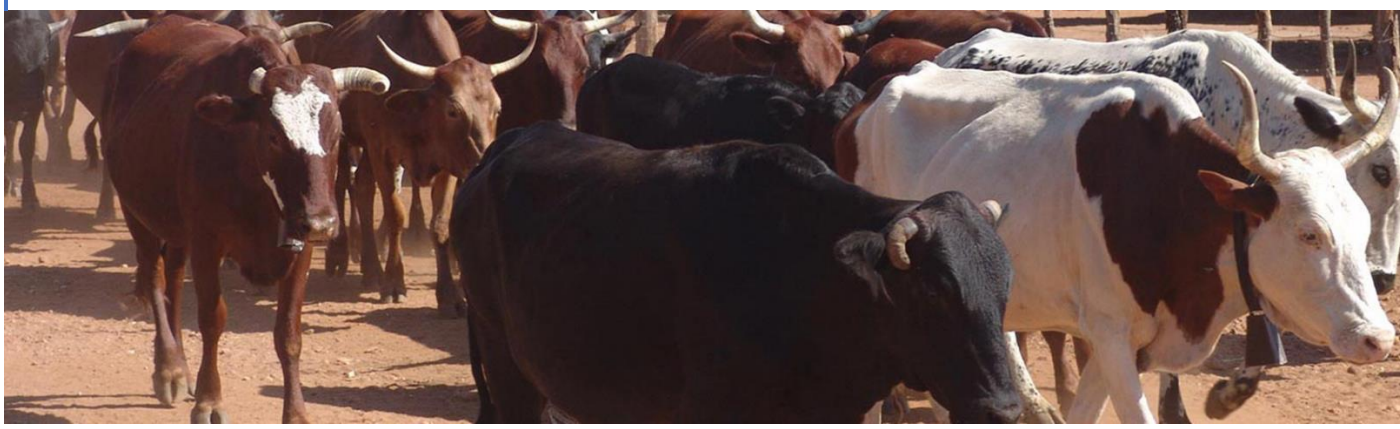
KNOWLEDGE AND PRACTISES IN CONTROLLING (BOVINE) THEILERIOSIS IN ZIMBABWE



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ACKNOWLEDGEMENTS

Reflecting on how I started conducting research during the COVID-19 pandemic and ended up writing this thesis made me realise that this was such a life-changing experience. This research was made easier through the support of various people. First, I would like to thank Nuffic Development/Orange Knowledge Program Fellowship for sponsoring my Master's degree at Wageningen University and Research, the Netherlands. A special thanks goes to my supervisor, Kees Jansen, whose professional support and competent guidance enabled me to finish this journey. My gratitude goes to the farmers, veterinary extension workers, and shop assistants in Gutu district, whose participation in this research meant a lot to me. My loving husband, Goden, and our children, your help, support, and reassurances that I will finish gave me the courage to persevere throughout my studies and strengthened me despite our distance. My friends (Laura, Oluwatosin, Wadzanai, Matthew, Marlous), you have been more than just friends. Above all, I give thanks to God for being able to travel this journey.

ABSTRACT

Farmers and Department of Veterinary Services (DVS) extensionists in Zimbabwe's rural communal areas have a growing negative perception of each other when it comes to managing *Bovine Theileriosis* disease. Farmers are concerned about the extensionists' lack of commitment to disease prevention and management. Agrovet shops are replacing the DVS both as sellers of acaricides and livestock treatments and as providers of animal health management advice. Most cattle owners have taken on the responsibility of controlling ticks and treating theileriosis on their own. There are, however, growing livestock reports of perceived persistent treatment failure of theileriosis disease in Zimbabwe communal lands.

Objective: The main goal of this study is to try to figure out why the *Bovine Theileriosis* disease keeps spreading in the communal lands of Zimbabwe.

Methods: The research was constructed using a theoretical framework that consists of a combination of technical perspective concepts and the two theories, which are the imagined lay-imagined expert theory and the relational theory of risk. The study employs a case study method that includes semi-structured interviews and field observations of communal farmers, extensionists, and agrovets.

Results: The study discovered significant knowledge gaps concerning theileriosis management among farmers, extensionists, and agrovets. Everyone blames each other for how they handled the disease in the study area. When diagnosing, prescribing, and treating diseases in the field, DVS extensionists are frequently absent; agrovets sell cattle pharmaceuticals to farmers without a prescription; and farmers administer cattle drugs on their own without adhering to label recommendations and correct drug application practices.

Conclusions: All the actors are contributing to the late, inaccurate, or inadequate diagnosis and/or medicine prescriptions and thus to the late, incorrect, or insufficient treatment of ill cattle suspected of having *Bovine Theileriosis* disease treatment failure of the disease. Thus, the cattle in the communal areas are now not only under threat of the *Bovine Theileriosis* disease but also at risk from the livestock owners, extensionists, and agrovets.

Keywords: Bovine Theileriosis, Relationship of risk, Communal farmers, Extensionists, Agrovet shops, treatment failure, Zimbabwe

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ACRONYMS

AGRITEX	Department of Agricultural Technical and Extension Services.
AI	Active Ingredient
AMR	Antimicrobial Resistance
DVS	Department of Veterinary Services
FAO	Food and Agriculture Organisation
GDP	Gross Development Product
MLWARR	Ministry of Lands, Agriculture, Water and Rural Resettlement
NGO	Non-Governmental Organisation

1. INTRODUCTION

1.1 Background

Agriculture contributes approximately 8 percent of Zimbabwe's GDP (World Bank, 2020). Livestock production, particularly beef production, accounts for 35 to 38 percent of agricultural GDP (FAO, 2021). Zimbabweans remain largely rural people who derive their livelihood from agriculture. Subsistence farming produces 70% of staple foods such as maize, millets, and groundnuts (MLWARR, 2021). Performance in agriculture is therefore a key determinant of rural livelihood resilience. Smallholder farmers, on the other hand, face ongoing challenges such as low and erratic rainfall, vulnerability to periodic droughts, low and declining soil fertility, low investment, draft animal shortages, poverty, and recurring food insecurity (FAO, 2021). In this harsh economic environment, cattle tend to act as a buffer for rural communal farmers by providing a traditional saving mechanism and a critical safety net in times of hardship. Cattle are a frequent source of income and draught power in Zimbabwe's rural villages. Cattle ownership accounts for approximately 60% of rural households in Zimbabwe (FAO, 2021). The largest cattle holdings in the rural communal areas can be as large as 50 animals, and the poorer herds can be as small as 3 to 5 animals.

The second-round crop and livestock assessment 2019/2020 season report by the Zimbabwe Ministry of Lands, Agriculture, Water and Rural Resettlement (MLAWRR, 2021) indicates that the national beef cattle herd declined by 5.7% from 5 774 525 cattle in 2018 to 5 443 770 cattle in 2019. The report attributes the cause to the national average cattle mortality that increased from 5% in 2018 to 9% in 2019. Drought and diseases were the major causes of these high mortalities. The FAO (2021) report confirmed that livestock diseases and lack of veterinary services were the major issues for livestock production, followed by the lack of pastures and water due to droughts. Tick-borne diseases, which include theileriosis, anaplasmosis (gall sickness), babesiosis (red water) and heart disease, continue to pose a serious threat to the national herd (MLAWRR, 2021). The highest number of cattle deaths has been attributed to theileriosis, a tick-borne infection, which is reported to have solely claimed 50 000 cattle in 2018 (The Sunday Mail, 2019). Theileria parva, which is spread by ticks in Zimbabwe, causes theileriosis, an acute disease that often kills cattle (Anipedia, 2017). The resource-poor community farming communities that own more than 80% of the country's almost 5.5 million cattle (Tavirimirwa et al., 2013) have been disproportionately affected, raising their poverty levels.

1.2 Economic importance of Theileriosis

The FAO (2021) study recommends that rigorous dipping rules be implemented to manage the theileriosis vector. However, there are concerns that foreign currency shortages are making it increasingly difficult to acquire dipping chemicals, forcing farmers in affected areas to either forgo dipping or dip their cattle in chemicals with inadequate concentrations (The Sunday Mail, 2019). Cattle, for example, are said to have gone five months without dipping in Gutu community lands in Masvingo province in 2020 (Masvingo Mirror, 2020). According to a government evaluation study for 2016–2017, theileriosis sickness is now prevalent in all provinces and is no longer limited to January, but rather continues until May (MLAWRR, 2017). Bovine Theileriosis caused by Theileria parva is causing cow losses in several Zimbabwean areas, including persistent outbreaks in Masvingo, the Midlands, and Mashonaland. Each year, theileriosis infections kill around 65 percent of Zimbabwe's cattle (Sungirai et al. 2015). The disease's frequency has grown considerably since 2010. Theileriosis killed 50,000 cattle between November 2017 and May 2018, according to the 2017/2018 Department of Veterinary Services (DVS) report. This is a significant setback for the country's goal of bolstering both the dairy and beef industries (The Sunday Mail, 2019). At the community level, the high morbidity and mortality in the cow herd is causing significant socioeconomic losses to farmers since it is emptying cattle pens after they have incurred considerable costs for (failed) disease treatment and control initiatives (Lawrence et al. 2004; Moyo et al 2017). This makes this disease the biggest threat to the livelihoods and food security of many rural communal areas (The Zimbabwean, 2021).

1.3 Research problem

There seems to be a growing negative perception of each other among communal farmers, extensionists, and agrovet shop personnel (referred to in this study as agrovets) in relation to the tick disease control programs, particularly those aimed at eradicating theileriosis disease. There are emerging reports where farmers express concern over the lack of commitment by the government's Veterinary Services Department (DVS) towards the prevention of the persisting theileriosis disease. The failure by DVS to frequently provide adequate dipping chemicals to dip tanks despite a continuous outbreak of tick-borne diseases is being perceived by farmers as neglect (The Zimbabwean 2021). Farmers seem to no longer wholly trust the advice from DVS. Some farmers say that the drugs that the DVS is recommending are making the problem worse (Kubatana 2020). The DVS perception, on the other hand, is that the challenge in addressing theileriosis disease is due to resistance from *"ignorant"* farmers who do not want to bring their

cattle to the dips (Mambondiyani 2018). The question is, are there any other reasons at present that are contributing to this growing resentment between DVS and the farmers?

In contrast, it appears that agrovet shops are increasingly taking over from the DVS as suppliers of acaricide and cattle medications, and are gradually transforming into the new source of expert guidance on the prevention and treatment of livestock diseases. At veterinary supply stores, long lines are now commonplace (The Zimbabwean, 2021). It is unclear why farmers wait in queues for hours at agrovet stores rather than contacting the government's veterinary extension services. It is also unknown how well-versed are agrovets in veterinary knowledge of theileriosis disease.

Instead of receiving veterinary services from the Department of Veterinary Services (DVS), the majority of livestock owners have taken on the responsibility of controlling ticks and treating their cattle for tick-borne diseases such as theileriosis on their own. There is a growing trend where most veterinary drugs are being handled by unqualified farmers (Byaruhanga et al. 2020; Musaka et al. 2012). Some communal livestock farmers have resorted to buying their own cattle dipping equipment, chemicals, and vaccinations for controlling ticks and treating tick-borne diseases (The Zimbabwean, 2021). However, successful theileriosis disease prevention and control using acaricides and vaccines relies on one's knowledge of tick biology, correct disease diagnosis, acaricide and antibiotic chemical groups, and correctly following application instructions (Mutavi et al. 2021). Many questions arise as to whether farmers are correctly diagnosing the *Bovine Theileriosis* disease and distinguishing it from other tick-borne diseases of cattle that occur in Zimbabwe and are treated with different vaccines. The other questions are about whether livestock owners read and understand how to use acaricide and other cattle medications, and how this affects the control and treatment of theileriosis.

There are growing livestock reports of perceived persistent treatment failure of theileriosis disease in Zimbabwe communal lands (Manyenyeka et al. 2021, The Cattle Site 2021, Mambondiyani 2018). These reports necessitated studying how DVS, agrovet shops, and the communal farmers perceive the prevention and control of the disease. The extent of the sustainability of the new parallel relationship developing between the farmers and the agrovets needs to be examined. The underlying causes contributing to the dying relationship between DVS and farmers need to be explored as well. The results of this study will then try to answer the question of how the risk knowledge, perceptions, and related practices of different actors is contributing to failure in preventing and controlling theileriosis disease.

1.4 Research Objectives

The main goal of this study is to try to figure out why the *Bovine Theileriosis* disease keeps spreading in the communal lands of Zimbabwe.

The study is undertaken with the following specific objectives:

(1) To explore communal farmers', DVS extensionists', and agrovets' level of knowledge on preventing, managing, and treating *Bovine Theileriosis* disease in communal lands.

(2) To investigate communal farmers, extensionists and agrovets' perceptions on how other actors deal with *Bovine Theileriosis* disease treatment and management.

(3) To assess how knowledge of communal farmers, extensionists, and agrovets relate to actual field practices for preventing, controlling, and treating *Bovine Theileriosis* disease in communal lands.

1.5 Research Questions

The main research question is: why does it seem like *Bovine Theileriosis* disease cannot be treated in Zimbabwe's communal lands?

Specifically, this study addresses the questions of:

(1) How much do communal farmers, veterinary extensionists, and agrovets know about *Bovine Theileriosis* disease and how to prevent, manage, and treat it?

