductive achievement is accomplished by choosing animals based on absolute growth rate, milk output, and feedlot performance, and then putting them in a hybrid of natural and artificial environment to reach their genetic potential (Rehman et al., 2017). Otsuka and Fan (2021) reported that sustainable animal reproduction and production is key to fighting hunger in the world.

To end the discussion on reproductive performance, Dauda et al. (2023) did a study to look at the reproductive and productive abilities, feed availability, feed management, and major limitations of three breeds of cattle raised in Northern Nigeria using an extensive system. The breeds were White Fulani, Sokoto Gudali, and Red Bororo. Dauda et al.'s (2023) findings revealed that 70% of the farmers were in agreement with the initial service occurring between 2.3 and 3 years of age for all three breeds as a strategy to improve reproductive performance. It was revealed through the study that at the age of 3.3–4 years, the first calving rate for white Fulani farmers was 40%, whereas it was 80% for Sokoto Gudali and Red Bororo farmers, respectively. Additionally, sufficient observation was made of the calving interval ranging from one to two years across all three breeds, and it was found that the female reproductive period lasted from 13 to 15 years. Eight to eleven calves were expected to be produced per cow's lifetime for White Fulani and Sokoto Gudali

in the current study, compared to four to seven for Red Bororo. In line with what Namwala found, Dauda et al.'s (2023) study of feed resources and management for three breeds of cattle that were heavily managed showed that natural pasture was the main food source for the cattle during the rainy season. During the dry season, natural grassland, tree leaves, and shrubs were also utilised as cattle feed. Feed and water were cited by the farmers as the primary obstacles to cow development in the study area, while the breeds managed to endure and mature despite these significant limitations, as they are for Namwala traditional farmers.

5.3.7 Adopted Innovation-Animal Health

This research study found that livestock farmers have adopted several animal health innovations such as deworming control at 22%, spraying and dipping at 22%, vaccinations at 20%, and parasite diagnosis at 20%, animal health planning at 9%. One of the reasons that has fostered the increase in health management practices is the presence of many private companies supplying products and services tailored to meeting challenges facing farmers' animals. Hernández-Jover et al. (2019) assert that access to input products in rural areas has helped the farmers to improve their production and productivity to some larger extent. A study from Silverlands in Zimba district shows that animals health and husbandry management practices have led to improved adoption of animal management practice through willing to pay for different services and products (Copenhagen Social, 2017).

Spraying and dipping is a critical procedure in livestock disease management and control. Spray races have enabled the farmers to construct mobile spray races in the plain where dip tankers are not allowed to be installed for both economic and environmental factors. In addition to spray races, farmers have plunge dips in various places built by private traditional farmers. Research indicates that use of spraying and dipping controls about 80% diseases brought by ticks and other biting insects (Ledwaba et al., 2022; Chitanga et al., 2021). Spraying and dipping control diseases such as east coast fever, heart water, gall sickness, trypanosomiasis and lumpy skin.

This study found worm control and management to be 22% on average at district levels. It was submitted that worm control and management measures are carried out by farmers to reduce economic financial losses (Doidge, Ferguson, et al., 2021; Doidge, Lima, et al., 2021). Similar studies by Nyirenda et al. (2019) found that in Western Province animals are highly infected by worms as results have shown at abattoir when animals are slaughtered. Most studies have shown that worms such as liver flukes are responsible for economic and financial losses at farmer and industry levels (Moojen et al., 2022; Nyirenda et al., 2019; Köstenberger et al., 2017; Lindsey et al., 2013; Genicot et al., 1991).

Routine vaccination was found to be one of the procedures farmers in Namwala carry to control and manage livestock diseases. Surveys indicated that there are two types of vaccinations taking place in the smallholder farming system. Compulsory mass government vaccinations to control diseases of economic importance such as FMD and CBPP and the other one categorised as a management illness, which means that farmers are responsible for controlling it (Mumba et al., 2017), where farmers outsource and pay for drugs and services.

This study found that government veterinary staff carry out these procedures followed by farmers themselves and finally the private service providers. However, there's low adoption of animal herd management plans. The farmers attributed this to vastness of the camps making it difficult for them to hire a veterinary assistant in time while the veterinary assistance attributed to low funding by the ministry to manage the farmers. Indeed, the veterinary profession appears to have failed miserably in this endeavour for decades. It was observed again that the issues of quality services provision by the veterinarian and willingness to pay for the herd health plans by farmers has been the challenge.

A study done in Zimba district revealed that farmers who participated in the anima production schemes had experienced improved animal health (Copenhagen Social, 2017). Musika (2017) study found that farmers who participated in the scheme had higher livestock productivity than those who didn't participate. Participating farmers had a reduced death rate of around 1.7% per household herd, while nonparticipating farmers had

a higher mortality rate of about 5.8% per household herd. From the interviews carried out, this study found that farmers can tell the kind of parasite causing diseases and or sucking blood of their animals in the early stage. Early detection of parasite especially the external one is a spring bolt to early treatment and prevention which comes with less cost when well managed.

Tick infestation is visible on an animal's body, signaling the need for dipping or spraying to remove them. Tick bites can cause inflammation, itching, and swelling, as well as the possibility of subsequent infections. Ticks have a negative influence on cattle because they cause weight loss and lower milk output (Uspensky, 2014). According to some estimations, a large infestation of engorged Boophilus female ticks might diminish annual weight by up to 0.5 kg per animal and annual milk production by up to 200 litres per animal (Alfen, 2019).

This study found that the most widely employed parasite control method is knapsack sprayer accounting for 38%, followed by dip tanks and spray races at 29% and 24% respectively, while intangible technologies combined (spray race combined, knapsack plunge dip or pour on/tick greasing) accounted for 9%. Many farmers were using knapsack over the other control methods because it is handy and cheaper to acquire, and suitable for farmers with few animals. Dip tanks were rated the second option in the prevention and control of ticks. The initial costs to build the dip tank technology is higher than the other technologies. At a local level, the cost ranged between K90,000 to K150,000 with 15,000 litres to 35,000 litres capacity. This conforms to the Zambia Statistics agency report, which indicates a reduction in number of households owning dip tanks from 1,746 in 2016 to 1,598 in 2018 because of the introduction of knapsack sprayers. According to Mpundu et al. (2018) disease control was more difficult with farmers adopting communal grazing. Therefore, the spray race concept was also ideal for application in wetland areas where dipping was needed.

5.3.8 Possible Barriers that may Impact the Cattle Farming Business

This research study found that limited capital (23%), cost of veterinary services and drugs (22%), cattle diseases (19%), and climate change effects (15%), are critical factors inhibiting entry into the cattle farming business. Least impacting factors, according to the findings, are council levies (8%), technical knowledge (6%), and shortage of drugs/vaccines (2%).

Namwala district of Southern Province remains one of the districts in Zambia hosting cattle, and according to district veterinary and livestock office, there are about 152,440 cattle in the district (Manyori et al., 2017). However, survey results obtained indicate that limited capital for farmers to invest into the growth of the business hamper the development and growth of the industry. Furthermore, results show that cost of veterinary products (drugs) and services are continually increasing and never seem to come down.

Research indicates that the rising prices for inputs have been a hindrance to improve the productivity and production of the cattle business in the Namwala district. The rise in the costs of veterinary drugs and services are associated with a rise in the inflation rate. The COVID-19 and the new war in Ukraine has triggered the rise in input costs globally and domestically. Cattle diseases are also viewed as a hindrance to the growth of the livestock sector in the Namwala district. Survey results obtained from the interviewed farmers indicate that the outbreak of foot and mouth in the Chisamba district, which later spread to Southern Province, Monze district, increased the cost of treating animals in the district, province, and country. Past and present studies indicate that the Zambia livestock sector has been struggling to eradicate East Coast Fever (ECF), FMD and other CBPP (FarmTech Africa & Calle Schlettwein, 2021; Muma et al., 2009; Mumba et al., 2017; Nambota et al., 1994) partially because of lack of coordination and cooperation among stakeholders charged with responsibility of managing the sector.

One of the key respondents submitted that if there is any company that is dealing in the cattle business (either on the input or offtake market) and does not have a presence in Namwala district, then that company should reconsider their way of doing business in Zambia. People in Namwala are in the serious cattle business. However, ever since, they

have been challenged by climate change, which has affected the watering points and pastures for animals.

A similar study conducted by Odubote (2022a) revealed that 59.1% of households reported being impacted by cattle diseases of which ECF/Corridor disease was identified by 24.1% of households that reported diseases in cattle as a serious disease affecting cattle, followed by lumpy skin disease (LSD) at 18.5% and black quarter (BQ) at 15.9%. Climate change effects (15%) have been rated as one of the hindrances to the growth of the cattle industry in Namwala. According to survey results, 2016 and 2019 droughts stressed animals in Namwala district (Kalapula & Mweemba, 2018b; Siankwilimba, 2019a; Thierfelder et al., 2013). Studies by Waha et al. (2022), Njei & Lubungu (2022), and Hamududu & Ngoma (2019) projected that rainfall is likely going to decline by 3% and 0.6% by 2050 and 2100 while temperature was projected to increase by 1.9 C and 2.3^{o}C by 2050 and 2100. These studies revealed that changes in temperature and rainfall will likely reduce water available by 13% in 2100.