(2) How do different actors think about how other actors (communal farmers, extensionists, and agrovets) perceive and handle *Bovine Theileriosis* disease management in the communal lands?

(3) How do the knowledge of different actors and perceptions of each other relate to actual field practices for preventing, managing, and treating *Bovine Theileriosis* disease?

2. THEORETICAL FRAMEWORK

2.1 Introduction

The study's theoretical framework is schematized as shown in Figure 2-1. The level of knowledge of communal farmers, DVS extensionists, and agrovets on managing *Bovine Theileriosis* disease in the rural communal lands of Zimbabwe is investigated using the technical perspective approach (Gonzalez). The "imagined specialists and imagined lay-people" model (Blok et al., 2008) is used to examine how the aforementioned actors view one another's approaches to managing the disease. The relational theory of risk (Boholm and Corvellec, 2011) is used to evaluate the knowledge of the said actors and how their perceptions of one another relate to actual field practices for treating the disease.

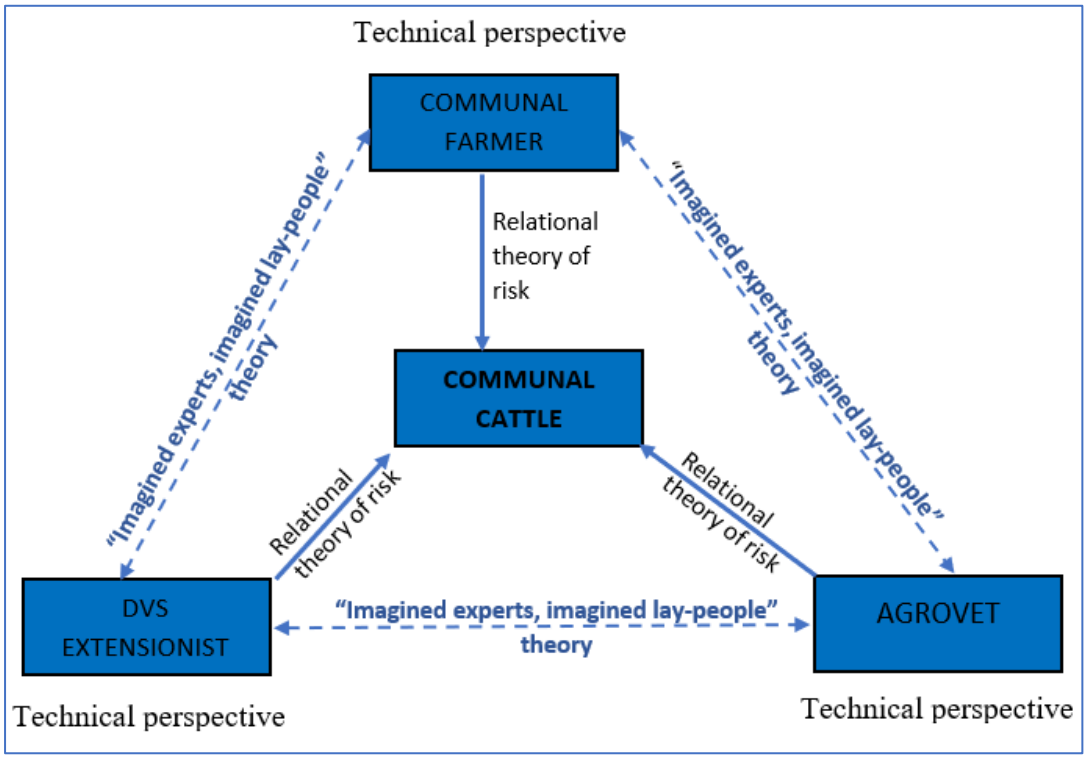

Figure 2- 1: Schematic of theoretical framework of the study

2.2 Definitions of key terms

Knowledge

This study defines knowledge as how we perceive and apply information and practices to a situation. Education and experience give knowledge. Knowledge is best understood as a collection of "interpretation schemes." For example, in this study, in the farmer's thoughts, this may be *'cattle producing tears,*' '*theileriosis,*' *'cattle will die,*" *requires treatment,*' *'call extensionist,*' *'call neighbour,*' or *'go to agrovet shop'*. Farmers' minds give situations meaning,

so they act accordingly. Farmers can as well apply social knowledge. In the study area, a DVS extensionist could be taken as a livestock disease specialist. Language expressions are given a meaning too. Farmers may take an extensionist's statement that *Theileriosis*-infected cattle are terminally ill and should be slaughtered as a lack of empathy. For a greater grasp of knowledge, we shall compare lay vs. expert, scientific vs. experienced, techne vs. social knowledge.

Perception

Perception is often the result of applying knowledge. Farmers will use knowledge and perception while attempting to reduce risk and save cattle. Knowledge and perceptions are intertwined with individual and societal practices and changes. In transformation processes, contrasting and contradictory perceptions, disagreements, and knowledge claims play a role (Leeuwis, 2013). These can only be interpreted, defined, and understood by looking at the different actors in a complex problem. Thus, contrasting fixed information with easily transferable meaning.

Practice

Practices are a set of similar activities repeated over time by an individual or a group (Leeuwis, 2013). In this study, all actors' theileriosis control practices are investigated in relation to knowledge gaps and bad relations. Practice also refers to a routine of activities or a set of activities that frame a practice (Gherardi, 2012). In this study, practices, alternatively, encompass a set of actual field activities that are related to the control of theileriosis treatment. These include the ways farmers and other actors involved in the process dip the cattle, diagnose the disease, obtain prescriptions, purchase livestock drugs, and administer the drugs.

2.3 Technical perspective approach

This study defines "technical perspective" as farmers, extensionists, and agrovets' way of thinking about Bovine Theileriosis management. DVS standards of practice reflect a technical perspective on preventing and controlling Bovine Theileriosis, including diagnosis, prescription, and antibiotic application. The technical perspective will also be used to assess whether actors involved in the disease's management administer the right amounts of cattle medication at the right bovine body position according to the drug's label of instructions. The pesticide risks study by Ros-González et al. (2013) used a technical perspective to compare farmers', farm workers', and extensionists' ways of thinking with scientific knowledge about pesticide risks. Their "*good practices*" included labeling, storing, trading, mixing, using,

adjusting spraying equipment, and using personal protective equipment, as outlined in the FAO's International Code of Conduct on the Distribution and Use of Pesticides (Ros-González et al., 2013). Mutavi et al. (2021) used the approach in their tick acaricide study. Technical perspective was assessed on whether and how livestock owners read, interpret, and apply acaricide application instructions on product labels, and if they know when to switch AI classes (Mutavi et al., 2021).

2.3.1 Technical perspective approach to the study

In this study, a technical perspective is used to examine the way communal farmers (considered lay people) and DVS extensionists and agrovets (considered experts) think about preventing and controlling *bovine theileriosis* disease on communal cattle. On assessing the technical perspective, this study broadens the focus from communal farmers (often the single focus of most literature) to other actors (which include the DVS extensionists and the agrovets) who provide advice, diagnose, prescribe and treat the disease in communal cattle on behalf of the farmers. Communal farmers in the study area are diagnosing, prescribing and administering cattle drugs on their own, a job normally done by the veterinarian, this means they have assumed as well the role of lay-expert. Thus, their animal health knowledge level on *Bovine Theileriosis* disease management was assessed using the technical perspective as a yardstick. The communal farmers' knowledge about the disease management that differed from the technical perspective was noted. Technical perspective tends to prioritize expert view of what is risky (Wynne, 1996). This study hypothesized that the extensionists and the agrovets' views would more or less follow the technical view considering that they are trained in animal health management and would disagree with assertions that go against the technical perspective. So, knowledge of experts that deviate from technical perspective was noted. Assertions by farmers, DVS extensionists, and agrovets about disease management that are dissonant with the mainstream technical perspective of disease management were qualified as knowledge gaps about disease management.

The researcher took a sociological approach, recording all actors' perceptions on disease management from a more neutral standpoint, i.e., formulating assertions based on people's own ways of expressing themselves rather than following the 'technically correct' approach. This is not to say that identifying actors' knowledge gaps in comparison to a technical perspective was impossible; however, such a comparison was made later in the analysis, when the technical perspective was used as a yardstick.

2.3.2 Limitations of the approach

The application of this approach acknowledges that science knowledge does not lead in a linear way to more ‘correct’ management of *Bovine Theileriosis* disease in the communal lands of Gutu district. Given that, the level of science knowledge is not the single factor explaining factor how much of the technical perspective is followed by actors on the disease management, the study had to look at other factors especially which explain why farmers, DVS extensionists and agrovets express dissonance towards how they manage the disease in the study area.

2.4 “Imagined experts, imagined lay-people” theory

2.4.1 Introduction

The "imagined experts, imagined laypeople" theory examines how experts and laypeople perceive each other's identities and competences (Blok et al. 2008). Irwin et al. (1996) studied laypeople's adoption of scientific patterns of reasoning in relation to "local" knowledge, identities, and trust in experts and institutions. Blok et al. (2008) identified four categories of citizens and experts between "typical" imagined experts and laypeople: experts' imagined experts, laypeople's imagined experts, laypeople's imagined laypeople, and experts' imagined laypeople. These mental models emphasize knowledge and value (Pellizzoni, 1999). This study examines imagined laypeople's and imagined experts' discursive conversations.

2.4.2 Lay-people’s imagined experts

Blok et al. (2008) noted that laypeople believe knowledge is never certain, even though we should seek as much information as possible. Expert knowledge is perceived as limited and defective by laypeople, especially when it cannot predict long-term consequences and falls short of the "expert" level of all-encompassing knowledge competency. Even when laypeople trust experts, they do not expect them to be completely knowledgeable. When laypeople realize they are "ignorant" of scientific risk reasoning, they are more likely to rely on what experts say.

Expert knowledge is required to comprehend laypeople's risk assessments and environmental attitudes (Coppin et al., 2002; Siegrist et al., 2000). People's perceptions of experts are influenced by their own perceptions of themselves (Michael, 1996). They imagine government or industry regulators ruling over the state and, by extension, them as citizens. Blok et al. (2008) discovered that ordinary people do not distinguish between experts, regulators, and politicians, instead viewing them as part of a "system" of regulation, implying that they are not value neutral. Laypeople believe government experts over NGO or industrial experts due to their

monetary or value interests. Laypeople differentiate between "interested" experts and those to whom they attribute material interests and problematic value biases. The majority of laypeople distrust economically dependent "interested" experts. Laypeople tend to have no faith in political experts and rely more on their own judgment.

According to Horst (2004), lay-expert relationships are distinguished by "pro-science" and "critical" lay attitudes. This pattern reflects the education of laypeople (Bourdieu, 1984). "Pro-science" lay respondents have a higher level of education than their counterparts. Expert conflicts, according to "pro-science" laypeople, are evidence of experts' heterogeneity and variation. Expert clashes are uncomfortable for both groups due to mistrust. Laypeople who are "pro-science" are more active and capable of dealing with risk concerns than "critical" laypeople. (2008) The majority of expert skepticism stems from experts' disagreeing or saying contradictory things over time. "Critical" laypeople do not trust what experts say because it changes later. People in the general public question whether they can trust experts they do not know.

2.4.3 Experts' imagined lay-people

Blok et al. (2008) noted that professionals feel laypeople's lack of comprehension impedes rational decision-making. Researchers and industry leaders make sweeping statements about laypeople's cognitive capacity. The "deficit" concept of laypeople's cognitive insufficiency prompted academics to conclude that, although lacking information, laypeople are unduly emotional and value-laden when it comes to risk situations (Blok et al. 2008). Too emotional = uninformed. In risky situations, laypeople are typically described as "easily afraid," "panicked," "worried," "confused," and "irrational."

Blok et al. (2008) discovered that when professionals allude to imagined laypeople, they rarely address the entire community. They refer to imagined sub-publics that operate within the expert's institutional framework. Sub-publics extend beyond imagined laypeople and emerge in expert discourses, showing a gap between "purely imagined" and "actually experienced" laypeople. "Experienced" laypeople have better cognitive ability. Experts have had real-world interactions with properly conceived laypeople. Some experts go beyond the concept of "deficient" by attributing "moral" or "value-based" talents to subgroups of laypeople. A "good sense lay" attitude develops when professionals regard laypeople as bearers of well-founded critiques of a "illogical" regulatory structure.

Blok et al. (2008) discovered two distinct basic patterns of expert imagined lay-expert relationships, called "bureaucratic" and "partisan" expert opinions. Expert risk assessments are predicted by institutional membership (Slovic, 1999). "Bureaucrat" experts labor in the regulatory system, whereas "partisan" experts work in marginal contexts, such as NGO and university settings. According to "bureaucrats," the issue under examination is "tightly supervised," "acceptable," and "safe." As a result, "bureaucratic" experts demand value-freedom and regard "political" promises as illegal border crossings. Expert knowledge is expected to deliver "safe" results. In contrast, "biased" specialists are more critical. The partisan expert claims that values are buried in experts' specialty, meaning that knowledge and values are inextricably linked. Experts who blend knowledge and value tend to bring comfort to the general public.

2.4.4 Imagined experts, imagined lay-people" theory of the model to study

The "imagined-expert and imagined-laypeople" theory helps us understand different actors' imaginations toward each other in terms of theileriosis disease treatment and control. It also aids in understanding how the identified "imaginations" have fostered differences on how to manage the disease, making it difficult to control. Farmers (lay) and experts (DVS extensionist and dip attendant), including the agrovet, are hypothesised to have opposing viewpoints. The theory also directs us to investigate any earlier social and discursive contacts between lay (farmers) and expert (extensionists), as well as lay expert lay expert discrepancies in risk perception and communication, and how they contribute to disease persistence. Furthermore, because the roles of layperson and expert vary due to social, discursive, and situational constraints, little is known about how the actors in this study view the identities and abilities of others. The theory explains how the dynamic of these actors' social interactions can help us understand the participants' varying risk assessments, which contributed to the continuation of the problem.

2.5 Relational theory of risk

2.5.1 Introduction

Boholm and Corvellec's (2011) "Relational Theory of Risk" explains how people perceive risk. Risk emerges from the simultaneous presence of "threatening risk objects" to valued and "vulnerable items at risk" by assuming causal links between them. Hilgartner (1992), Rescher (1983), Rosa (1998), and Boholm (2003) developed the relational theory of risk. Hilgartner (1992) provides a constructivist risk theory. According to Hilgartner (1992), "risk definitions

have at least three conceptual elements: an item supposed to "pose" the risk, a "putative harm," and a causal link between the object and the harm." Risk emerges through situated perception, which generates a causal and contingent risk relationship between a risk object and an item at risk. The risk object is believed to endanger the valued object at risk in some way and under specific conditions. The Hilgartner (1992) paradigm asks, "How do people see a risk?" Different people view the same object's danger differently (Hilgartner, 1992).

2.5.2 Elements of a relational theory of risk

The relational theory of risk regards risk as a product of situated cognition positing a relationship of risk linking a risk object and an object at risk. Boholm and Corvellec (2011) schematise the theory as follows: [Risk object] ← (Relationship of risk) → [Object at risk] for example: [Farmer] ← (overdosing) → [cattle].

According to Boholm and Corvellec (2011), an object is not harmful unless a relationship is established between it and the possible harm. As new dangers and values are judged to be at risk, risk-object features evolve (Bauman 2005). Risk items are comparable to dangers, but the former refers to anything manufactured explicitly. An "object" is any delineated physical, cultural, or social artifact. Risk objects include natural and manmade events, cultural representations, and social behaviour. Risk items are social because they affect and contribute to social activities and representations.

Objects at risk have a risky value (Boholm and Corvellec, 2011). Objects at risk have values, losses, vulnerabilities, and protective needs. "Value" alludes to life, nature, or principles, yet it's increasingly defined in monetary terms (Bourdieu 2003). The object at risk should be conserved and treated with care. Risk objects can be placed in new situations at any time, and what's valued now may not be relevant tomorrow.

An observer develops a relationship at risk between a risky object and an at-risk object, with the former threatening the latter's value (Boholm and Corvellec, 2011). This is also a social construct because it's a semantic association that must be constructed, crafted, and established (van Loon 2002). This doesn't mean it's arbitrary or disconnected from reality. The risk connection should show an observer's knowledge and understanding of risk objects (Shaw 2000). Relationships at risk must meet certain requirements. First, a relationship in danger begins with 'What if?' (1997, Ravetz). Because risk is a claim about a change that could happen but doesn't usually, a risk connection speculates about adverse conditions. A risk connection must show how and why a risk object threatens another. It must imply that the risk item can

change the at-risk item (Corvellec 2010). Dangerous relationships are tied to action and decision-making (Luhmann 1993).

Observer knowledge gives risk objects, and risk objects, and risk connections identity. A risk object only emerges in connection with a risk object via a risk-accidental relationship. Risk objects, at-risk objects, and at-risk interactions are built simultaneously. Their identity is determined by the assembling of items and interactions as a risk construct. Risk items, objects, and linkages are identified differently. Risk, value, harm, victim, actor, goal, decision, cause, and consequence are frequently reframed. So, risk understanding can lead to action, creating new risk scenarios.

2.5.3 Relational theory of risk of the model to study

This study hypothesised that the communal cattle could be an object at risk. Applying the "*Relational Theory of Risk*" (Bolholm and Corvellec, 2011), the study examined how communal farmers, DVS extensionists, and agrovets participating in the prevention, control, and treatment of *Bovine Theileriosis* disease in the study area might become *threatening objects* to communal cattle, which are here referred to as "*valued and vulnerable objects at risk*". This study delved deeper into identifying the risk relationships between threatening risk objects and objects at risk (Christoffersen, 2018), as well as how the causal relationships between them are contributing to the ongoing prevalence of *Bovine Theileriosis* disease in the study area, and possibly throughout Zimbabwe. The theory provides an understanding of how the actual practices, knowledge gaps, and bad relationships of actors lead to the prevalence of theileriosis.

2.6 Integration of concepts and theories

The technical perspective is used to determine whether there is a scientific knowledge gap among the actors (farmers, agrovets, and DVS extensionists) in theileriosis treatment and control. Farmers', DVS extensionists', and agrovets' assertions regarding disease management that contradict the mainstream technical perspective of disease management are classified as disease management knowledge gaps. Based on the fact the actors' level of scientific knowledge is the only interpretation of how much of the technical perspective is followed by actors in disease management, the study had to look at other factors, particularly the social perspective, to explain why farmers, DVS extensionists, and agrovets express dissonance in how they manage the disease in the study area. The "Imagined professionals and imagined laypeople" theory is thus used to study how the actors' contrasting perspectives of one another in the treatment and control of theileriosis contribute to a hostile environment for theileriosis

management. The drawbacks of this theory include that it does not consider how actors' opinions of one another and previously documented information gaps affect real field methods for managing bovine theileriosis disease. A relational theory of risk is applied to acquire a better understanding of how actors' knowledge gaps and diverse views influence actual practices, good or poor, for theileriosis control.

3. METHODOLOGY

3.1 Introduction

The study examined why Bovine Theileriosis disease keeps spreading in the communal lands of Zimbabwe. This was done through assessing the knowledge of communal farmers, extensionists, and agrovets and their perceptions of each other, and related actual field practices for preventing, controlling, and treating Bovine Theileriosis disease in communal lands. The study employed a case study approach. A case study approach is chosen in order to thoroughly examine the dynamics of the relationships (Fidel, 1994) and as well to understand the phenomena in individual situations (Harling, 2012). The approach facilitated examination of knowledge, perceptions, practices, beliefs, and attitudes embedded in the cultural context of the population in the case study area. The case study approach also allowed for descriptive inferences about how specific situations occur on the ground (Gerring, 2004). An approach was applied to answer the research questions as it was extensive enough to produce descriptive data. The multimethod approach was chosen to grasp the holistic view of the dynamics of different actors (Langevang, 2007). The methods include in-depth semi-structured interviews and participant observations.

3.2 Description of the case study area

The research was conducted in Chikwanda Communal Lands in Gutu district. The district has a population of around 203,000 people, and total population density of 29% per km^2 (Zimbabwe National Statistics Agency, 2012). Gutu is the third largest (7,054 km^2) and northernmost district in Zimbabwe's Masvingo province. The district is one of the districts in the nation that was heavily struck by theileriosis disease, which affects their livelihoods and food security (Masvingo Mirror, 2021). Hundreds of cattle perished over the 2018/2019 season, and many farmers were left with nothing after losing all of their livestock. The loss of cattle in communal areas has negatively impacted major source of livelihoods.

The Gutu district is largely communal lands, along with old resettlement areas and some small-scale commercial farming areas. The district has a semi-arid climate, with most of the territory categorized as natural regions IV and V, with noticeable hot and dry weather throughout the majority of the year. The rain season is distinguished by some of the lowest rainfall in Zimbabwe, typically 450-600 mm per year, and its distribution is irregular, with recurrent protracted mid-season dry spells, often resulting in severe drought, crop failure, and food shortages. As a result, Vincent and Thomas (1962) classify the district as only suited for

intensive beef production or semi-extensive animal production. The district's principal crop is maize; however, the minimal rainfall makes growing maize difficult.

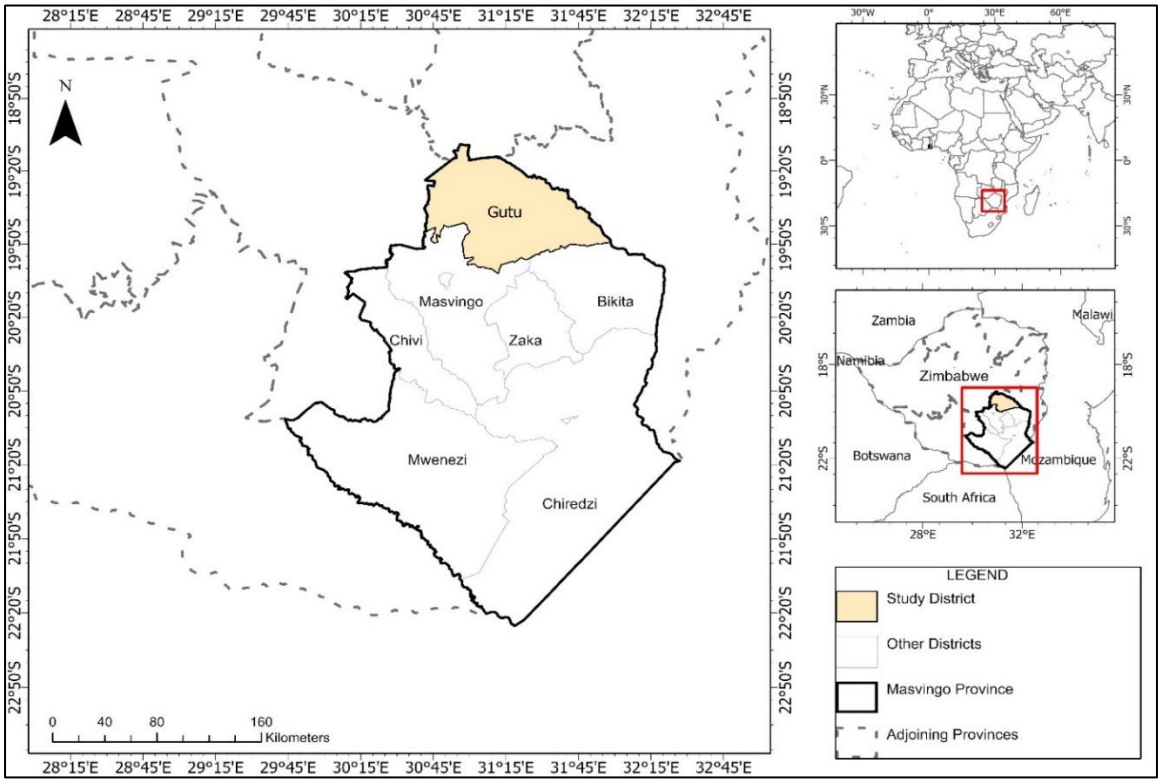

Figure 3- 1. Map of the study area. Source: (Author's construct)

Crop cultivation and livestock raising are the district's primary agricultural activity. Cropping patterns are dominated by grain cereals like maize. Maize production, on the other hand, is very fragile since farmers must wait for the rains to begin before planting, and if the rains are late, their maize crop will not have enough time to mature before the dry season. Worse, the crop is very vulnerable to rainfall changes throughout important stages of growth, particularly blooming, so that a lengthy mid-season dry spell often damages harvest. Drought-resistant small grains have been heavily promoted in recent decades, but their success rate has been modest, since families have attempted to produce maize even in drought years. In general, the district suffers from significant food insecurity as a result of low harvests induced by the area's irregular rains (Chimire and Chitongo, 2018). As a result, most families buy the majority of their food from the market, and many are claimed to have received food help in recent years.

Livestock serves as a buffer for the district's communal farmers. Cattle and goats are maintained for monetary reserves and animal traction, but they provide very little direct nourishment in the form of milk or flesh. According to information received from the Department of Agricultural Technical and Extension Services, the district contains around 126,004 cattle (AGRITEX). The greatest cow holdings in rural communal areas may have up

to 50 animals, while the lesser herds might have as little as 3 to 5 animals (FAO, 2021). Most farmers have Mashona (an indigenous breed) and Brahman cross cattle. There are 147 dip tanks in the district for dipping cattle in the district. The research focused on two dip tanks, Dip tank 1and the Dip tank 2 community dip tanks, where farmers from Chikwanda communal lands dip livestock.

3.3 Actors involved in the management of *Bovine Theileriosis* in the study area

Communal farmers, DVS and agrovet store staff in the study area play a role in the management of *Bovine Theileriosis* disease. Communal farmers own the cattle and are considered to be responsible for identifying the disease, notifying DVS personnel, accompanying their cattle to the community dip tank, paying the annual cattle fee to buy acaricides, purchasing the treatment if cattle get sick, and hiring the veterinarian to administer the treatment. At ward level, the DVS includes a veterinarian extensionist, community dip attendants. Veterinary extensionists supported by dip attendants diagnose the disease, provide prescriptions for treatment, notify the DVS district office of the disease's presence, train and educate the community about the disease, lead national vaccination programmes at ward level, raise awareness of the disease, dip community cattle as scheduled, and assist farmers with treatments. The agrovet store staff (called agrovets in this research) provides treatments according to farmers' prescriptions and advises them on how to utilize the drug. The above is DVS SOP. In fact, as will be shown, there is a lot of overlap in the roles of the actors. The research studied the actors' technical understanding of the disease, perceptions of each other, and real field practices in managing Bovine Theileriosis on communal lands.