5.4 Developed Cattle Business Model

This section describes the proposed sustainable and dynamic cattle business model

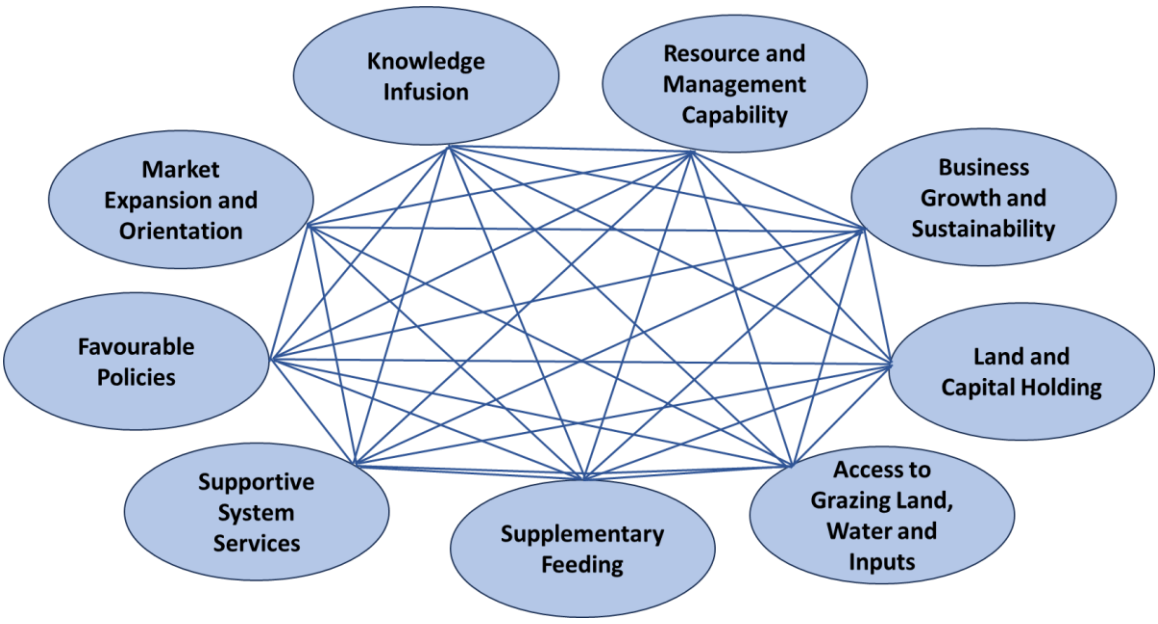


Figure 5.1 Cattle Business Model

This model presents key areas that need attention to ensure cattle business profitability, growth, and sustainability. These areas are Knowledge Infusion, Resource and Management Capability, Improved Land and Capital Holding, Access to Grazing Land, water and Inputs, Supportive System with Services, Favorable Policies, Market Expansion and Orientation, Supplementary Feeding, and Business Growth and Sustainability. These areas are interrelated and can interact to strengthen or weaken the livestock cattle business.

5.4.1 Knowledge Infusion

Among the important factors of production is technical knowledge, which is highly required if any business venture is to be successful. Knowledge has been named the fourth factor of production besides land, labour, and capital. It is important that farmers have some level of knowledge to be able to combine the factors of production for business growth. Education level has been found significant in this study. However, knowledge provision should go beyond educational knowledge and focus on animal production knowledge that is basic and practical to the farmers. This should involve knowledge provision in the aspects of cattle management, such as feed production, land and water management, and disease control and management. Currently, the adverse effects of climate change are having a significant impact on livestock and crop production, in terms of excess temperature and poor rainfall (Siankwilimba et al.,2023c). Therefore, farmers need to be provided with knowledge on how to cope with these challenges to continue production. Agriculture is a pure science in which there are emerging challenges like new disease outbreaks, which continuously pose challenges to farmers.

The government extension service department in the Ministry of Livestock and other stakeholders in the country need to equip farmers with knowledge on production, resource management and knowledge on how to combat the adverse effects of climate change and ensure continued production for business sustainability. Through conducting training, a priority should be given to more women to equip them with knowledge of the cattle business. Women are key to ensuring household food security, and their empowerment with adequate knowledge of food production is very important. The results of this study show that a significant proportion of farmers inherit cattle farming from their families.

Therefore, priority should also be given to youths in the cattle farming business, as well as youths in families carrying out the cattle farming business. Equipping the youths with adequate knowledge of the cattle business is key for sustainability, as the youths are the future leaders who will take up their cattle farming businesses for their families. Training families in the cattle business has the social, economic, and environmental aspects of passing this knowledge on to other family members and friends, thereby ensuring knowledge transfer to a wider population.

5.4.2 Resourceful and Management Capability

Knowledge is an important resource required in production, without which the business is destined for failure. Through knowledge infusion from the Ministry of Livestock and other stakeholders, farmers will have the necessary knowledge and skills, making them capable to combat the challenges of climate change, controlling animal diseases and operate profitably. For farmers to be completely resourceful, the farmers need other support systems other than knowledge, which includes access to resources and other factors of production like land and water, capital, extension services, input market, and insurance services.

Insurance is very important to ensure business continuity as a result of climate change effects on farming like diseases, inadequate water, inadequate feed, and excessive temperatures, which can cause huge losses. Access to land capital, extension services, and markets is crucial for business growth and economic gains. A move should be made to empower women and youths with access to these resources for business sustainability.

5.4.3 Improved Land and Capital Holding

This research study has found that land has a significant impact on cattle herd size. Land plays a critical role in livestock production, it's on land that pastures grow for animals. A farmer needs adequate land from which cattle can graze, land to put kraals for cattle. However, the country is facing population increase and industrialization which has a bearing on land size available for livestock production. Most farmers in the Namwala District are using open communal land for cattle production, however, access to open land is not quarantined. There are many cases in the country where chiefs have sold open

communal land to investors. Therefore, farmers are at risk of losing access to open land. The government of the republic of Zambia need to take a deliberate decision to empower farmers with access to land. Livestock farmers need to be given title deeds for their land; and livestock farmers should also be given title deeds to open communal land. Livestock farmers can form cooperatives and the government through the Ministry of Livestock in partnership with the Ministry of Lands, who can give title deeds to farmer cooperatives for the use of open communal land. This will also help in protecting the environment, as the community will be guarding the land from burning by other people and cutting down trees. Without giving farmers authority over open communal land, many farmers will have no land on which their animals will be grazing. Therefore, the sustainability of the cattle business among farmers requires empowering farmers with access to land through titling open communal land.

Apart from equipping farmers with land holding, it's important that farmers are helped with access to capital and capital assets like drugs for cattle vaccination, drugs for tick and disease control. Farmers need to be linked to financial institutions for capital and production inputs as described.

5.4.4 Access to Grazing Land, Water and Inputs

By ensuring farmers access to grazing land through titling open communal land, their cattle business is more sustainable, which will enable farmers to be resourceful and stand business shocks that may approach them. Water is an important resource and input for cattle production. On a daily basis a full-grown bull can take up to 90 litres of water during the hot season. Water is the most important nutrient for cattle. It accounts for 50% to 80% of an animal's weight and is involved in every physiological process. Cattle must have free access to all the quality water they will consume. Without water, feed intake greatly decreases, the animal becomes dehydrated and body functions fail. Water availability and quality can become a major issue during a drought. It is important to check water sources frequently during a drought for water availability and quality.

Water requirements for beef cattle depend on weight, stage of production (such as lactation), and temperature. As weight increases, the amount of water needed also increases. The same holds true for temperature, as temperatures increase, so does water intake. Also, if the animal is lactating, water requirements also increase. Daily water intake may vary from 3 to 80 litres per day depending on age, body size (weight), stage of production, and the environment (mainly air temperature). As a rule of thumb, consumption will range from 1 litre per 100 kg of body weight during cold weather to nearly 2 litres per 100 kg of body weight during the hottest weather. Lactating cows require nearly twice as much water compared to dry cows. Clean fresh water, free of manure, dirt, and other debris is important. However, a farmers' access to clean fresh water is a challenge, especially in the dry season. Therefore, farmers need to be assisted with access to clean fresh water for their animals through the sinking of reliable boreholes that do not dry out during dry season. This can be done through partnerships between the Ministry of Livestock and other stakeholders like the World Vision Zambia, WFP, Ministry of Community Development, and other stakeholders. The Ministry of Livestock under agribusiness department should help communities to have access to constituent development funds to be used for sinking of boreholes. However, the composition of cattle in terms of sex, and other categories and their market period is critical in cattle business.

5.4.5 Supportive System with Services

In all the areas that farmers are lacking and need help for business growth and sustainability, it all depends on the support system that can be given to addressing these issues. Cattle farmers need support in many areas, and that depends on the goodwill of government, the government ministries, and all stakeholders. For farmers to have title deeds to open communal land, it will require support from the government. Government and stakeholders' support is also needed in the area of access to financial capital and capital assets. In many cases it's quite difficult for lending institutions to lend to individuals, and farmers have a tough time accessing financial services.

Livestock farmers need a number of services which include input market services, output market services, and financial market services. There is a need for a marketing department under the ministry of livestock and other stakeholder organisations to support farmers with

access to all the inputs needed in cattle production, including water. This can be done through market facilitations, linking farmers to different input suppliers and helping farmers get the best deals with input suppliers in terms of prices and payment plans. There is also a need to create and strengthen business partnerships between livestock farmers and financial lending institutions and insurance companies.

5.4.6 Favorable Policies

In order to adequately support livestock farmers for business growth and sustainability, there is a need for government through the ministry of livestock to put in place favorable policies that ensures cattle business growth and sustainability, for the sector to contribute positively to food security and economic development of the country and the world at large. Among the key policies needed is a policy that gives livestock farmers access and authority over natural resources such as land and water. There is a need for policies that protect farmers from losing out from industrialisation that involves grabbing of land and polluting water bodies that supply water for livestock production. The government also need to help farmers through development a policy that encourages farmers to access inputs cheaply, such as zero tariff on imports of drugs for livestock and equipment for livestock production. This should be done with the support from stakeholder organisations in the country such as World Vision Zambia, Musika Development Initiative, and others. More importantly, there is a need to set up standards and quality boards for beef and dairy if these industries are to develop sustainability. Additionally, dairy boards and beef boards should be functional to control the issues of grading animal products by choice, standard, or grade A, B, and/or C, which is an incentive for production and productivity. Above all, incentives will encourage private veterinarians to offer herd health management programs at a commercial cost to farmers.

5.4.7 Market Expansion and Orientation

There’s a need to expand the market for livestock, that is, the market for cattle and cattle products. From the results, most of the farmers were not earning any income from animal products such as manure, skin and hooves and horns. Therefore, there’s a need to strengthen the market for these products. One way is to identify companies that can be

buying these animal products from farmers to process various products such as fertilizer and biogas from manure and glue from horns and hooves. Therefore, the marketing department and other stakeholders can engage with different companies like fertilizer, gas and heat producing companies within and outside the country to take up these products.