3.4 Data collection methods

This research collected data using semi-structured interviews and participant observations. Farmers, DVS extensionists, agrovets, and university animal health specialists were interviewed. As researcher I had no experience with Gutu farmers, agrovet-shops, or DVS. Most farmers in the area tend to keep their livestock operations and identities private. Farmers, at first viewed me as an outsider. The farmers were wary even after I presented myself as a researcher. Even the ward councillor hesitated. I later chose to be escorted by the village head's wife (whom I resided with throughout the study) to meet the councillor, who afterwards accepted me as one of them when he met the village head's wife. The councillor from then allowed me to work with farmers. Thereafter I gained access to most farmers by traveling with the village head's wife, whose livestock also died from the sickness.

3.4.1 Sampling

The study used a snowball interview sample approach, in which possible participants were found via recommendations from previously interviewed individuals, therefore expanding the participants' network (King & Horrocks, 2010: 34). The researcher used the snowball interview sampling approach from the village head homestead forward. After being interviewed or during the interview, the interviewed farmer directed the researcher to the next farmer who encountered a similar difficulty. The farmers who were recommended were supposed to have either lost cattle or cared for cattle with theileriosis illness. The same technique was used on the different actors, which included DVS extensionists, dip attendants, agrovet shop personnel (agrovets), and experienced farmers who tended to treat other farmers' cattle. The snowball sampling procedure was repeated until the data was saturated (Burns, 1993). I was able to build trust with interviewees while simultaneously increasing the interviewee response rate due to the snowballing sampling approach. However, this technique had flaws, one of which is prejudice. The farmers being interviewed tended to refer me to other farmers who lost cattle as well to *Bovine Theileriosis* disease. I had to ask village head's wife to refer me as well to farmers who did not the cattle to the disease.

3.4.2 Semi-structured interviews

The study involved in-depth semi-structured interviews through which the interviewee had the liberty to express and unfold key experiences in the control of theileriosis disease. An interview script consisting of open-ended questions was constructed with data gathered from literature, which turned out to be a referral script during interviews. The interview script had six categories of communal livestock farmers: more experienced farmers (who often diagnose and treat village cattle), dip attendants, and extensionists. The researcher carried out a total of 41 semi-structured interviews; livestock farmers (n = 28), (untrained personal n = 2), extensionist (n =3), dip attendance (n =2), Agrovert shop assistant (n =4), and other key informant-veterinary lecturer (n =1).

The semi-structured interviews between October 2021 and January 2022, while staying in Maungwa village, which is in Chikwanda communal lands in Gutu district. The semi-structured interviews were conducted at farmers' homesteads. For the other actors, the interviews were carried out at the participants' areas of work, such as the agrovet shops, dip tanks, and so forth. The semi-structured interviews for all the actors involved similar questions. These questions were formulated in different ways relating to the roles of the different actors interviewed in the control of the *theileriosis* disease. The duration of the semi-structured interviews was about 45

minutes to 1.5 hours. All the participants gave consent to record most parts of the conversation, except for 2 farmers and 1 dip attendant.

Figure 3- 2: Carrying out semi-structured interview with the farmer

Semi-structured interviews were carried out until a point of interviewee saturation. This implies that the number of interviews may be relatively enough when researching different groups of participants. The chances of finding new information are, however, limited (Guest et al., 2006; Saunders et al., 2018). Most of the interviewees preferred questions to be addressed in Shona. Translation into the Shona language was unnecessary, as both the researcher and the interviewee speak the Shona language.

3.4.3 Participant observations

The researcher spent four months in Maungwa village, a Gutu District communal area, studying Bovine Theileriosis. The researcher spent October 2021–January 2022 in Maungwa observing and describing the community. The researcher would examine social interactions and cultural symbols in Maungwa village. Dip tanks, agrovet shops, and farmers' homesteads were observed. Observing farmers' and other actors' normal behaviours revealed their knowledge and perceptions. The field observations were meant to help understand how theileriosis is controlled. Observations were recorded in a field diary. Visual research methods (photographs) were employed to enhance observations and improve reader understanding. This strategy

illustrates social problems visually and improves social problem research (Herzog, 2019). In accordance with Fangen (2004) and Polit and Beck (2004), the researcher combined fieldnotes, pictures, and interview data in the results section.

Figure 3- 3: Observing farmers preparing the dip before dipping the cattle

3.5 Data processing and analysis

Near the end of data collection, the researcher noticed respondents repeating information. This signalled data saturation to the researcher, who stopped collecting data thereafter. The researcher had to revisit the audio interview, write field notes, and prepare verbatim transcripts. The researcher coded transcripts using an excel file for improved interpretation and sorting of data (Bernard 2006). The researcher created early codes using the framework. Key topics helped organize the data. Data was grouped under the following main themes: knowledge of theileriosis of actors; perceptions of actors for each other and related practices. Inductive coding was used to analyse the original data, allowing the researcher to construct new codes (Thomas, 2006). The researcher used codes to check the data sequence. Thematic coding analysis was employed to track the text of different participants that contained similar themes (Gibbs, 2007).

3.6 Ethics

Prior to the semi-structured interviews and observations, all the participants were asked for informed agreement by oral consent. The consent form was translated to the interviewee in

Shona. The interviewees were informed about the freedom to withdraw whenever it suited them. Participation of the interviewee depended on the interviewee's liberty. Additionally, interviewees were recorded, pictures taken, and filmed after informed agreement from participants. In situations where the participants did not agree to be recorded during interviews, the recordings were not made. For the purposes of anonymity of the interviewees, numbers were given to the participants. Data was gathered, transcribed, and saved on a hard drive.

The period of her research was a year before the country's general elections, when people were preparing for elections. As a researcher, to be allowed entrance into the community, they had to be certain the researcher was not a journalist. With the help of the local head of the village, who understood her purpose of research, she was accompanied to the local councillor, who initially refused to grant her permission to conduct research but eventually agreed after the village head convinced him that the researcher was a student conducting research. The researcher had to dress like the local women in the area, covering her head and her body with material, for the villagers to consider her part of them. Even at the community dip tank, the researcher was able to assist where help was needed. The researcher was careful to follow the Code of Conduct for Scientific Practice (Association of Universities in the Netherlands, 2012) in all of the steps he or she took. Finally, the expectancy effect and confirmation bias in the research had to be considered.

3.7 Limitations of the study

During the period of research, the COVID-19 omicron variant spread which affected researchers' data collection process. During that period, the researcher could not travel to the provincial city, where communal farmers buy cattle medication. All the activities were readjusted to be done within the Gutu district. Interviews were conducted in the afternoon as farmers went to the field in the morning until midday.

4. TECHNICAL PERSPECTIVES ON MANAGEMENT OF BOVINE THEILERIOSIS DISEASE

Through in-depth semi-structured interviews and observations, the following section compares different actors' perceptions of the technical aspects of the theileriosis disease control. The term 'technical perspective' is defined in this study as a way of thinking in line with scientific knowledge about how to deal with *Bovine Theileriosis* disease. This is achieved by addressing the question of how much communal farmers, veterinary extensionists, and agrovets know about *Bovine Theileriosis* disease and how to prevent, manage, and treat it. This chapter reveals knowledge gaps not only of communal farmers (considered as lay people) but as well of DVS extensionists and agrovets (considered as experts) in *Bovine Theileriosis* disease management, which might be contributing to the disease prevalence.

4.1 Farmers' technical perspective in controlling *Theileriosis* disease

This section describes the technical perspective the farmers employ in the prevention and control of the Theileriosis disease in the Gutu community.

4.1.1 Knowledge of tick-borne diseases

More than 50% of farmers were able to identify only *Bovine Theileriosis* as tick-borne disease, mainly because it was present problem in the study area. Few farmers were able to mention a few other tickborne diseases like *lumpy skin and red water*.

'*Theileriosis turns the cattle blind. You see tears, excess frothy, not grazing becomes weak. Redwater see cow urine with blood, lumpy skin, you notice lumps. I do not know if there are other diseases, but that is what I know.' (Farmer 24).*

The findings show farmers get knowledge of cattle diseases mainly from personal experience, from dip tank attendants and from other farmers.

"At the dip tank that is where we were told that theileriosis is caused by ticks and we need to dip cattle regularly. Most times we see the dip attendant than the extension worker who we only saw when she is distributing cattle grease." (Farmer 21).

4.1.2 Diagnosis of Theileriosis disease

Communal farmers could positively diagnose *theileriosis* disease through experience of managing cattle with the disease. Unfortunately, many of the symptoms were largely for the late stage of the disease. The following was the narrative of most farmers:

'Usually, the cattle remain standing for a long time, stand under the shed, fail to graze, froth from the mouth, tears, the eyes change colour to white and they become blind. When you start to see these signs, the cattle have deteriorated.' (Farmer 1a,)

Figure 4- 1:A dead cow that had Theileriosis disease

Farmers took a long time to detect theileriosis because they believed it was related to culture and religion. Many farmers believed their cattle had been bewitched, while others believed COVID-19 was God's way of saving animals. Others blamed the dead. Some farmers reported bloody cow manure, bloody pee, and blindness. These symptoms are not from theileriosis, but another condition.

4.1.3 Farmers' knowledge and perceptions for preventing theileriosis disease

Most farmers assert that dipping cattle is the ultimate way to prevent and control the spread of the disease. However, depending on circumstances, farmers additionally spray their cattle, administer drugs, administer ethnoveterinary herbs, or apply tick grease.

"*We are told at the dip tank to dip cattle. Dipping the cattle weekly during the rainy season and after two weeks in winter." (Farmer 21)*

Figure 4- 2:Community dip in the study area

7% of farmers had a different opinion that dipping the cattle increase the spread of the disease:

"I do not think the dip tank is more effective against theileriosis. Sometimes ticks increase after dipping the cattle." (Farmer 1c)

4.1.4 Farmers' knowledge for treating theileriosis disease

The majority of the farmers named Butachem and Hitet as prescription medications to treat theileriosis. A fifth of the farmers could not name medications used to treat the condition. From the analysis, half of the farmers maintained track of the expiration dates of livestock drugs, while 40 percent didn't, and 10 percent of them put their trust on those who treat their cattle in the area that they do not use outdated drugs.

"No. Our home has emergency medications. We rarely check livestock medication expiration dates. We use what we have till it's gone, then we look for more. An expired medicine shouldn't be thrown away. Before finding a replacement, we must finish the available medicine." (Farmer 4).

Figure 4- 3: Two popular antibiotic drugs for treating Bovine Theileriosis in the study area

Most farmers knew to read instructions before administering the necessary dosage and 32% of farmers reported that they can give the medicine without a vet. To avoid medication resistance, the farmers could not decide when to switch from one drug to another. Farmers did not always consider weight when giving medications.

4.2 Extensionists' technical perspective in controlling *Bovine Theileriosis* disease

The Department of Veterinary Services (DVS) has a mandate to provide extension and advisory services on good animal health care, hygiene, and husbandry. It is the duty of the department as well to carry out surveillance, prevention, control, and eradication of specified animal diseases and pests. DVS extensionists carry out the extension mandate at ward level and DVS has the responsibility to dip communal cattle at community dip tank level. The community dip tank services a number of nearby villages, but not enough to make a ward.

4.2.1 Technical perspective of DVS extensionists

DVS extensionists provide advice, diagnose ill cattle, and prescribe and administer medications in wards. They learnt about Bovine Theileriosis in college and on the job. Extensionists in the study region had 3 to 15 years of experience and at least a diploma in agriculture or animal health and production.

Diagnosis of the theileriosis disease

All extensionists could diagnose Bovine Theileriosis by noting its symptoms: *"tears, high temperature, excess froth, fever, jaundice, lymph node enlargement, and death" (DVS extensionist 1)*. Theileriosis, redwater, heartwater, gall sickness, and anaplasmosis are tick-borne diseases they could identify. The extensionist could not reliably recognize the signs of other tick-borne diseases other than theileriosis and red water, showing that most of their expertise was derived through dealing with troublesome diseases widespread in the region. Not dipping the animals, not managing the veld to disrupt the vector cycle, and unrestricted cattle movement contributed to the high frequency of theileriosis. All the extensionists agreed that something outside their expertise is contributing to the disease's prevalence. They noted the possibility of cattle suffering from a mix of tick-borne diseases, tick mutations, climate change, and medication resistance.

Prescribing treatment

Extensionists primarily prescribe Butachem and Hitet drugs for the treatment of theileriosis. Extension personnel couldn't identify new therapies and were not sure whether the medications they gave farmers were still accessible. Extensionists tend to rely mostly on their undergraduate animal health expertise. This may be why farmers choose agrovets for prescriptions. Extensionists lacked knowledge of AI compounds: how they work and how to rotate them. Lack of this knowledge may be contributing to antimicrobial resistance in cattle.

Treatment of the disease

All the extensionists said they could administer cattle drugs using different methods. They knew intramuscular, subcutaneous, and intravenous injections. They showed the importance of following instructions and administering the correct dosages. Extensionists knew the importance of dose-to-weight ratio while medicating cattle. No extensionist could mention the importance of cattle holding pens while administering drugs. Despite the fact that nearly all farmers use herbs, extensionists were unfamiliar with ethnoveterinary knowledge. Extensionists consider this an obsolete, unscientific method of cattle care.