Farmers also need to develop a systematic plan for selling livestock. This study found that selling calves and steers has a significant impact on cattle business profitability, therefore, farmers can take this advantage develop a plan when to sell. Farmers should also be selling at systematic intervals unlike bulk selling which can result in huge price discounts that can lead losses, as buyers may take advantage. Farmers should also be selling cattle at the right weight and age while factoring in the production costs of drugs, feed, etc. To regulate the uncontrollable offloading of animals by farmers while at the same time at a loss on the market, a beef warehouse forward receipt contract system and contract farming could be developed in which farmers could be allowed to deposit live animals into the hands of warehouse system operators who manage the warehouse under the auspices of the ZAMACE. This could be extended to milk, which is produced in high volumes during the rainy season and goes to waste compared to the dry season when there is little production. The government could help build cold storage chain systems in milk production regions. This world reduces postharvest losses experienced by farmers annually. Cooperatives and associations could be allowed to venture into this niche business that would benefit all players in the country and value chains. This strategy incentivizes to develop the auction marketing systems that are lacking in the smallholder livestock system in the country.

5.4.8 Supplementary Feeding

Farmers need to start looking into supplementary feeding of animals for many reasons. Supplementary feeding plays a critical role in livestock production where cattle have no access to open grazing land. In an event that farmers in Namwala are deprived of access to open communal land, it could be the collapse of many cattle businesses in the district. At the moment there’s no guarantee for farmers accessing open communal land in the future, which is the greatest threat to this sector. There are cases of land grabbing, the recent one was in the Mumbwa District in Nangoma area, where the chief sold the open communal

land for cattle to an investor. To overcome these problems, farmers need to be trained in supplementary feeding of animals using local cheap resources, while taking advantage of the existing resources. In this study land was found to have a significant impact on cattle herd size, dictating to farmers how many cattle to keep. However, with supplementary feeding, the number can be increased. The development of the auction yard under the structure market will trigger supplementary feeding investments by livestock farmers.

5.4.9 Business Growth and Sustainability

The growth and sustainability of cattle businesses depends on all the areas explained in this model, without which many businesses will remain stunted and collapse. Climate change is having an impact on livestock production due to drought and excess temperature, thereby making grass for animals scarce, and supplementary feeding comes in to sustain cattle production. Supporting farmers with land holding authority over open communal land will ensure that farmers continue livestock production. Farmers access to capital and inputs enables farmers to increase production for growth and re-investment, making the business sustainable. Expanding the market for cattle and cattle products will enable profitability of the business for growth and re-investment, guaranteeing sustainability. Therefore, all the areas explained in this model will help with cattle business growth and sustainability. A priority should be given to women and youths in all these areas, as women play a very important role in household food security and youths are important in taking up these businesses for sustainability.

5.5 Equation for a Dynamic Cattle Business Model Framework

The cattle business model above is simplified and presented in an equation model as follows:

$$CBGS = b_1KI + b_2LCH + b_3SSS + b_4RMC + b_5GLWI + b_6FP + b_7MEO + b_8SF$$

From this equation, CBGS is Cattle Business Growth and Sustainability, which is a function of Knowledge Infusion (KI), Land and Capital Holding (LCH), Supportive System with Services (SSS), Resourceful and Management Capability (RMC), Access to Grazing Land water and Inputs (GLWI), Favorable Policies (FP), Market Expansion and Orientation (MEO) and Supplementary Feeding (SF).

In this equation, b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8 are the effect sizes of each of the listed explanatory factors, positively impacting on the Cattle Business Growth and Sustainability.

5.5.1 Cattle Business Model Implementation Framework

This study presented the model components and how they interrelate to provide a sustainable business model. To realise the benefits of this Cattle Business Model, the implementation framework below (Figure 5.5), clearly indicating what needs to be done and who should implement it.

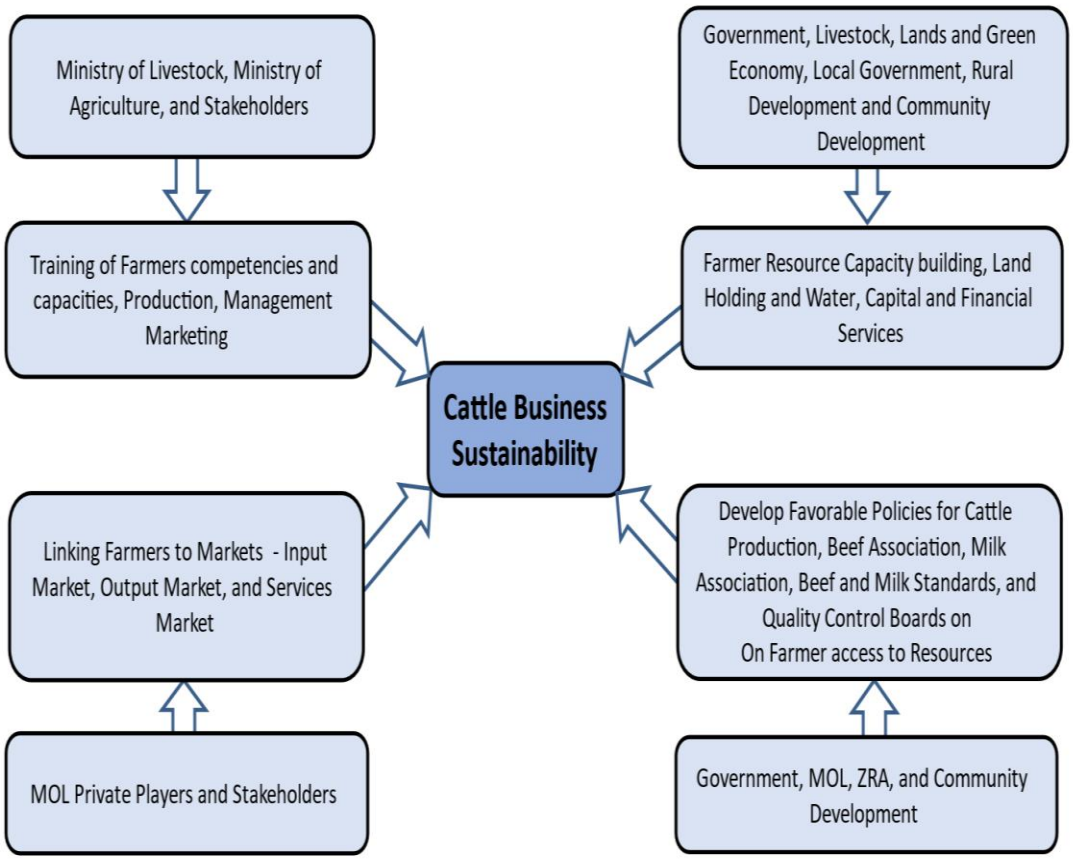


Figure 5.5 Framework for Cattle Business Model Implementation

5.5.2 Expected outputs from the general model framework implementation.

Figure 5.6 below clearly shows the expected outputs from implementing the cattle business model. The figure indicates system change activities at the initial stage that need to be considered. The second stage is farmers' knowledge infusion, followed by improving farmers access to many services and systems which will trigger new enterprise performance which will benefit farmers and their families with increased income level and improvement in the standard of living, especially for women and youths.

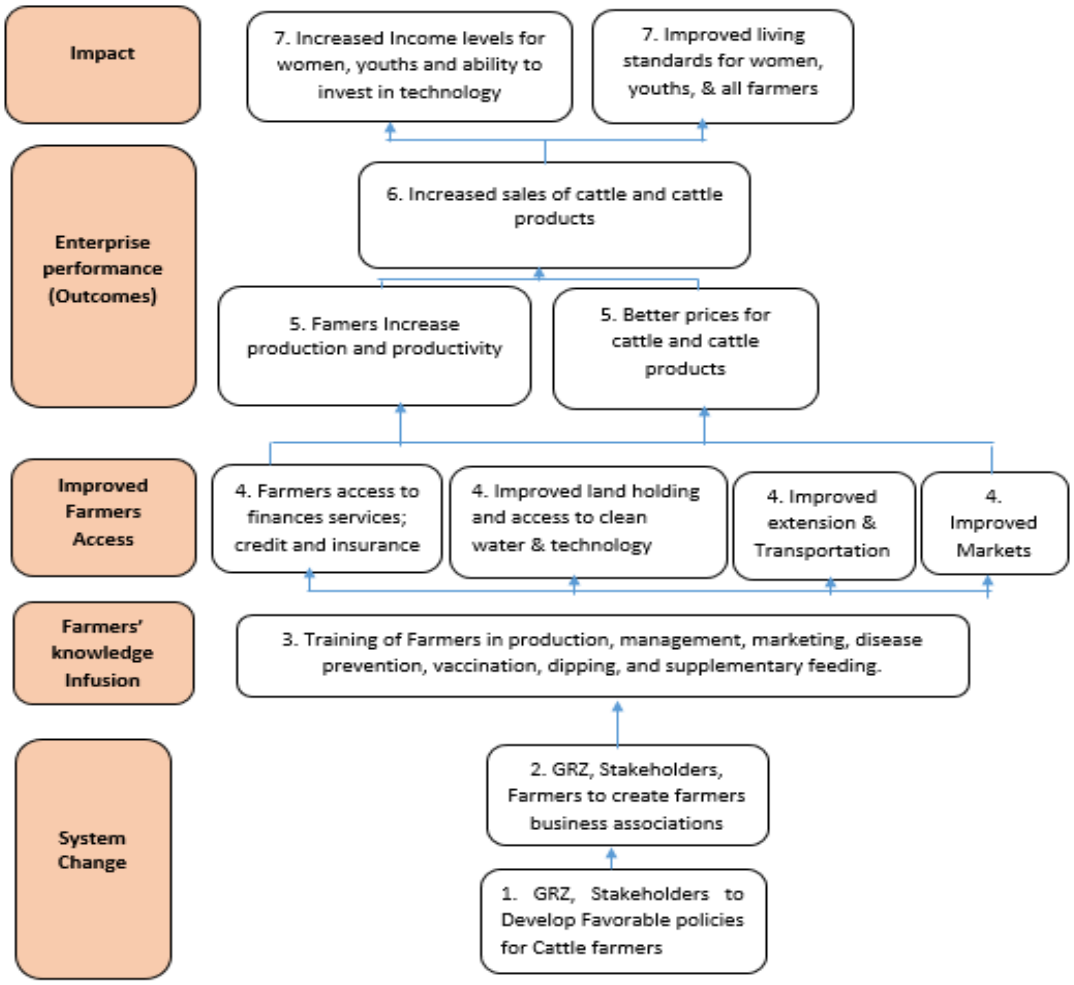


Figure 5.6 Expected outputs from the model framework implementation.