4.2.2 Technical perspective of dip tank attendants

There are three community dip tanks in the study area, each staffed by a DVS dip attendant. The researcher visited two of the dip tanks. The dip attendant is responsible for dipping communal cattle. They inform farmers about disease problems and how to treat them. Two community dip attendants had 18 and 20 years of experience. In 2000, DVS sponsored a two-week cattle-dipping course. They learned cattle dipping, tick-borne illness signs, and medication delivery. Dip attendants were chosen from among farmers based on how often they dipped their cattle and whether they attended extension training.

Diagnosis of the disease

Dip attendant's diagnosis is poorly precise but matches the farmer's diagnosis. The dip attendants could mention tick-borne diseases but could not mention their symptoms, except for theileriosis. Since they are closer to farmers and more likely to notice problems with cattle than extensionists, more cattle may be wrongly diagnosed, leading to wrong treatments.

Prevention and control measures of the disease

Dip attendants know it is important to vaccinate, dip, and limit livestock movement to prevent sickness. They also stressed the need to report sickness to DVS. The dip attendants ascribed the increased incidence of theileriosis to the proliferation of ticks due to the failure of the cattle to be dipped, the lack of quarantine for ill cattle, and unrestricted cattle movement. The dip attendants couldn't answer if a farmer should bring his theileriosis-infected livestock to the community dip tank.

Dipping cattle

The dip attendants stressed the importance of dipping cattle in the morning since the chemical becomes less effective as the day develops. The dip attendant explained why farmers must pay $2 annually per head of cattle to access dipping chemicals, why they must gather water in bulk to decrease dipping costs, and why the water in the dip must be changed often. Dip attendants emphasised the importance of farmers applying cattle grease to cattle positions not dipped. Dip attendants understood the importance of mixing the dip chemical with water in a container before pouring it into the tank, but did not know how to measure the dip strength. The dip attendants only knew about Amitraz, a drug that has not been changed in years. They did not know the dipping chemical should be replaced every six months to avoid tick resistance. The dip attendants also emphasized the importance of keeping stock records to track newly-arrived livestock, deceased animals, and their causes of death..

Administering medication

Even though DVS extensionists are responsible for treating animals, dip attendants sometimes do so as well. Their knowledge of drug administration, hence, was examined. The dip attendants couldn't suggest any additional medications other than those already known by the farmers. They only know intramuscular drug administration and they downplayed the use of weight belts while dosing livestock, saying they rely on eye judgment.

4.3 Agrovet shops personnel's technical perspective in controlling *Theileriosis* disease

The agrovets' understanding of preventing and managing Bovine Theileriosis varied. The amount of expertise varied by firm size, experience, and whether the shop was registered or unregistered. At least one employee of the registered agrovet shop had a Diploma in Animal Health and Production or Agriculture. Large stores had workers with bachelor's degrees in Animal Science or Veterinary Science. Many agrovet shop employees lacked formal training. Some employees said company owners instructed them on-the-job about livestock medications and immunizations. Some agrovets said their expertise was of the hardware retail industry. Since they had been in the business for years, they knew how to sell cattle medicines, notably theileriosis, which was prevalent in the Gutu area. Some agrovets said that after years in the agro-veterinary sector working under trained personnel, they understood animal health medicine, including preventing, treating, and managing Bovine Theileriosis illness.

"I learned from my husband about veterinary drugs after working with him in this shop. My husband has a diploma in veterinary science." (Agrovet shop no. 5)

4.3.1 Diagnosis of Theileriosis disease

Almost all agrovets, like farmers and extensionists, could diagnose *Bovine Theileriosis* based on its symptoms. Because they had the same or greater credentials than extensionists, many agrovets assumed they could better diagnose animals even in the store. Agrovets at stores 1 and 2 were aware that farmers needed to first visit the DVS to properly diagnose and contain the illness. Other agrovets did not understand the importance of diagnosing the disease physically, not over the shop counter. Many agrovets couldn't distinguish the disease from other tick-borne diseases except those from shops 1 and 2.

4.3.2 Prescribing medication for Theileriosis disease

Nearly all agrovets could identify Butachem, Butacure, Hitet 120, Hitet 200 injections for treating Bovine Theileriosis, and dipping acaricides such as Tickbuster, Triatix, and Taktic. Agrovets could identify which was more effective. They were up-to-date on outdated or soon-

to-be-discontinued drugs. They said they kept in touch with cattle drug manufacturers for up-to-date information on medications entering and leaving the market. However, agrovets were not aware of the acaricide and cattle antibiotic AI molecules or how to rotate them.

4.3.3 Storage of the medication.

Many agrovet shops emphasised on the importance of storing medicines properly before and after purchase. Since their customers lack refrigerators, the retailers they mostly sell room-temperature drugs. Vaccines are stored in refrigerators, and farmers are provided ice to keep the medications cool throughout transit. Once they arrive, they said they urge farmers to vaccinate their animals. Hardware and agrovet stores do not appear to understand the need of preserving acaricides in ideal settings, as indicated by their inadequate storage and selling conditions, which expose acaricides to direct sunlight, which can degrade their quality before they are sold.

4.3.4 Administering of cattle medications

Agrovets revere following animal medication instructions. They stated they read the instructions and advised farmers on how to administer the drug. All acaricides and antibiotics sold in stores were approved and contained instructions. Shop 1 employees knew the importance of dose-weight and could detect under- or overdose. They could identify all methods of administering cattle medications. Others could only identify oral and intramuscular methods.

4.4 Chapter summary

Technical perspective of farmers

Bovine Theileriosis was widespread in the study region, so most farmers could recognize it. Farmers can detect theileriosis sickness, but they find it difficult to distinguish it from other tick-borne diseases. Most only recognize the disease in its last stages. Many farmers initially thought their animals were bewitched. Most farmers think that dipping cattle prevents and controls disease transmission. Farmers said they could also spray, medicate, or tick-grease their livestock. The majority of farmers identify *Butachem* and *Hitet* as cures for theileriosis. Half of the farmers appreciate the importance of tracking prescription expiration dates, but most farmers do not appreciate the significance of following weight-dose criteria. Only a third of farmers can confidently provide the drug without a veterinary specialist.

Technical perspective of DVS extensionists

DVS extensionists' knowledge of *Bovine Theileriosis* disease prevention and control came from college training and work experience. All could coherently identify the *Bovine Theileriosis* disease through coherently identifying the symptoms of the disease. DVS extensionists, like farmers, primarily prescribe *Butachem* and *Hitet* drugs for the treatment of theileriosis. They were unable to identify the new treatments on the market. They were able to distinguish between intramuscular, subcutaneous, and intravenous injections. Extensionists were also aware of the significance of the dose-to-weight ratio. There may be a need for them to have a more in-depth understanding of the effectiveness of ethno-veterinary herbs.

Technical perspective of community dip tank attendants

The dip attendants' diagnosis of theileriosis is vague but matches the farmer's diagnosis. Dip attendants only detected the illness in its later stages. Since dip attendants are closer to farmers, more cattle may be erroneously diagnosed, resulting in inaccurate prescriptions and treatment. Dip attendants ascribed the high prevalence of theileriosis to the lack of livestock dipping, which led to tick proliferation and no quarantine for ill cattle. Dip attendants only knew about Amitraz, a drug that hasn't been updated in years. Long-term use without rotation may have made ticks resistant to Amitraz acaricide. The use of weight belts while dosing livestock was not mentioned by dip attendants, which could indicate the possibility of under-or overdosing.

Technical perspective of agrovet shops personnel

Agrovet knowledge varies according to business size, experience, and whether it is official or informal. Many unskilled people work in informal agrovet enterprises. Agrovets in registered stores have diplomas or bachelor's degrees in animal science or veterinary science. Registered agrovet stores appreciate the need for farmers to see the DVS extensionist first for a proper diagnosis. Many agrovets have access to up-to-date information about new or soon-to-be withdrawn drugs. Acaricide and antibiotic AI molecules are not clearly understood. Hardware stores did not understand the need to properly store livestock medicine. Agrovets underlined the need to adhere to correct animal medicine recommendations, but most only know that medications can be taken orally or intravenously.

5. PERCEPTIONS OF DIFFERENT ACTORS ABOUT HOW OTHER ACTORS MANAGE *BOVINE THEILERIOSIS* DISEASE

5.1 Farmers' perception to extensionists

Farmers had doubts about extensionists' ability to treat theileriosis. They believed that the extensionists' training and demonstrations were insufficient. They claimed that although extensionists primarily encourage people to dip livestock, it has little impact on eradicating theileriosis. Farmers have also complained that extensionists are unresponsive in an emergency. Others considered extensionists' advice to be ineffective. Farmers who often sought their advice, lose livestock. Extension guidance, according to them, discourages and demotivates. Extensionists advise farmers not to treat sick cattle because the cows will die anyway so are advised not to inject animals in order for the beef to be marketable. Farmers are upset because extensionists always advise them over the phone without first visiting the sick cow. Farmers believe extensionists only assist those who pay for their transportation.

"What would you do if someone needed aid and you couldn't?" In an emergency, she asks you to arrange transportation for her. She recommends you to sell or butcher the livestock, citing no solution. She told me to slaughter my cattle, which I treated with herbs and is still alive. I wouldn't expect a professional to give such counsel; she's ignorant." (Farmer 13).

Farmers believed extensionists should alter their practices. Farmers claim that extensionists at one time simply gave them tick grease without explaining how to use it. Farmers believe that it is critical to first examine their information before purchasing livestock medications. According to one farmer, an extensionist once advised him to go buy a phased-out drug, only to be told at the agrovet shop about the new drug. Farmers, in particular, stated that they are compelled to dip livestock, despite the fact that DVS frequently closes the dip tank due to acaricide shortages. Farmers believe extensionists don't understand the disease because their advice has not saved any animals. As a result, the farmers say they no longer seek their advice because it is a waste of time. Others believe their advice sometimes is beneficial, but comes too late. Extensionists only advised farmers to use tick grease after they had lost nearly all of their livestock. Even weekly animal dipping was imposed after half of the cattle in the area died.

According to the farmers, they received more cattle disease awareness than training. They argue that training should provide current knowledge rather than just what they already know. Farmers also anticipate more frequent extensionist visits to help them resolve issues. Farmers want a more personal connection with extensionists that focuses on two-way communication.

5.2 Extensionists' perceptions to communal farmers

Extensionists said farmers rarely notify them about diseases. In most cases, farmers treat the cattle first and then alert extensionists when they're dying or are losing a lot of animals. Farmers generally treat livestock alone. Farmers ignore extension workers' suggestions. Most farmers care for cattle with methods and treatments they have learnt from other farmers. When they discover nothing is changing and the cattle are dying, they then seek extension help. The farmers often blame them when the livestock die after extensionists attempt to treat them. When asked for help, extensionists now tend to ask farmers if they've given the medicine to the animals. If they are not careful, they can mishandle the livestock and be held responsible.

Extensionists said the problem is that most farmers now believe that any sick cattle have theileriosis since the disease has spread throughout the village. Extensionists noted that farmers tend to utilize *Hitet* to treat any disease. Sometimes cattle have an infection that doesn't require Hitet, but because theileriosis is a problem in the region, they wrongly identify it as theileriosis and give the cattle the wrong drug. Extensionists also noted that some farmers are resistant to forsaking their traditional methods, even after being instructed in new, more efficient methods. Extensionists say some farmers seek their advice just as a formality. The farmers would call them just to notify them that their cattle had theileriosis and had purchased Hitet to treat it.

Extensionists say livestock diseases spread swiftly due to the witchcraft beliefs of farmers. Farmers often believe their animals are cursed and seek spiritual help before DVS. Anthrax and rabies are reported first at community hospitals and clinics before DVS is aware of them. One extensionist mentioned a man who was bitten by a cow, and the villagers started claiming that the animal was possessed and blamed witchcraft. It was only after the man was hospitalized that they discovered it was rabies. In the same way, extensionists said that many animals could have been saved if farmers had reported theileriosis right away.

"We have an incident where a farmer was bitten by cattle and never reported to us. Now the cattle had the tendance of running after the people in the village and biting them. They thought it was an act of witchcraft. This continued to happen until there were cases of rabies at the hospital. That is when we had to find out how the disease started and had to visit the village. We had to slaughter the cattle and inform them that the cattle had rabies" (Extensionist 2).

DVS extensionists believe they are "pretentious farmers" who believe they know more than they do. Farmers in this group go to agrovet stores to buy and heap medicines for their cattle. They then treat village cattle while saying they know more than the extensionists. Because they are persuasive, farmers approach them first. When these farmers cannot manage the disease, that is when they seek help from extensionists, but by then the disease will have spread and

killed many cattle. Despite this, they are the first point of call for farmers. Most farmers believe this group can heal animals. This happens when these "experienced" farmers manage to cure one or more sick cattle. The rampant incorrect information they receive from this group of farmers contributes to the disease's spread. Cattle are misdiagnosed with theileriosis when they actually have red water or any other livestock disease. Incorrect diagnosis leads to wrong treatment.

"You can see that this office is not busy. Farmers have their own informal veterinary officers they have created in the village and they store their own drugs in their homes. When the farmer calls them for help, they just come and administer any drug. Often, they give the cattle over dose or under dose of drugs because they do not know that this later creates drug resistance. Cattle drugs are administered using wrong method. They are just too confident, when they are in front of the farmer acting as if they know much." (Extensionist 2)

Illegal livestock movement across provinces, districts, wards, and communal areas contributes to the spread of theileriosis. Extensionists say f armers bribe DVS or police officers to allow illegal movement. Extensionists say farmers pay bribes to move their livestock because the legal process is too expensive. One extensionist had an opinion that farmers' communal relationships spread disease as well.

"The living set up here is that most individuals are related across communities. So, you discover that livestock is transferred from one area maybe where an aunt lives to come and to plough in another village where the uncle or grandmother resides. Which is more of moving the livestock inside the region. Thus, there is a transfer of disease from one village where theileriosis exist to the other village where there is no theileriosis. So, you discover that there are instances of theileriosis in one village and during the following 2-3 months the illness spread to most areas of the region but there is no recorded movement of cattle." (Extensionist 2)

DVS extensionists pointed out that some farmers believe dipping their cattle in local dip tanks spreads the disease. Farmers only visit the dip tank when their animals are infested with ticks. Extensionists believe those farmers are more likely to listen to other farmers who incorrectly advise that spraying on the farm is better than letting cattle mix at the dip tank and contract theileriosis.

"If they do not see any cattle that has died you might go to the dip tank on the day for dipping and only find a quarter of the total number of cattle in that area at the dip tank. If there are high cases of cattle mortality that is when you find them at the dip tank.". (Extensionist 1)

5.3 Farmer perceptions to agrovets

Farmers believe agrovet store workers are more knowledgeable than DVS extensionists. Farmers think agrovets recommend more effective drugs. Farmers believe agrovets have current knowledge of veterinary pharmaceuticals, while extensionists prescribe old drugs. Farmers like agrovets' adaptability, where they avail alternatives when what they are looking for is not available. Farmers prefer their efficiency and cost-effectiveness. By going directly to

agrovet shops, they save money on extension worker transportation and can save their livestock quickly. When they describe their situation to an agrovet, they are told which medication to buy. Farmers say agrovet shops readily recommend which drug to take and how to store and administer it. Farmers believe agrovets are very accessible because they could visit agrovet shops anytime, including weekends and holidays, unlike extension workers.

"(Agrovet shop 1) is open on Sundays and Saturdays as well. When you have a problem, you find the shop open, and when you explain the state of your cattle to the staff, they instantly offer a remedy and advise you on which drug to purchase. With theileriosis, it is critical to seek treatment promptly; otherwise, the cattle will die shortly after purchasing the drug, resulting in a double loss." (Farmer 4).

Farmers also believed that agrovets were sufficiently flexible because they allow them to purchase livestock medications without a prescription, allowing them to stockpile them in case of an emergency.

"We go to the agrovet shop with the empty container and demonstrate to the agrovet salesman the cattle medication we desire. Once they notice the empty container, they can sell the medication on our behalf." (Farmer 17)

Farmers prefer to patronize agrovet shops that are highly recommended by other farmers. They frequently go to *agrovet shop 1* because the staff is kind and willing to listen to their concerns.

"*We go to (agrovet shop 1) where everyone goes." (Farmer participant 5)*

The staff at this shop has the time to listen to their problems and offer advise freely without requiring them to make a purchase at their shop later. According to the farmers, the staff at the agrovet shop 1 has the time to explain the drug's mechanism of action clearly.

"When I went to Gutu Growth Point, I knew that the money I had was insufficient. As a result, I went to (agrovet shop 1) for guidance on which drug to use and how to use it. Then I left the shop and proceeded to the hardware store, where the medicine was cheaper." (Farmer 13)

Additionally, farmers believe that the staff at this business is trustworthy, as they do not sell expired medications but rather urge farmers to check expiration dates while purchasing medications. Farmers also believed agrovets kept them informed of outdated medications and new medications to use. The farmers stated that this is in contrast to extensionists officers, who frequently provide 'outdated' information and consistently fail to prescribe improved treatments or identify ways to assist farmers. Thus, to farmers, the agrovet shop 1 appears to be superior to extensionists.

"The agrovet shop sellers are knowledgeable. The medication recommended by the extensionist may be ineffective, and you may be prescribed different medication at the pharmacy. The majority of the information that extension workers provide when you visit the agrovet shop is said to be no longer recommended." (Farmer participant 12)

Additionally, the farmers believe that the agrovet shops serves as an excellent meeting place for them to exchange ideas with other farmers from other areas.

"There was a time when I went to the agrovet shop seeking for dosing drugs and met another farmer who had travelled from another village in search of livestock drug. The man suggested me to get a more effective anti-theileriosis medication. At the time, I did not have enough money to purchase medications sufficient for my cattle. Thus, I purchased enough medication for five animals but did not administer it to the remaining livestock. When theileriosis disease attacked my cattle, I lost those that I was unable to medicate. I wish I'd given the medicine to the entire herd." (Farmer Participant 26)

Some farmers believed the agrovet shops coerced them into buying drugs because they wouldn't let you leave without them. Farmers believe some agrovets are opportunists who profit from the disease's prevalence. If one is not vigilant, they may substitute a different or expired prescription. If the prescribed drug is too expensive or has increased in price, shopkeepers may suggest a less expensive drug or a small container of the recommended drug. Farmers doubt these cheaper treatments' effectiveness.

"To a certain extent, they are beneficial because they can advise you on which drug to use simply by telling them your condition over the counter. Their issue is that if you are not vigilant, they may sell you a medicine that is not what you were seeking for." (Farmer 23)

5.4 Agrovets perceptions towards farmers

The agrovets feel the increase in line-ups is because farmers know and trust the employees. Farmers can bargain about which medicine to use in agrovet shops. They feel it's because they're always available to farmers and have animal health training, which means they can substitute as extensionists. They also boast that they have updated knowledge about livestock diseases and drugs for cattle diseases. Some farmers can call them from home for help and they give them the most efficient therapy. Thus, farmers respect them because they save farmers' animals from dying.

"If you assist the first farmer and his cattle recover from a certain ailment, they contact the next farmer, who then notifies another farmer about the shop, resulting in a large number of farmers visiting." (Agrovet shop no. 1)

Agrovets believe farmers don't need the extension officer's prescription because most know what they need. In the event of theileriosis, they provide medications to farmers even without a prescription due to the severe status of the farmers' livestock. They feel responsible to help the farmer avoid future cattle losses due to the disease.

"*If they do not notify the veterinarian first, the procedure will become lengthy, which will result in death. As a result, people prefer to bypass the DVS offices and go directly to the shop. As the majority of farmers come here in a haste to ensure the survival of their cattle." (Agrovet shop no. 5)*

Many agrovets perceive farmers' ignorance and explain how to apply medicine. Farmers who know what they want are not taught how to use medicine, they said. Despite the importance of the dose-weight relationship in medicine administration, most farmers don't weigh cattle. Low demand caused them to stop selling weighing belts. When the treatment fails, farmers always blame them. While many farmers take their advice, others return to their farms and do things the old way. Agrovets believes some local farmers who claim to know veterinary medicine are increasing farmers' problems with their malpractices. Local farmers inject cattle medication wrongly, according to the stores. When cattle are injected with medication, these farmers wrongly tell other farmers they shouldn't drink water. These pretentious farmers often prescribe the wrong medicine. They underdose sick cattle to use the leftover medication on other animals and make more money. Some overdose. When injecting cattle, they frequently use the same needle size on all of them spreading the disease to numerous livestock.

5.5 Agrovets perceptions towards extensionists

The agrovets say extensionists offer farmers little information; hence, farmers have resorted to self-diagnosing animals. Extensionists prescribe outdated drugs to farmers. Agrovets believe that this is because many DVS extensionists graduated years ago, and the pharmaceuticals they know have since been replaced. They believe extension workers are lacking relevant and helpful information, especially about evolving drugs. Agrovets feel extension personnel's diagnoses are often wrong, so farmers prefer their opinion. They feel their medications are better than those recommended by extension workers. Agrovets, think they have an advantage over extensionists because they work directly with drugmakers, who give them the most up-to-date information.

Agrovets believe farmers and DVS extension officers have a tense relationship. They say farmers often ask why they must visit DVS headquarters. Ineffective DVS interactions with farmers are causing problems, they say. Due to the paucity of extension personnel, farmers lack information and don't know where to turn for help. Agrovets believe farmers prefer them to extensionists because they are more approachable. Extensionists need transportation the way farmers lack it. They also argue that extension personnel can't deal with all farmers at once, especially during emergence. In many cases, extensionists are overwhelmed by the number of farmers they have to cover.

Agrovets claim that if extension staff diagnose problems quickly, it will be easier to offer the farmer with the right drugs. The existing approach, in which retailers must first listen to

farmers, is not ideal, as farmers sometimes fail to communicate important symptoms needed to provide the right medications for cattle.

"Some extensionists do not visit the farm to observe the condition, we are left to listen to the farmer, who frequently overlooks some of the critical reasons for the sickness. If we collaborate with extensionists, they will keep us informed about what is actually happening on the ground." (Agrovet shop no. 1).

5.6 Extensionists' perceptions towards agrovets

According to extensionists, certain vet stores stock the most up-to-date and diverse range of pharmaceuticals. Some farmers select stores based on price or their relationship with the agrovet. According to extensionists, some of these recommended businesses are unlicensed and sell counterfeit pharmaceuticals.

Extensionists encourage farmers to purchase medications from licensed agrovet shops with experienced staff that sell approved cures. Farmers are recommended agrovet shops 1 and 5. According to extensionists, many farmers shop at unregistered stores and are more interested with staying in business than with assisting farmers. These companies frequently market wrong medications to farmers while some sell illicit, dangerous medications. These agrovet shops are said to employ unskilled, tech-illiterate workers. Extensionist 1 allege that some unlicensed business operators may sell diluted animal medications. She alleges that they open containers, take some of the contents, and dilute the medicine with water, reducing its effectiveness but f armers are hoodwinked with the low prices.

According to extensionists, farmers should consult DVS professional before visiting agrovet stores. Farmers purchase Butachem whenever their cattle become ill since agrovet stores sell whatever they want without understanding the animal's history. According to extensionists, agrovet should stop supplying pharmaceuticals to farmers without a veterinarian's prescription since farmers are misdiagnosing cattle diseases and prescribing the inappropriate remedies. Extensionists feel that the way agrovets diagnose cattle ailments without a farm visit is unreliable. According to extensionists, agrovet shops provide over-the-counter medicines to stay in business, but farmers are unaware. Extensionists believe that agrovets are therefore contributing to the disease's high prevalence in the research area by making incorrect diagnoses, resulting in cattle losses.

"It is not advisable for farmers to walk into an agrovet shop and purchase medications without first being referred by veterinary professionals. When farmers notice their cattle are not grazing, they think its theileriosis. However, not grazing can be caused by a variety of factors. (Extensionist no. 3)

5.7 Chapter Summary

Farmers perceive extensionists' knowledge and recommendations are not helping to cure theileriosis. Just encouraging dipping cattle is not addressing the situation. Farmers say extensionists only advise those who can afford their travel. Farmers demand more training and demonstrations from extensionists. Extension workers say farmers rarely report diseases. They added that farmers tend to use Hitet to treat any cattle illness. Extensionists noted that farmers' superstitious beliefs also contribute to the spread of diseases. Farmers regularly get bad advice from fellow farmers, according to the extensionists. Extensionists also blame unlawful cattle exchanges by farmers for spreading the disease. `

Farmers perceive agrovets are more knowledgeable, have up-to-date expertise and are more empathetic. Agrovets believes the increase in queues is because farmers know and trust them. Agrovets, say they advise farmers to buy an affordable medicine because it's better than nothing. Agrovets believe farmers however still need to learn more about animal diseases. They claim that when farmers inject cattle, they don't know the proper needle size and use the same injection on all animals, spreading disease.

Agrovets think extensionists provide farmers with insufficient information. Farmers lack of extension, they believe this is why farmers self-diagnose cattle illnesses. Agrovets believe extension personnel don't update livestock health information. Since agrovets work directly with pharmaceutical makers, they believe their drugs are superior to extensionists'. Extensionists say some farmers' favoured agrovet businesses are unregistered and sell fake medications. Extensionists believe agrovets' over-the-counter diagnostics are unreliable and don't consider the animal's health history, so farmers buy *Butachem* every time their cattle are sick.

6. ACTUAL FIELD PRACTICES FOR *BOVINE THEILERIOSIS* DISEASE CONTROL

6.1 Prevention and control of *Theileriosis* disease

6.1.1 Cattle dipping

DVS standard operating procedures emphasize weekly summer dipping and fortnightly winter dipping. However, cattle in the study area are dipped once a month. Cattle only started dipping weekly in January 2022 following the unprecedented spike of cattle mortalities due to Theileriosis disease. Most farmers dip their cattle as a preventative measure against tickborne diseases. Farmers say dipping is more effective than other methods at killing ticks and costs only US$2 per head per year.