5.5.3 Expected outputs from Market Expansion and Orientation part of the general model framework implementation (Results Chain)

In order to increase the market expansion and orientation to meet both local and internation markets for livestock and livestock products, this model proposes the establishment of a

beef market enterprise. It is believed that the model will support smallholder farmers and improve the value chain within the livestock industry. The initiative aims to increase livestock income for smallholder farmers, provide a reliable market for their livestock, and enhance their livelihoods. As shown in Figure 5.7 the government will secure funds for the operationalization of this model through private public partnerships (PPPs). The PPP will build infrastructure that will be referred to as livestock marketing hubs in different target areas managed by the dual owned market enterprise.

The market enterprise (dairy/meat) adds value to the purchased cattle through processing and packaging, producing high-quality beef and beef products that are then marketed and sold locally wholesale and internationally in the EU and regional markets.

The establishment of livestock marketing hubs will serve as a platform for knowledge sharing and capacity building among stakeholders in the livestock industry. This will lead to improved production practices, market understanding, and business skills. The marketing enterprise will also strengthen livestock associations and quality control boards, enabling smallholder farmers to advocate for their interests and access resources. Quality control boards will ensure compliance with international standards for food safety, hygiene, and animal welfare, enhancing the reputation and competitiveness of Zambia's beef products in the global market.

The enterprise will also offer storage and aggregation services through a warehouse receipt system, allowing farmers to store their produce in certified facilities and access financing against stored commodities. This system will improve market efficiency, reduce post-harvest losses, and provide farmers with access to credit and better prices for their livestock, further enhancing their economic opportunities and resilience.

In conclusion, the proposed government beef market enterprise under the market expansion and orientation represents a holistic approach to addressing the needs of smallholder farmers, promoting value addition, market access, knowledge sharing, and strengthening the competitiveness of Zambia's livestock industry as shown in Figure 5.7.

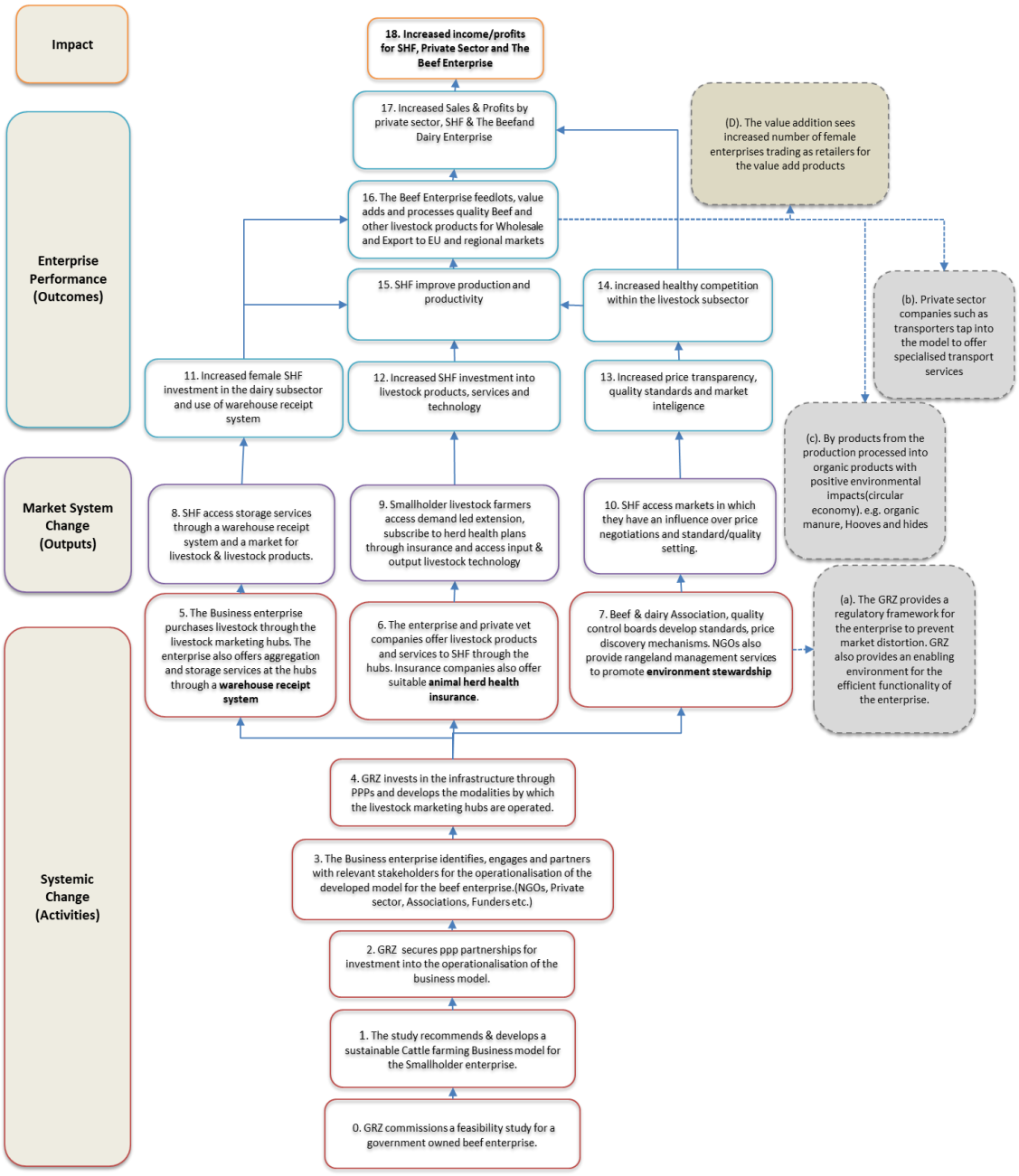


Figure 5.7 Expected outputs from Market Expansion and Orientation part of the general model framework implementation (Results Chain)

5.5 Chapter Summary

This discussion chapter provided a comprehensive discussion of the research data collected, in light of the existing literature, with a focus on the Namwala District of Zambia from 2016 to 2020 to gain a more in-depth insight into the determination factors of the

current traditional cattle business model. A sustainable Cattle Business Model was developed and associated dynamic framework for implementation presented for traditional cattle farmers in the Namwala District of Zambia, with an explanation of each component.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter brings out the conclusion of the study on developing a framework for a sustainable cattle business model for small scale cattle farmers. The chapter starts by highlighting the background and problem under study and brings out the objectives of the study. The chapter further explains the research methodologies that were used in achieving the research objectives. The conclusion explains the findings of the study, which are in line with the research objectives, and explains the proposed business model for growth and sustainability. The chapter then gives recommendations to farmers, the government, the Ministry of Livestock, and all stakeholders on how to ensure growth, profitability and sustainability of cattle business. Lastly, the chapter gives recommendations for future research in cattle business.

6.1 Background and Problem under Study

The traditional cattle business system is continuously characterized by low productivity. This study therefore sought to develop a framework for a sustainable cattle business model for small-scale cattle farmers.

6.2 Research Methodologies Adopted

The study was a mixed method research, which was both quantitative and qualitative in nature. The study used descriptive and causal research designs. A total of 405 cattle farmers participated in the study. Descriptive statistics, multiple linear regression and logistic regression analyses were used for data analysis.

6.3 Findings of the Research Study

From the results, the study found that majority (88%) of the farmers owned open communal land, and family is the main source of labour for cattle production. This study found a 37.27% growth in the average stock from 22.0 cattle per smallholder farmer in 2016 to an

average of 30.2 cattle per smallholder farmer in 2020. Water is a major challenge in cattle production. Most of the smallholder cattle farmers in the region feed their animals off the plains, which accounted for 52% as a feed source.

The majority (80%) of the farmers were not marketing their cattle to potential buyers, had no cattle trading areas, no market associations (99%), and could not fix a price for their animals, but buyers dictate the price to them. Veterinary professionals and meat processors are the most attractive markets preferred by farmers. Local chain stores such as Pick n' Pay, Shoprite Checkers, and Choppies Supermarket, followed by border markets such as Kasumbalesa market, were the more preferred markets. The majority of the farmers were not securing revenue from by-products. Lastly, the majority of the farmers had no access to financial services.

Using multiple regression analysis, the study found that supplementary feeding, access to extension services, dipping of animals, adequacy of water, regular vaccination, access to open communal land, secondary education level, land adequacy, and traditional ceremony (Shimunenga), were found to have significant effect on cattle business production.

From the logistic regression analysis, this study found that milk selling, selling to processors, business attractiveness, selling calves and steers, price of sale, and number of cattle sold were found to have a significant impact on cattle business profitability. This study further found that supplementary feeding, attractiveness of the cattle business, access to extension services, regular dipping of animals, adequacy of water, regular vaccination, profitability of the cattle business, savings and insurance, and access to open communal land had significant impact on sustainability of cattle business. This study developed the cattle business model and a framework for implementation of the model for cattle business sustainability. Therefore, all the study objectives were achieved, and this study gives the following recommendations.

6.4 Research Recommendations

The ministry of Livestock and stakeholder organisations, such as the World Vision Zambia, Musika Development Initiative, World Food Program, Ministry of Community Development and other stakeholders need to support and empower cattle farmers with acquisition to cattle production knowledge for farmers to be capable of running sustainable businesses in environmental, economic and climatic challenges.

The government through the ministry of Livestock, Ministry of Community Development, the ministry of Lands and all stakeholders need to support and empower cattle farmers with acquisition to resources such as land, water, financial capital, and financial services for business sustainability.

The government through the ministry of Livestock need to develop policies that empower cattle farmers in terms of acquisition to resources, which may involve incentives like zero tariffs for inputs in livestock production, titling open communal land to be in the hands of local communities.

The ministry of Livestock and stakeholder organisations need to develop and facilitate the market for livestock products like manure, skin, horns, and hooves; by engaging companies like Omnia, ETG and other companies that can use manure for fertilizer production and biogas.

6.5 Recommendation for Future Research

Future research is required for a needs assessment for financial and extension services and willingness to pay for these services among the traditional cattle farmers.

6.6 Final Conclusion

In considering the traditional cattle business system as continuously being characterised by low productivity, this research study developed the following cattle business model (Figure 6.1) for small-scale cattle farmers. Each section is detailed in chapter five to provide an

integrated Cattle Business Model that presents key areas that need attention to ensure cattle business profitability, growth, and sustainability.

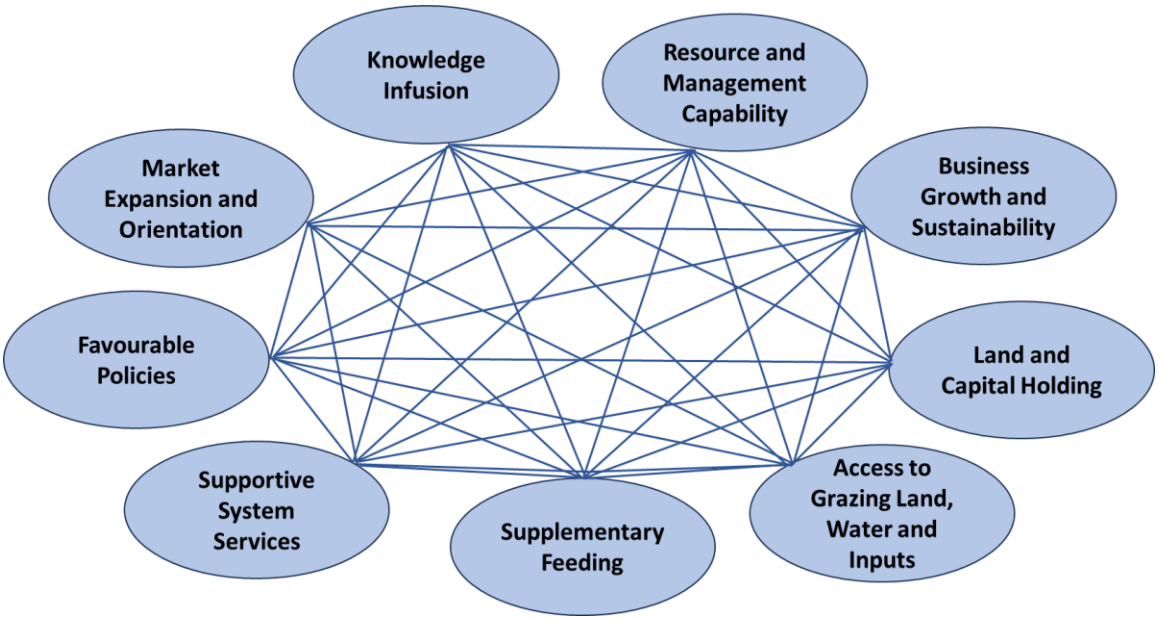


Figure 6.1 Cattle Business Model

Additionally, this research developed an implementation a framework (Figure 6.2) to transition the Cattle Business Model in aiding business growth and sustainability for smallholder farmers.

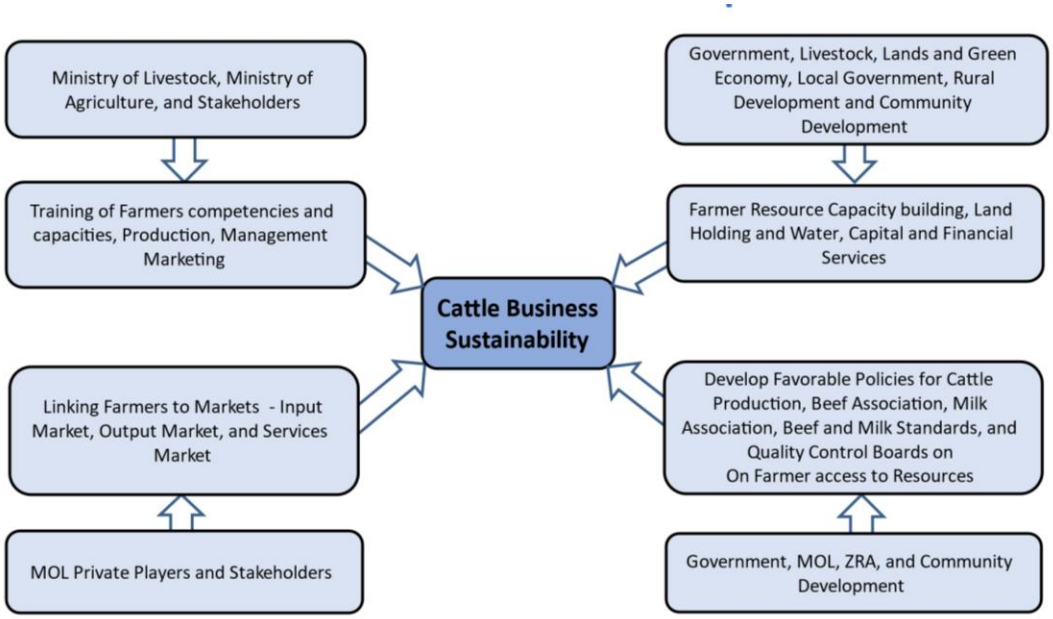


Figure 6.2 Cattle Business Model Implementation Framework

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APPENDICES

Appendix 1: Cattle Farmers Questionnaire

THE UNIVERSITY OF ZAMBIA

GRADUATE SCHOOL OF BUSINESS

LUSAKA-ZAMBIA

Questionnaire on the Development of a framework for a Sustainable Cattle Farming Business Model for Small Scale Cattle Farmers: The case of Namwala District of Zambia

Introduction for Respondent

My name is Enock Siankwilimba, a postgraduate student at the University of Zambia (UNZA), conducting a study on the Development of a framework for a Sustainable Cattle Business Model for Small Scale Cattle Farmers in Namwala District of Zambia. The purpose of this study is to enable me, in part, to fulfil the requirements for the award of Doctor of Philosophy in Business and Management. As a member of the cattle farming community in Namwala, you have been selected as a respondent in this study and I would like to ask you some questions. The information you give will be kept strictly confidential. Therefore, I encourage you to be as open and free as possible. This study adds to the Zambian livestock sector by making an important contribution to poverty reduction, household food security and nutrition, economic growth and exports through increased Livestock Productivity and Production, improved household Food Security and Income, the panacea of diversification of the Livestock Production Base and increased Trade in Livestock and Livestock Products as stipulated in the livestock policy of 2012 in Zambia.

PART A: RESPONDENT INFORMATION

This section includes socio-demographic information about your cattle business in general. Please fill in the information in the spaces provided where appropriate and circle the relevant options where required.

Date of Interview	Day: _____ Month: _____ Year: _____			
A1. Name of Veterinary Camp				
A2. Interviewer Name				
A3. Respondent ID				
Respondent Age and Sex	A4. Age:	A5. Sex:	Female:	Male:
A6. Landholding category *(Tick appropriate response)*	Landless	Small	Medium	Large
A7. Any other occupation besides cattle farming?				
A8. Name of Settlement				
A9. Name of Village				
A10. Number of persons owning farm	1-owner	2-owners	3-owners	4-owners
A11. Years in cattle farming business				
A12. How many workers do you employ?	Paid workers:	Family workers:		Total:
A13. Highest educational level of main owner *(tick appropriate response)*	Primary	Secondary	College	University
A14. Number of people in the household				
A15. Gross household income per year	ZMK:			
A16. Listed below are the possible sources of your income. Estimate how much each source of income contributes to the total household income.				
Income source *(List them order of importance:*	% contribution to total household income (100%)			
i. Cash crops				
ii. Cattle sales				
iii. Food crops				
iv. Labouring				

v. Off-farm business					
vi. Poultry (eggs)					
vii. Poultry (meat)					
viii. Remittances (income support from others e.g., children)					
ix. Other *(please specif)*					
Total *(must up add up to 100%)*					
A17. How did you start the cattle farming business? (Tick appropriate response)		Inheritance	Purchased an existing cattle farm	Built a new cattle farm	*Other
**Other could include purchasing a family business or converting a crop farm into a cattle farm*					
A18. Reasons for owning cattle Circle 1 number *(3= very important reason, 2= important reason, 1=least important reason)*					
	a. Sale of live animals	1	2	3	
	b. Sale of livestock products	1	2	3	
	c. Food for the family	1	2	3	
	d. Savings and insurance	1	2	3	
	e. social status prestige	1	2	3	
	f. Crop agriculture	1	2	3	
	g. Transport	1	2	3	
	h. other reasons (specify):	1	2	3	
A19. CATTLE STOCK *(Please provide the number cattle you owned in each year from 2016 to 2020)*					
a. Total number of cows	2016:	2017:	2018:	2019:	2020
b. Total number of heifers	2016:	2017:	2018:	2019:	2020
c. Total number of calves	2016:	2017:	2018:	2019:	2020
d. Total number of bulls	2016:	2017:	2018:	2019:	2020
e. Total number of steers	2016:	2017:	2018:	2019:	2020
f. Total number of cattle	2016:	2017:	2018:	2019:	2020
A20. CATTLE SALES AND LOSS (*Please provide the number of sales and losses in each of the years below.*					
a. Total number of cows sold	2016:	2017:	2018:	2019:	2020:

b. Approximate weight per kg					
c. Total number of heifers sold	2016:	2017:	2018:	2019:	2020:
d. Approximate weight per kg					
e. Total number of calves sold	2016:	2017:	2018:	2019:	2019:
f. Approximate weight per kg					
g. Total number of bulls sold	2016:	2017:	2018:	2019:	2020:
h. Approximate weight per kg					
i. Total number of steers sold	2016:	2017:	2018:	2019:	2020:
j. Approximate weight per kg					
k. Total number of cattle sold	2016:	2017:	2018:	2019:	2020
l. Total number of cattle lost to disease/or other causes	2016:	2017:	2018:	2019:	2020:
m. Total number of cattle given as cultural payment e.g., lobola	2016:	2017:	2018:	2019:	2020:
n. Total number of draught cattle	2016:	2017:	2018:	2019:	2020:
o. Total number of dairy cows	2016:	2017:	2018:	2019:	2020:
A21. What is your estimate of the average price per animal per kg throughout the year for each month?					
Jan:	Feb:	March:	April:	May:	June:
July:	Aug:	Sept:	Oct:	Nov:	Dec:

A.22 What is the average milk yield in litres per day over the course of a year?					
Jan:	Feb:	March:	April:	May:	June:
July:	Aug:	Sept:	Oct:	Nov:	Dec:
A23. What is the average price per litre of milk over the course of a year?					
Jan:	Feb:	March:	April:	May:	June:
July:	Aug:	Sept:	Oct:	Nov:	Dec:
A24. Describe the availability of water for cattle	Write Description here:				
A25. Describe the availability of grazing pasture for cattle in your area.	Write Description here:				
A26. Do you have a specifically built feeding lot for your cattle? 1. Yes 2. No	Write Description here:				

PART B: BUSINESS OFFERING

Part B looks at the type of cattle business that you are offering to your clients. This includes your thoughts about how attractive the cattle market is, and how much value for business you offer your clients. Please answer all questions.