"Dipping seems it works. It is cheap for us and more effective then spraying. It is cheap. We do not buy the expensive chemicals." (Farmer 13)

Figure 6- 1:Communal cattle waiting to dip at community dip tank

Some farmers failed to dip their livestock on the scheduled days for various reasons. Due to their age, the old farmers can't walk more than 10 km to dip their cattle at the communal tank and cannot afford herd boys or weekly day labour to follow their livestock to the dip tank. They rely on younger neighbourhood relatives to drive their animals to the dip tank, but such goodwill is not always accessible. Farmers with children, grandchildren, or herd boys send cattle to the dip tank often. Several farmers say Friday's dipping clashes with other field operations. Farmers hoped that the day for dipping would be changed to Thursday, which is traditionally a day to rest after working in the fields (Chisi-in Shona).

The dip tank has been inoperable since May 2021. It lacked dipping chemicals. Most farmers didn't dip livestock for six months. When the dip tank was later opened, many farmers grew accustomed to not dipping cattle. According to the dip attendant, only one in 10 farmers regularly dipped their livestock. Before the *Bovine Theileriosis* outbreak, dipping livestock was inconsequential and farmers felt dipping was a law enforced. Due to infrequent dip tank visits, the disease-transmitting vector was not contained in time. Some farmers even perceive that the dip tank spread sickness. They only come to dip when the cattle are infested with ticks.

Because the drug's effectiveness is affected by increasing temperature, DVS recommends dipping should take place between 0600 and 0900 hours. The communal farmers, however, do not bring their cattle on time for dipping. When the researcher visited one of three dip tanks in the study area on November 19, 2021, the dip attendant only opened the dip at 0800 hours. Farmers who had been waiting almost two hours with their cattle were angry, and the DVS dip worker told them in an arrogant way that they could not do anything about it.

"I attended training in order to obtain this position. If I lose my work, the dip tank will become inoperable. You're jealous of me; you're vying for my position." (Dip attendant 1)

Figure 6- 2: Dip attendant mixing acaricide in a container before pouring into dip tank

Before pouring the dipping chemical into the tank, it should be thoroughly mixed in a container. When the researcher visited another community dip on December 30, 2021, she noticed that when the dip attendant was going to mix the acaricide, he discovered that the container he had brought was leaking and had to quickly send one of the farmers to bring a good container. This

implies that the actual practice at these dip tanks was to pour the acaricide directly into the container, despite the fact that the chemical should be mixed first. The extensionist then chose the first 30 animals to dip twice. The majority of farmers had to inquire as to why this was done today. The extension worker defended this unusual method to the farmers by stating that, generally, on the first dip, the acaricide is not adequately mixed, which is why the first 30 cattle are dipped twice. This means that, despite the fact that this was regular operating protocol, the dip attendants in the area did not follow it.

6.1.2 Cattle spraying and applying cattle grease

When the common dip tank is not operational, farmers must spray their cattle with a dipping doze and apply cattle tick grease to inaccessible body parts of the bovine. Farmers were encouraged to buy knapsack sprayers and dip acaricides to spray their livestock during the six-month dip tank shutdown. Farmers got free government-supplied tick grease. Few farmers could afford knapsack sprayers and cattle dipping acaricides. Out of 29 homesteads visited, the researcher found only two cow holding pens, proving the method's ineffectiveness. Farmers who couldn't afford the acaricide sprayed their cattle with Zumbani (Lipia Javanika). Farmers who tried this approach say ticks flourish when this plant is applied to livestock. This shows that the herb is either useless or that farmers don't know the right water concentration. Farmers reported they were on the point of losing all their livestock to the disease when they received cattle grease. Most farmers didn't use it on their cattle, despite having large amounts on hand. Farmers said they were given cattle grease but were not shown how to use it. Farmers report they end up oiling wheelbarrows and scotch carts with tick grease.

6.1.3 Vaccinating cattle

DVS standard operating procedure calls for vaccinating cattle against many diseases, including Theileriosis, every three months. Almost all farmers said they didn't frequently vaccinate because of expense and because the drugs were packaged for at least 50 cattle, which they didn't have. Farmers have an average of three cattle. A single farmer simply couldn't afford vaccine medications. A collective strategy to buy vaccines was missing at the time of the investigation. Those who could afford only vaccines stated it made no economic sense because they had to be used completely or stored in a refrigerator, which they lacked.

6.1.4 Restricted cattle movements

DVS bans cattle movement for grazing, fattening, marketing, and breeding to contain foot-and-mouth disease (FMD), anthrax, and theileriosis. Cattle movements inside and outside the

research area are forbidden. Cattle illegally move inside the study area and to other wards, districts, and provinces. Farmers are accused of paying corrupt DVS and police officers to unlawfully transport livestock from the red zone districts to Gutu, where the disease is infrequent. Some farmers know it's unlawful to move cattle from specific places, so they lie and say it's for slaughter, but they breed them instead. "Ubuntu" spreads disease through movement. When the bride price is paid in cattle, the bridegroom's livestock must go to the bride's community. When relatives dwell in different villages, individuals owning cattle often move them to a village where other relatives live to plough the soil for them. Accordingly, theileriosis spreads from one village to another.

6.1.5 Veld management

DVS proposes controlled veld fires to kill ticks that spread Theileriosis. The veterinary extensionist urged the community to initiate controlled veld fires to eradicate the vector in livestock pastures. This advice was strongly rejected since, during the dry season, most of the villages make a living selling traditional African brooms.

Figure 6- 3: A villager preparing African traditional brooms for sell in urban areas

6.2 Treatment of *Theileriosis* disease

6.2.1 Diagnoses of theileriosis disease

Farmers self-diagnose theileriosis. They detect tears pouring from bovine ears, eyes changing colour, excessive mouth froth, and cattle standing in the shed and not grazing to identify

theileriosis sickness. Some experienced farmers help other farmers diagnose sickness. Farmers react when they see excessive mouth froth and livestock not grazing. Farmers are diagnosing their livestock late since these indicators suggest deterioration. Farmers assumed their cattle had theileriosis when they stopped grazing, even though it could be another disease. Theileriosis disease is not the only reason cattle stop grazing.

"When we see cattle that are not grazing or are becoming blind, then we know it is theileriosis." (Farmer participant 17).

Farmers report cattle urine and dung containing blood, yet they diagnose theileriosis. Farmers in the study area may have a mix of cattle diseases that must be carefully diagnosed and addressed. Thus, farmers are not detecting the disease early enough and are making fast conclusions that their cattle have theileriosis sickness when it could be another bovine disease or a mix of diseases.

6.2.2 Informing the extensionist of the notifiable disease

DVS expects a farmer to notify a veterinary officer when his herd is sick so the officer can diagnose and prescribe medicine. Extensionists will then alert the DVS of any notifiable disease before it spreads, allowing for preventative measures. Farmers reported they used to notify the extension worker when the disease affected cattle, but had stopped. Farmers gave many reasons for not telling the extensionists. Farmers said the extensionist demanded payment for travel to identify the ailment. Farmers said an extensionist advised them the sickness had no cure and they should let their cattle die naturally for the meat to be edible. Others report that one extensionist failed to treat their livestock when called. Some say she just doesn't visit the farmers, and some are even unfamiliar with her. Other farmers said the process of notifying the extension worker takes too long, given the dire circumstances their livestock will be placed in.

6.2.3 Prescribing drugs

Veterinary specialists prescribe medication and therapy. The veterinary extensionist inspects sick cattle, identifies the ailment, and prescribes medications, which the farmer can buy at the agrovet shop. Few farmers get a veterinarian extensionist's prescription before buying animal health drugs at an agrovet shop. Farmers said veterinary extension agent prescriptions were too pricey. If farmers contacted her, she'd have to travel to and from the transport to cure sick animals. When the farmers acquire the medicine, they must pay for her to inject their livestock. If the drug needs injections for more than three days, the farmer must pay for her transportation. Farmers say going to agrovet outlets without a prescription saves money and time. Farmers asked the extensionist for prescriptions in person or by phone, but she didn't always give them.

Other farmers ask neighbouring farmers for medicinal advice (which, most of the time, farmers recommend Butachem or Hitet 120–200). If their other farmers couldn't prescribe, they'd seek veterinary-savvy farmers' help (hired on a fee basis). They often misdiagnose, thereby recommending wrong prescriptions. Sometimes it's related to the condition, but the treatments they advise may be wrong because of previous experience with cattle presenting similar symptoms. They don't consider that the medicine they seek may be no longer available.

Farmers in the study area prefer to visit Agrovet Shop 1 first to get the necessary medication, get dosage instructions, and check prices. Farmers carry an empty container to an agrovet shop and request medicine. Once agrovets detect the empty bottle, they sell it to farmers. Some farmers don't bring the prescription and would say the extension agent advised them over the phone on which medicine to use, but they lack the prescription and if they wait, their cattle will degenerate or die.

"If you describe your cattle's condition to the boys at (agrovet store 1), they will advise you on which drug to purchase and how to utilize it appropriately." (Farmer 19)

Farmers who visit local agrovet shops without a referral risk being sold the wrong drug due to insufficient information. An extensionist must visit the place and physically examine the cattle to offer an accurate diagnosis and administer the proper treatment. Cattle may have theileriosis, redwater, and heartwater simultaneously, but the contra diagnosis may be only theileriosis, resulting in an insufficient prescription.

6.2.4 Purchasing the drugs

The farmers are expected to buy the prescribed medications at the agrovet shop, not substitutes. In practice, agrovet shops sell drugs to farmers without prescriptions. Farmers buy cattle medicine from cheaper retailers. Many of these cheaper outlets are unregistered, and registered stores suspect them of providing diluted, ineffective drugs. When farmers visit the agrovet shop for the "prescribed" drug, the agrovets often tell them there is a better drug available or that the drug is out of stock but they have an alternative. If farmers can't afford the therapy, agrovets recommend a cheaper option. Farmers often choose to buy smaller containers of medication, regardless of the number of cattle they want to treat. Some farmers who cannot read claim that agrovet shop personnel sell them erroneous or unapproved drugs. Agrovets often convince farmers that the alternative is better to pressure them into buying their medications. Thus, drugs are sold based on farmers' ability to pay, not what's best for them.

"I normally purchase from (Agrovet Shop 6) in Masvingo. However, their issue is that they will suggest you to purchase the drugs they have rather than the drugs you wish to purchase. If I go there to purchase

Butachem, they will urge me to purchase Hitet instead, just because they have Butachem out of stock at that moment." (Farmer participant 23).

Figure 6- 4: Farmers purchasing cattle medication in an agrovet shop

Agrovet stores said they take the time to explain how to use it to the farmers and advise them to study the instructions on the drug bottle in greater detail. Because most rural households lack power, agrovet shops sell drugs that can be kept at room temperature. Agrovet retailers confirmed that they do not, however, commonly highlight dose-weight ratios.

6.2.5 Administering of treatments

A veterinarian must always administer cattle medications according to the manufacturer's instructions. Farmers say when the animal is sick, they first give ethnovert herbs by mouth to the animal. If they have medications at home, they utilize them to treat their cattle, regardless of the ailment. They borrow medication from a neighbour when they can't get it. If the situation worsens, they hire a local expert farmer who carries his own remedies. Farmers say sometimes some people roam the countryside treating animals, and if they encounter them, they pay them to treat their cattle. After failing at self-treatments, farmers seek help either from an extensionist, an experienced local farmer, or an agrovet store.

"When cattle become ill, you make an effort to treat them using a variety of methods that you believe will help the cattle recover. If this does not work, we visit the agrovet stores." (Farmer 17).

When farmers buy "approved" drugs, many treat their animals themselves. When farmers can't treat their cattle themselves, they pay local experts to do so. Unwritten requirement: local

expert' own livestock and those they treated before must have survived. Only three farmers reported that all their livestock survived despite using the indicated treatment or an alternative. According to other farmers, the extensionist also gave the drug to their animals, which died. Those who administer the antibiotic say it's often given when cattle have deteriorated. Others were unsure how much medication they give their animals. Several farmers said they checked the expiration date at purchase but use drugs till depleted, regardless of expiration date. When hired local farmers bring drugs to treat their cattle, they do not verify the expiration dates, drug names, or contents of the drug container. Instead, they presume the drugs are authentic and unexpired.

"We do not discard a medication simply because it has expired. We must utilize the medicine till it expires and then seek out another." (Farmer participant 15)

Farmers say they do not use a dose-weight ratio when giving drugs. They use visual estimation gained from experience. Even the DVS extensionists do not use weighing belts. In the absence of a weighing scale, bovine overdose and underdose may have caused their deaths. Farmers and hired locals confess using syringes to measure medicine. Most farmers said hired locals give double doses rather than one. One hired local confirmed hat that they give s ick animals double the dose, while healthy cattle get the specified dose hence contradicting manufacturer's directions. They overdose the cows, which is harmful. Some hired locals walk around with their own meds, offering sub-doses and earning a bigger price per cow treated.

Most farmers reported that whatever treatment method recommended for specific drugs they end up injecting the antibiotics at the bovine's thigh since it is what they are familiar of. Farmers say hired locals inject each cow in at least three spots, which is not on the drug label. As long as the cattle are treated, the farmers seem alright, even if the medicine is overdosed or underdosed in the wrong body position.