2A: MARKET ATTRACTIVENESS – This section looks at how attractive the cattle market is, in your area. Please respond to all items.

	B1. Do you deliberately market your cattle business to market players? 1. Yes 2. No *(tick one)*	
	B2. If YES, how do you market your cattle business?	Write Description here:
	B3. Do you have specific cattle marketing place in your area? 1. Yes 2. No (tick one)	

	B4. Are you currently using the cattle livestock market in your area? *(Tick one)* a. Yes, I regularly buy and sell livestock there. b. Yes but I only sell livestock there. c. Yes but I only buy livestock there. d. I only visit but don't buy/sell any livestock. e. No I don't visit the market	B5. Give reason/s for your answer here for B4
	B6. If YES, how often do you use the cattle market? a. Once a week b. Every other week c. Once a month d. Once a quarter e. Once or twice a year f. Less frequent g. Not Applicable	B7. Give reason/s for your answer here for B6.
	B8. What other markets do you attend regularly to PURCHASE cattle? Why?	Write Description here:
	B9. Are after-purchase services provided? 1. Yes 2. No *(tick one)*	B10. Explain further your answer in B9.
	B11. What other markets do you attend regularly to SELL your cattle?	Write Description here:

	B12. Are after-purchase services provided? 1. Yes 2. No *(tick one)*	B13. Explain further your answer in B12.									
	B14. Is there cattle marketing association in your area that you belong too? 1. Yes 2. No *(tick one)*)	B15. Explain further your answer in B14.									
	B16. If YES, describe the market benefits of belonging to this association or network.	Write Description here:									
	B17. On a scale of 1-10, where 10 = very attractive (VA), 5= adequately attractive (AA) and 1=not attractive (NA), how attractive is the cattle market in your area. (Circle one number for each item)										
	a. Attractiveness of the cattle market in your area	1	2	3	4	5	6	7	8	9	10
	b. Market attractiveness offered by cattle market association	1	2	3	4	5	6	7	8	9	10
	c. Market Attractiveness offered by cattle transporters	1	2	3	4	5	6	7	8	9	10
	d. Market Attractiveness offered by meat processors	1	2	3	4	5	6	7	8	9	10
	e. Market Attractiveness offered by cattle dealers	1	2	3	4	5	6	7	8	9	10
	f. Market Attractiveness offered by cattle brokers	1	2	3	4	5	6	7	8	9	10
	g. Market Attractiveness offered by food restaurants	1	2	3	4	5	6	7	8	9	10
	h. Market Attractiveness offered by livestock professional	1	2	3	4	5	6	7	8	9	10

	B18. Of all the network players in your business, with whom do you prefer to do business with? Why?	Write Description here:
	B19. Does the traditional cattle market in your area offer strategic partnerships for preferred market players?	B20. Explain how this affects the market (e.g., cooperatives, insurance, funding, animal health etc):
	B21. Are cattle purchasing or marketing deals done with or without the help of middlemen? 1. Yes 2. No *(tick one)*	B22. Explain how this affects the market (e.g., increased access, increased animal costs, reduced number of players in the business)

2B. UNIQUE VALUE PROPOSITION – This refers to how unique and special is the value addition to your cattle business

B23. On a scale of 1-10, where 10 = very high value, 5= high attractive and 1=low value), what value advantages do the traditional cattle farming business offer to cattle market players in your area?										
a. Location/Proximity	1	2	3	4	5	6	7	8	9	10
b. Ease of Access	1	2	3	4	5	6	7	8	9	10
c. Mixed livestock sales	1	2	3	4	5	6	7	8	9	10
d. Size of market	1	2	3	4	5	6	7	8	9	10

e. better prices	1	2	3	4	5	6	7	8	9	10
f. Quality of livestock available	1	2	3	4	5	6	7	8	9	10
g. Business services & Advice	1	2	3	4	5	6	7	8	9	10
h. Local Facilities on site	1	2	3	4	5	6	7	8	9	10
i. Visit Family & Friends	1	2	3	4	5	6	7	8	9	10
j. Able to make linked visits shopping or business	1	2	3	4	5	6	7	8	9	10
k. Other (Explain):	1	2	3	4	5	6	7	8	9	10

B24. What mode of transport is used to transport cattle to the markets? a. Road b. Rail	B25. Does the mode of transport affect the value of cattle? Explain how?
B26. Is there adequate transportation for ferrying cattle to the market for far flung cattle farmers? 1. Yes 2. No *(tick one)*	B27. Explain further your answer in B26.
B28. Describe how the types of vehicles used in transportation add/reduce value to your business.	Write Description here:
B29. Is there a group of market players you want to sell your cattle to, but you do not have the necessary access to? List them down.	List here:

B30. On a scale of 1-10, where 10 = very unique & attractive, 5= unique & attractive and 1= hardly unique & attractive), What makes cattle business and services very unique and attractive in your area?

a. Mixed livestock sales	1	2	3	4	5	6	7	8	9	10
b. Coordinated livestock collection	1	2	3	4	5	6	7	8	9	10

c. Specialist slaughtering	1	2	3	4	5	6	7	8	9	10
d. Cold storage/butchery facility	1	2	3	4	5	6	7	8	9	10
e. Small Business Units	1	2	3	4	5	6	7	8	9	10
f. Beef Processing	1	2	3	4	5	6	7	8	9	10
g. Business Advice/Support	1	2	3	4	5	6	7	8	9	10
h. Flexible Business Space	1	2	3	4	5	6	7	8	9	10
i. Mobile communication facilities	1	2	3	4	5	6	7	8	9	10
j. Farm Shop	1	2	3	4	5	6	7	8	9	10
k. Rural retail units	1	2	3	4	5	6	7	8	9	10
l. Veterinary facilities	1	2	3	4	5	6	7	8	9	10
m. Cattle breed types	1	2	3	4	5	6	7	8	9	10
n. Other; (Describe)	1	2	3	4	5	6	7	8	9	10
B31. Describe any challenges that you face in market attractiveness and your unique value offer.	Write Description here:									

PART C: MONETISATION

Part C of this questionnaire is about how well your business is doing in terms of profits, sales performance and business expenses. Please ensure that you answer all questions as truthfully as possible.

3A. CATTLE BUSINESS PROFIT

C1. On a scale of 1-10, where 10 = very profitable, 5= profitable and 1= hardly profitable, describe your revenue in the last three seasons of your cattle business?										
a. 2018 revenue	1	2	3	4	5	6	7	8	9	10
b. 2019 revenue	1	2	3	4	5	6	7	8	9	10
c. 2020 revenue	1	2	3	4	5	6	7	8	9	10

C2. Of the three years listed above, which was the most profitable and why?	Select most profitable year and describe why:
C3. Of the three years listed above, which was the least profitable and why?	C4. Select most profitable year and describe why:
C5. Are you able to sell cattle or its by-products and services for as much as you think and want? 1. Yes 2. No *(tick one)*	C6. Explain Your response to C5:
C7. Does your household size influence your cattle business profitability? 1. Yes 2. No *(tick one)*	C8. Explain Your response to C7.

C9. Rank the following cattle business costs from 1 to 10 in terms of how significantly they affect and influence your cattle business revenue; 1= low influence, 5= medium influence 10=High influence.

a. Wages for cattle attendants/herdsmen	1	2	3	4	5	6	7	8	9	10
b. Feeds	1	2	3	4	5	6	7	8	9	10
c. Water	1	2	3	4	5	6	7	8	9	10
d. Transport	1	2	3	4	5	6	7	8	9	10
e. Veterinary services	1	2	3	4	5	6	7	8	9	10
f. Association fees	1	2	3	4	5	6	7	8	9	10
g. Loading and unloading fees	1	2	3	4	5	6	7	8	9	10
h. Local taxes	1	2	3	4	5	6	7	8	9	10

C10. On a scale of 1-10, where 10 = very high expenses, 5= high expenses and 1= low expenses, describe your expenses in the last three seasons of your cattle business?										
a. 2018 expenses	1	2	3	4	5	6	7	8	9	10
b. 2019 expenses	1	2	3	4	5	6	7	8	9	10
c. 2020 expenses	1	2	3	4	5	6	7	8	9	10

C11. Is your smallholder cattle business operationally efficient in the last three years? (Efficiency ratio = total revenue/total cost) 1. Yes or 2. No *(tick one)*	C12. Explain your response to C11:		
C13. Do you have access to financial services from the following?	Bank	Insurance	Government/Family
C14. If yes, how often do you access the insurance products and services and from which company	Once a year	Every quarter	Twice per year
C15. If no, why don't you access these financial services for your business?	No company selling	Very expensive	No information about the products

C16. Does your business get any revenue from the following: Yes or No	
a. Milk: 1. Yes or 2. No	Explain your response:
b. Cow dung: 1. Yes or 2. No	Explain your response:
c. Cattle hides: 1. Yes or 2. No	Explain your response:
d. Cattle hooves: 1. Yes or 2. No	Explain your response:

3B. SALES PERFORMANCE

C17. Describe the general picture of cattle business sales in your area.	Very adequate	Just adequate	Not adequate
C18. What is the average age of sale for your cattle stock?			
C19. Are you able to sell cattle or its by-products and services for as much you think it is worth? 1. Yes or 2. No *(Tick one)*	C20. Explain your response to C19:		

C20. On a scale 0f 1-10, rank these characteristics in how they influence cattle herd sales formation with: 10=very important, 5=important, 1= not important.										
a. Age of cattle	1	2	3	4	5	6	7	8	9	10
b. Body condition	1	2	3	4	5	6	7	8	9	10
c. Occasion	1	2	3	4	5	6	7	8	9	10
d. Colour	1	2	3	4	5	6	7	8	9	10
e. Sex	1	2	3	4	5	6	7	8	9	10
f. Breed	1	2	3	4	5	6	7	8	9	10
g. Prevailing market demand &supply	1	2	3	4	5	6	7	8	9	10
C21. On a scale 0f 1-10, rank the following market players, who offer the best sales deals: 10=best sales deals, 5=good sales deals, 1= low sales deals										
a. Cattle transporters	1	2	3	4	5	6	7	8	9	10
b. Meat/Food Processer	1	2	3	4	5	6	7	8	9	10
c. Cattle retailers/dealers	1	2	3	4	5	6	7	8	9	10
d. Brokers	1	2	3	4	5	6	7	8	9	10
e. Caterers	1	2	3	4	5	6	7	8	9	10
f. Other	1	2	3	4	5	6	7	8	9	10
C22. Explain how seasonal variations affect your sales.	Explanation:									

C23. How often do you do barter system with you cattle and other essential goods?	1. never	2. Sometimes	3. Always
C24. List the cultural barriers that you think affect your sales,	List:		

PART D. SUSTAINABILITY OF THE SMALLHOLDER CATTLE BUSINESS

This section contains items on how sustainable your cattle business is, in the short and long term. Please respond very carefully. The section focuses on how competitive your business is, how well you are adopting newer cattle business practice and how eventually you will exit your business leaving it viable and profitable.

4A. ONGOING COMPETITIVE ADVANTAGE SYSTEMS

D1. Rate each of the following statements on the scale 10-point scale with 1=totally disagree, 5= not sure and 10=Totally agree. Circle only one number.									
a. Traditional cattle farming business has lower cattle rearing costs compared to others.									
1	2	3	4	5	6	7	8	9	10
b. Elaborate your response above:									
c. Traditional cattle farmers have access to cattle rearing resources.									
1	2	3	4	5	6	7	8	9	10
d. Elaborate your response above:									
e. The current traditional approaches to cattle farming allows players to maintain and grow their business									
1	2	3	4	5	6	7	8	9	10
f. Elaborate your response above:									
g. Annual ceremonies such as Shikaumpa/Shimunenga help to grow the traditional cattle business									
1	2	3	4	5	6	7	8	9	10
h. Elaborate your response above:									

i. Transhumas or Kuwila grazing systems influence the decision to sell animals.									
1	2	3	4	5	6	7	8	9	10
j. Elaborate your response above:									
k. The bargaining power of buyers is increasing.									
1	2	3	4	5	6	7	8	9	10
l. Elaborate your response above:									
m. Partnerships are being entered into two by cattle farmers and other key market players.									
1	2	3	4	5	6	7	8	9	10
n. Elaborate your response above:									

4B. INNOVATION FACTOR SYSTEMS:

D2. Are you willing to innovate and bring new technologies into your cattle farming business? 1. Yes 2. No *(tick one)*	Explain		
D3. Has your cattle farming business adopted any new innovations to sustain the business? 1. Yes 2. No *(tick one)*			
D4. In which of the following areas have you adopted new innovations:	List the adopted innovations	Y	N
a. Adopted cattle management	Record systems utilised		
	Specific breeding planning		
	Grazing planting		
	Grazing of crop residues		
	Other:		
b. Feeding:	Use of silage		
	Processed feed		

	Molasses/urea		
	Vitamins provided		
	Other:		
c. Breeding	Male breeds utilised		
	Female breeds incorporated		
	Female/male crosses utilised		
	Calves' selection criteria used		
	Other:		
d. Reproduction	Evaluation in bulls		
	Cow body condition analysis		
	Continuous mating		
	Planning mating control		
	Other:		
e. Animal health	Animal health planning done		
	Vaccinations done		
	Parasite diagnoses done		
	De-worming control done		
	Spraying and or Dipping		
	Other		
D5. List the barriers to innovation that you have faced.	List:		

4C: AVOIDANCE OF PITFALLS OR COUNTERBALANCING AND REINFORCEMENT SYSTEMS:

D6. List all the possible barriers that may impact your cattle farming business.
D7. Rate each of the following statements on the scale 10-point scale with 1=totally disagree, 5= not sure and 10=Totally agree. Circle only one number.

a. Agricultural Support Services Market System players fully support all the players in the cattle smallholder business?									
1	2	3	4	5	6	7	8	9	10
b. Elaborate your response above:									
c. The support service market systems for small scale cattle farmers are operating adequately.									
1	2	3	4	5	6	7	8	9	10
d. Elaborate your response above:									
e. Governmental regulations and rules (or the removal of them), affect the smallholder cattle business players.									
1	2	3	4	5	6	7	8	9	10
f. Elaborate your response above:									
g. Cultural and traditional rules and regulations affect the daily operation and running of the smallholder market players in the industry.									
1	2	3	4	5	6	7	8	9	10
h. Elaborate your response above:									
i. Climatic and environmental changes in the recent past can affect cattle business farming									
1	2	3	4	5	6	7	8	9	10
j. Elaborate your response above:									
k. There are enough customers in the cattle industry.									
1	2	3	4	5	6	7	8	9	10
l. Elaborate your response above:									

4D. GRACEFUL EXIT

D8. How many people are involved in running this cattle business?										
D9. As a cattle business owner, you are the final decision maker.										
D10. If 'No' which other persons support, you in making decisions.										
D11. Do you always use the same business partners, or you work with whoever has a cattle business deal?										
D12. Rate each of the following statements on the scale 10-point scale with 1=totally disagree, 5= not sure and 10=Totally agree. Circle only one number.										
a. The cattle business runs smoothly when the owner is around.	1	2	3	4	5	6	7	8	9	10
b. All hired persons are allocated job tasks by the owner.	1	2	3	4	5	6	7	8	9	10
c. The business current value exceeds the value needed to exit comfortably.	1	2	3	4	5	6	7	8	9	10
d. Key employees are incentivised, compensated, and motivated to increase the value of the cattle business and remain with the company.	1	2	3	4	5	6	7	8	9	10
e. There is a growth strategy for the cattle business.	1	2	3	4	5	6	7	8	9	10
f. The non-financial characteristics that make the company/enterprise valuable to potential buyers are clearly understood	1	2	3	4	5	6	7	8	9	10
g. It's good to transfer the cattle business to any family member that has sufficient business knowledge	1	2	3	4	5	6	7	8	9	10
h. My business is free from family succession concerns.	1	2	3	4	5	6	7	8	9	10
i. My successor should have the skills and knowledge to be the owner of the business.	1	2	3	4	5	6	7	8	9	10

Thank you for your participation!

THE UNIVERSITY OF ZAMBIA

GRADUATE SCHOOL OF BUSINESS

LUSAKA-ZAMBIA

Questionnaire on the Development of a framework for a Sustainable Cattle Farming Business Model for Small Scale Cattle Farmers: The case of Namwala District of Zambia.

Introduction for Respondent

My name is Enock Siankwilimba, a postgraduate student at the University of Zambia (UNZA), conducting a study on the Development of a framework for a Sustainable Cattle Business Model for Small Scale Cattle Farmers in Namwala District of Zambia. The purpose of this study is to enable me, in part, to fulfil the requirements for the award of Doctor of Philosophy in Business and Management. As a member of the cattle farming community in Namwala you have been selected as a respondent in this study and I would like to ask you some questions. The information you give will be kept strictly confidential. Therefore, I encourage you to be as open and free as possible. This study adds to the Zambian livestock sector by making an important contribution to poverty reduction, household food security and nutrition, economic growth and exports through increased Livestock Productivity and Production, improved household Food Security and Income, panacea of diversification of the Livestock Production Base and increased Trade in Livestock and Livestock Products as stipulated in the livestock policy of 2012 in Zambia.

FOCUS GROUP DISCUSSION GUIDE

Introduction

We are going to discuss various aspects of cattle farming as practiced in Namwala District. We would like you to pay attention to various aspects of your business namely: The nature of your business offer (describe the components); How you monetise your business transactions

and what you think about business sustainability. As you think about these three aspects you should also keep in mind how they are interrelated, how tradition cultural belief systems about cattle business influences them and the role of climatic changes.

Discussion Statements

1. What are the current business management challenges in your cattle value chain in terms of social, environment, economic, political factors?
2. Describe how you are currently managing the above challenges?
3. Describe how you got involved in the cattle farming business.
4. Market Attractiveness & Unique Value Offer
    a. Describe how you operate your current cattle business as a traditional farmer in Namwala District in terms of the following.
        i. Marketing.
            a) How do you market your cattle business?
            b) How attractive is the cattle business?
            c) Who are the key stakeholders in marketing?
            d) Are there cultural and traditional factors that influence your marketing strategy?
            e) What challenges do you face in marketing?
            f) How can you improve the marketing scenario?
        ii. Value Addition.
            a) How can you add value to your cattle business?
            b) What makes cattle farming business in Namwala to be unique?
            c) What are the barriers to value addition or proposition?
5. Monetisation - Describe the profitability and saleability of cattle in Namwala?
        i. Profitability.
            a) How profitable is your current cattle business approach?
            b) What recurring costs do you face every year?
            c) Are there costs that you think you can avoid?
            d) Does government and local government regulations affect your profitability?

e) Can you improve your cattle business profitability? How?
f) Do you have a preferred off-taker for your cattle business in dairy and beef? If yes give an account of why you prefer that firm

ii. Sales performance
a) Can you describe the sales performance of your cattle business?
b) What factors do you consider when deciding to sell your cattle?
c) Which stakeholders have you partnered with in selling your cows?
d) What are the major socio-economic constraints that you confront in your sales?
e) Do seasonal variations affect the sales performance of your cattle business?
f) Of the two which one gives you more revenue, dairy, and beef-business? and which one do you prefer?

6. Sustainability – Describe how the current business will be sustainable in future.
i. On-going competitive advantage.
a) How competitive is the current business model?
b) Can this advantage be maintained? How?
c) How do the Shimunenga/Shikaumpa ceremonies influence your cattle rearing business?

ii. Innovation and sustainability.
a) Has your cattle business adopted any new innovations in the recent past?
b) Can you describe these innovations in terms of?
- Cattle management
- Feeding
- Breeding techniques
- Reproduction strategies
- Animal health

c) What are the other benefits of having a sustainable business approach?
d) What pitfalls do you face in sustainability and how can you avoid them?
e) What is the role of socio-cultural factors in sustainability?
f) How is climate change and extreme weather conditions affecting your business approach?
g) How can you improve the sustainability of your business?
h) What the socio-cultural challenges to cattle business sustainability in Namwala

iii. Is it possible to create a cattle business entity that can survive even if you to leave or sell it? How?

7. Putting it together
   a. Describe the new approach to cattle business farming in Namwala.
   b. How can you improve the current cattle business model in Namwala to reflect all the components of a dynamic business model?
   c. How can Transhumans or Kuwila Ku Luntanga help to improve your animal business?

Data Collection Sheet-Spatial Group Model Building (Focus Group meetings) for developing a Framework for Livestock farming business management in Namwala.

Time	**Activity**	**Themes**
08:00-08:30	1. Registration	Participants settle
08:30-09:00	2. Introduction	-What do we seek to achieve -How we do it -Concepts of systems thinking (ST)-look at whole Livestock value chain/network -Organisation of the session -Hopes and fears

Time	Activity	Themes
09:00-09:30	3. A new vocabulary-SD	Stocks, flows (intervention), parameter (variables)
09:30-10:00	4. Scene setting defining the context	-where we are -What's there (layer definition), flip chat -Use of ST language -who is there in the VC -how it changed (setting/context) -how is it changing -What we would like to achieve (hopes, fears, expectation)
	Coffee Break	
10:30-11:30	5. Problem identification + variables (Use of the map). How can we improve livestock markets?	-What are key Animal issues in the VC with regards to markets? -Where do they take place (local or extend?) -To whom? -Which most important? -How measure (variables as metrics) -Behaviour over time for identified variables -How interact within context (Local process, diffusion process, structural)
11:30-12:30	6. Causes of the problem (socioeconomic impact)	-Identification of the direct and indirect (what causes the causes) -Internal versus external to context -How does space mediate it all -How interact with context?
12:30-13:30	7. Feedback (framework for marketing of livestock)	Causes and consequences. How the Namwala landscape mediates markets
LUNCH-END OF STAKEHOLDER MEETING		

Appendix 2: Ethical Clearance

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

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APPROVAL OF STUDY

6th October, 2020

REF NO.HSSREC-2020-SEP--005

Enock Siankwilimba
LUSAKA.

Dear Mr. Siankwilimba,

RE: "DEVELOPMENT OF A FRAMEWORK FOR A SUSTAINABLE CATTLE BUSINESS MODEL FOR SMALL SCALE CATTLE FARMERS: THE CASE OF NAMWALA DISTRICT OF ZAMBIA"

Reference is made to your protocol dated 9th September, 2020. HSSREC resolved to approve this study and your participation as Principal Investigator for a period of one year.

REVIEW TYPE	ORDINARY REVIEW	APPROVAL NO. HSSREC-2020-sep-005
Approval and Expiry Date	Approval Date: 6th October, 2020	Expiry Date: 5th October, 2021
Protocol Version and Date	Version - Nil.	5th October, 2021
Information Sheet, Consent Forms and Dates	• English.	To be provided
Consent form ID and Date	Version - Nil	To be provided
Recruitment Materials	Nil	Nil
Other Study Documents	Questionnaire.	
Number of Participants Approved for Study		

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Excellence in Teaching, Research and Community Service

Appendix 3: Published Articles

Appendix 3.1: Published Paper 1

Siankwilimba et al., Cogent Food & Agriculture (2023), 9: 2206233
https://doi.org/10.1080/23311932.2023.2206233

cogent food & agriculture

FOOD SCIENCE & TECHNOLOGY | REVIEW ARTICLE

Sustainability of agriculture extension services in the face of COVID-19: A study on gender-specific market systems

Enock Siankwilimba[1,2*], Jacqueline Hiddlestone-Mumford[3,4], Md Enamul Haque[5*], Bernard Mudendo Hang'ombe[6], Chisoni Mumbo[7], Oliver Jolezya Hasimuna[8,9,10*], Sahya Moulic[11,12], Joseph Mphande[13,14], Moses Chibesa[15], Mayoba B. Moono[16], Valdemiro Muhala[17,18], Luigi Pio Leonardo Cavaliere[19], Alessio Faccio[20] and Gunawan Prayitno[21]

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Reviewing editor:
Manuel Tejada, Nutrition and Biomatology, Universidad de Sevilla, Spain

Additional information is available at the end of the article

Abstract: In the fourth industrial revolution, achieving sustainable agricultural development while feeding a growing world population and maintaining a balanced interrelationship between the economy, society, and the environment has been a significant challenge. However, COVID-19 disrupted agricultural extension and advisory systems, affecting all market participants. The complexity of the pandemic has impacted the private sector, public sector, extension staff, donor funding, education, and research systems, subsequently affecting human nutrition. This paper aims to expertly review COVID-19's effects on the sustainability of gender-specific agricultural extension service systems. Demand and supply market stakeholders in the extension system are thematically discussed. The findings reveal various consequences of COVID-19 for market actors on both the demand and supply sides of the extension system. Private-sector players often support expansion directly or indirectly, with multi-sectorial support and funding strategies

Enock Siankwilimba

ABOUT THE AUTHOR

Enock Siankwilimba, a seasoned agricultural market system development expert with over two decades of experience, has contributed to numerous donor funded extension programs and projects in Zambia. He is a founding member of Musika Development Initiative Zambia Limited, where he currently serves as a consultant and technical advisor. Additionally, Enock is a PhD student at the University of Zambia's Graduate School of Business Studies, focusing on developing a sustainable cattle business model for small-scale cattle farmers in Namwala District, Zambia, utilizing a systems dynamic approach. His research interests encompass agricultural market system development, livestock and crop business models, climate change, value chain development, and rural agricultural extension development.

PUBLIC INTEREST STATEMENT

Agriculture faces complex challenges hindering its growth and global food production due to the ever-growing population. Women and youth significantly contribute to food production and have been disproportionately affected by these challenges. Creating gender-specific markets to promote inclusive and sustainable development has been a persistent challenge for international and national organizations.

Employing agricultural extension service systems to stimulate the growth of women and youth in agriculture received support, but COVID-19 disrupted this effort. This paper explores the literature on the sustainability of agriculture extension services amid COVID-19's impact on gender specific market systems in developing countries. The study's results are crucial for policymakers, academics, and program implementors involved in agricultural market development worldwide.

Appendix 3.2: Published Paper 2

SPRINGER LINK

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Bioecosystems towards sustainable agricultural extension delivery: effects of various factors

Review | Published: 14 July 2023

(2023) Cite this article

Environment, Development and Sustainability

Aims and scope →

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Enock Siankwilimba, Chisoni Mumba, Bernard Mudenda Hang'ombe, Joshua Munkombwe, Jacqueline Hiddlestone-Mumford, Munyaradzi A. Dzvimbo & Md Enamul Hoque

369 Accesses 2 Citations Explore all metrics →

Abstract

This review aims to explore factors that enhance the sustainability of agricultural extension systems in the traditional institution bioecosystem to deliver educational information. The study was based on a purposive sampling criterion for research articles from journal websites. One hundred and eighty-seven articles from 2015 to 2023 were reviewed. One hundred and fifty-three were double-reviewed articles from journals, twenty reports from trusted government and private websites, and fourteen web-based articles were synthesized according to the listed keywords and the overall objective. From the analysis, this study demonstrates that the literature attested to the interconnected relationship between traditional institutions and other market players, although inevitable negative consequences do occur. The findings also show that sustainability, value addition, innovation, collaboration, cooperation, and partnerships are critical factors in the extension bioecosystems in traditional institutions. This review study concludes that traditional institutions can enhance agricultural extension to provide sustainable rural development as long as the service providers harmonize the relationship with the local community to increase buy-in. Win–win commercial relations trigger value addition, innovations, collaborations, and sustainability for policy markets, politicians, researchers, and farmers.

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Abstract

Availability of data and material

References

Funding

Author information

Ethics declarations

Additional information

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Appendix 3.3: Published Paper 3

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REVIEW PAPER

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COVID-19 and the Sustainability of Agricultural Extension Models

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ABSTRACT

Agricultural extension and advisory services in information and technology dissemination and delivery are critical in a developing country's food security and sustainability. Without extension service provision, the productivity and production smallholder farmers are experiencing would have been much lower, and current global hunger and malnutrition worse. This paper assesses the effects of COVID-19 on the sustainability of agricultural extension models/approaches for smallholder farmers in developing countries. Over 60 papers were reviewed covering 2019-2021, commencing with the disease outbreak in China. Based on characteristics and usage, the findings indicate most reviewed extension models were disrupted. No single model was entirely disbanded as the impact of COVID-19 was being felt. However, each model incorporated a digital means of communication to keep farmers and service providers in touch. There is considerable criticism around the inadequacy of these extension techniques in advancing the agenda for smallholder farming's long-term viability that needs to be addressed.

Keywords: Agricultural Extension Model, COVID-19, developing country, small holder farmers

Appendix 3.3: Published Paper 4

ANIMAL HUSBANDRY & VETERINARY SCIENCE | REVIEW ARTICLE

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The dynamics of smallholder cattle business systems in Zambia: Geographical opportunities, challenges and sustainability business implications

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ABSTRACT

The study examines the potential of Zambia's cattle industry as a solution to food insecurity, while also addressing obstacles such as climate change, disease outbreaks and limited technology adoption. Employing the desktop review study design and drawing on data from the 2022 Livestock Survey Report and the 2017/2018 fisheries and livestock census, augmented by a systematically conducted literature review encompassing 63 peer-reviewed articles, the study provides insights into the geographical dynamics, challenges and opportunities within Zambia's cattle subsector. It identifies key factors influencing sustainable livestock production, including cattle management systems, environmental characteristics and socio-economic factors. Government policies, market dynamics and infrastructure development are highlighted as moderating factors shaping the viability of cattle enterprises. The study reveals notable variations in cattle populations across regions and identifies obstacles faced by smallholder farmers, including limited financing and regulatory burdens. Despite challenges, the study suggests that fostering sustainable cattle business models in Zambia is achievable through innovative strategies such as enhancing value propositions and improving market access. By addressing these challenges and seizing opportunities, Zambia can enhance its cattle industry, contributing to sustainable development, food security and economic prosperity.

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