All actors appear unaware of the optimal timing to change from continuous usage of one product to use of another. Since 2015, the farmers have been using only *Butachem* and *Hitet* to treat theileriosis. Farmers do not retain records of the medications they have given their livestock hence same drug can be used throughout a cattle's life. This suggests possibility of antimicrobial resistance. All the actors admitted as well of using the same syringe for multiple cattle revealing that syringes can be contributing to spread of theileriosis.

6.3 Impact of the Bovine Theileriosis in the study area

30 farmer participants were interviewed in the study area. Before theileriosis disease rampage in the area, that is in 2018, the total number of cattle for participants was 288 cattle, each farmer

owning between 3 to 30 cattle (see Figure 6-5). By end of November 2021, the farmers had lost almost 70% of their cattle to the disease and only 85 cattle were left. 33% lost all of their cattle and only 10% did not lose any cattle.

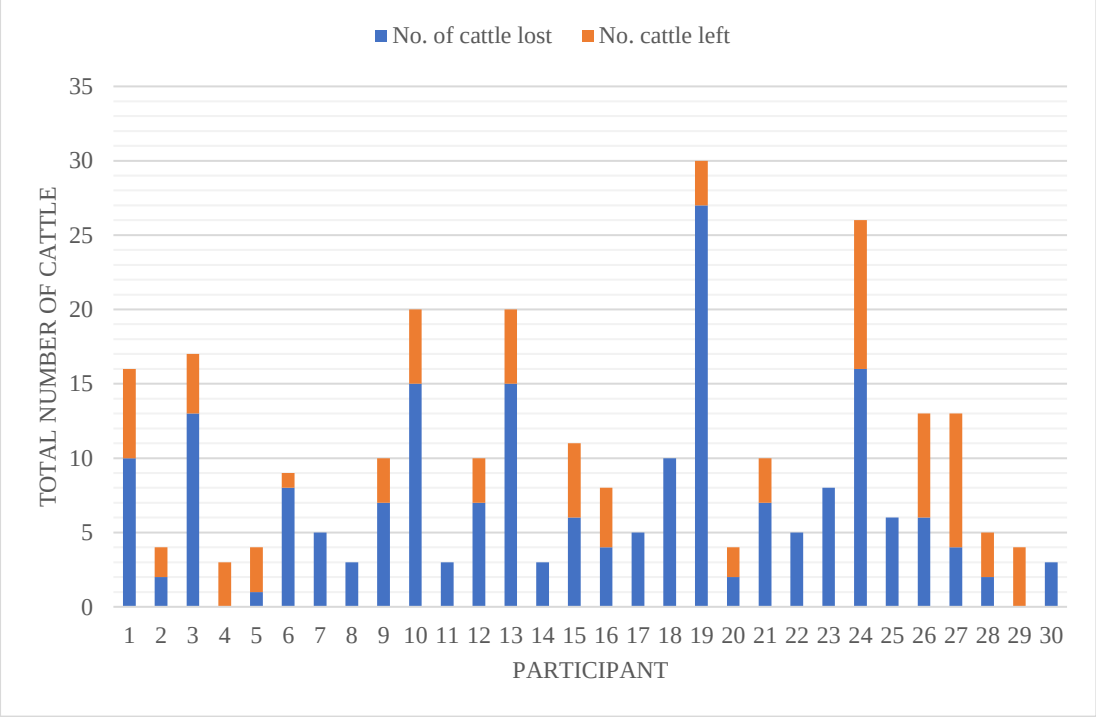

Figure 6- 5: Statistics of cattle lost to Theileriosis disease from 2018 to November 2021

6.3 Chapter Summary

Prevention and control practices of Theileriosis disease

Since May 2021, the dip tank has been inoperable for six months. According to the community dip attendant's statistics, just one out of every 10 farmers dip their cattle on a regular basis. Elderly farmers are not able to trek long distances every week to dip their animals in the common dip tank. According to some farmers, the Friday dip day frequently conflicts with other field duties. Cattle frequently dip late, and dipping acaricides are not properly blended.

When the communal dip tank is not in use, though farmers are expected to spray their cattle with a dipping doze and apply cattle grease, many farmers were not practising the method due to high cost of knapsack sprayers and dipping acaricides. Only two cow holding pens for spraying and treating livestock were identified by the researcher. This demonstrates the method's ineffectiveness in the area under study.

Almost all farmers stated that they do not vaccinate their livestock on a routine basis. Purchasing vaccination medications is excessively expensive for a single farmer. As a result,

farmers often treat their cattle only when they show signs of illness. Illegal cattle movements are suspected to be contributing to the disease's unrestrained spread. Farmers are alleged of corrupting DVS and police officials in order to move cattle illegally. DVS once proposed controlled veld fires to eliminate ticks that transmit tick-borne diseases such but, the farmers rejected this advice because they earn a living selling African brooms harvested from pastures.

Farmers gave a variety of excuses for not informing the extensionist. Other farmers indicated that notifying the extension worker takes significantly longer than necessary. Certain farmers merely attempt to cure the sickness privately, without disclosing its spread.

Treatment of Theileriosis disease

Farmers are failing to diagnose the disease early enough to prevent it from progressing, and farmers appear to be hastily diagnosing their cattle with theileriosis sickness when another bovine disease or a combination of several diseases could be present. Farmers feel that bypassing the extensionist and purchasing pesticides straight from agrovet retailers without a prescription saves them money and time. Farmers visit an agrovet store and advise the employees about their cattle over the counter. They would then advise the farmer on the best course of action. Other farmers seek advice from other farmers over which drug to take. If farmers cannot afford the therapy, shop employees propose a less expensive alternatives.

Farmers report that when their cattle are sick, they normally use whatever treatments they have on hand to treat their cattle regardless of the ailment. When they cannot obtain the medication, they borrow it from a neighbour to replace it later. If the situation deteriorates, they contact a local specialist farmer who brings his own remedies to treat the cattle. Farmers stated that they do not verify drug expiration dates, drug names, or the contents of the drug container, but instead assume the drugs are genuine and unopened. Farmers do not use weighing scale, thus bovine overdose and underdose may have occurred, resulting in cattle deaths.

Locals often double-dose cattle. Most farmers are unsure of which portion of the cow to inject the medicine; therefore, they inject at the thigh. Farmers say hired locals inject each cow in at least three spots, which isn't mentioned on the prescription label. Since 2015, Butachem and Hitet have been used to treat theileriosis. This might indicate antibacterial resistance. Multiple animals are medicated using the same syringe. Thus, pharmaceutical syringes might spread theileriosis quickly.

7. DISCUSSION

7.1 Introduction

The *Bovine Theileriosis* disease is still a major source of economic loss in Zimbabwe's rural communal lands. The purpose of this research was to determine what was causing the persistent presence of the disease in cattle on Zimbabwe's communal lands. This chapter examines how the differing perspectives of communal farmers, DVS personnel, and agrovet shop workers on how to prevent, control, and cure bovine theileriosis have resulted in the disease expanding out of control in Gutu communal lands.

7.2 Economic Impact of Bovine Theileriosis in Zimbabwe Communal Lands

Cattle are a communal farmer's main source of income; hence theileriosis causes economic loss. Cattle supply milk for the family, draught power for cultivation and transport, and have a high sociological value, acting as a reservoir of money and a status symbol, playing a role in ceremonies, and being used for bride price (Mwatwara, 2013; Norval et al. 1992; Hall, 1986). This investigation also found that communal farmers in the study area kept cattle for draught power, manure, milk, status symbol, bride price, and occasionally meat. The disease is hurting rural farmers' livelihoods. Thus, disease control needs more attention.

Theileriosis damaged rural lives and placed a financial strain on already destitute farmers by reducing their main source of revenue and benefits, wealth, income, and socioeconomic stability. Norval et al. (1992) note that combating the disease costs communal farmers money. According to the survey, farmers spend a lot of money to control and cure the sickness. Farmers said agrovet-stores sell livestock medications in US dollars but agricultural commodities in Zimbabwean dollars. In agrovet companies that accept Zimbabwe dollars for medicine purchases, the exchange rate is inflated. Farmers may be spending more on livestock health because animals with theileriosis have a low chance of getting better.

The decimation of Gutu's cattle represents the loss of wealth and the main source of income, according to the report. In rural Zimbabwe, cattle are a current asset, "estate," and inherited asset for coping with and recovering from stress and shocks and for providing sustainable livelihood options for the next generation, which improves other livelihoods (Freeman et al., 2008). Theileriosis has largely eroded the sustainability of livelihoods based on cattle by causing insecurity, loss of estates, and future socioeconomic wellbeing of communal farmers. Poor farmers in Gutu district are overloaded by the cost and difficulties of hiring cattle from the few remaining farmers, who are charging exorbitant fees because of rising demand for

draught power. Overall, the disease threatens both the major and related sources of income. So, it must be treated immediately before it damages many livelihoods.

7.3 Technical perspective for *Bovine Theileriosis* Disease Management

Technical perspective revealed gaps in farmers', DVS extensionists', and agrovets' scientific knowledge of how to treat the bovine theileriosis disease. The continuation of bovine theileriosis in Zimbabwe is attributed to deficiencies in their scientific knowledge regarding disease management.

7.3.1 Technical perspective of communal farmers

Most farmers in the study area could diagnose Bovine Theileriosis. Farmers largely agree that dipping livestock prevents and controls disease spread. Most farmers can name two prominent medications used to treat bovine theileriosis. The community farmers may have gained knowledge through practical experience dealing with the disease. Mwatwara (2013) noted that farmers tend to gain knowledge through ad hoc experimenting on their own farms. Rio-Gonzalez et al. (2013) confirm this finding as well in their study where they noted that farmers amassed knowledge about pesticide risks through experience working with pesticides.

The study however revealed significant knowledge gaps among communal farmers that contribute to the disease's prevalence in the study area. While farmers could detect bovine theileriosis symptoms, they were however diagnosing symptoms for a terminal case. In the terminal stages of the disease, cattle have problems breathing, frothing at the nostrils, corneal opacity, which can cause blindness; high temperatures that force them to remain in the shade; and high fatality rate (Norval et al. 1992). This reveals that farmers are late diagnosing the disease, resulting in a slim chance of survival even when the medication is administered. Early diagnosis, which requires a careful check for the disease's early signs, which are frequently high temperatures (fever) and enlargement of several lymph nodes (Norval et al., 1992), is still a problem for farmers to identify.

Farmers didn't know when to switch from one antibiotic to another to prevent drug resistance. They didn't know how AI molecules in cattle drugs relate to rotation practice (Mutavi et al., 2021) and antibiotic resistance (Doidge et al., 2020). Most farmers misunderstand that dipping livestock treats the sickness. Regular dipping is not meant to eliminate disease but to kill vector ticks (Mwatwara, 2013). Farmers are unaware of how to properly deliver drugs. Farmers still need to understand and appreciate the role of veterinary extensionists in diagnosing, prescribing, and administering drugs instead of assuming that role. This is because the

aetiology, epidemiology, and control of Bovine Theileriosis disease are complex and require to be handled by a veterinary specialist (Morrison, 2015)..

7.3.2 Technical perspective of agrovets

Agrovets were able to identify a number of veterinary medications for treating and preventing Bovine Theileriosis, but they were unable to identify vaccinations. The agrovet shop workers lacked formal expertise of animal medicine administration, such as the necessity of dose-weight for medication distribution and providing the drug in the right body postures. This issue appears to have affected both agrovets and agrochemical sellers, since Matowo et al. (2020) noted as well that agrochemical retailers lacked knowledge of pesticide usage, including pesticide doses.

Almost all agrovet stores, like farmers, were able to diagnose the condition by identifying the disease's symptoms; nevertheless, the diagnosis was for the terminal stage of the disease. Even though they didn't have this knowledge, the agrovets didn't think it was important that the disease had to be diagnosed in person, not in a store, and that veterinary drugs had to be bought with a prescription. The importance of obtaining animal health antimicrobials with a prescription appears to be underestimated in Sub-Saharan Africa (e.g., Johnson et al., 2019; Auta et al., 2018; Caudell et al., 2017; Bomah et al., 2016; Ojo et al., 2016).

The most common reason given for veterinary drug use patterns and particularly drug misuse, is a lack of knowledge or awareness about the importance of prudent use and drug resistance (Caudell et al. 2022). The study revealed a widespread dearth of knowledge among agrovet retailers regarding the many types of acaricide and veterinary drugs' active ingredients (AI) molecules, their functions, and how they should be rotated, as well as knowledge on AMR and prudent antimicrobial use. To understand how to prudently disseminate practices among agrovets, more knowledge on antimicrobial use, AI molecule functions, and AMR is thus required (Caudell et al. 2022).

The knowledge gaps identified among agrovet personnel on the management of *bovine theileriosis* disease are a serious concern given that agrovet shop personnel are regarded as an important source of information for farmers while veterinarians have been relegated to "last resort".

7.3.3 Technical perspective of veterinary extensionists

The DVS extensionists cited a number of knowledge gaps that were still beyond their learning that could be contributing to the unrelenting prevalence of the disease. Their knowledge of

vector biology was very limited, and they presumed that the brown ear tick had the ability to mutate. The extensionists find it difficult to explain the recurrence of the disease as well, whenever fresh cattle are introduced. There is a gradual realization that the parasite *Theileria parva* (T. parva) is extraordinarily diverse, and many geographical and other factors affect its diversity (Ochanda, 1994). Their sentiments concur with those of (Mwatwara, 2013) and (Norval et al. 1992), who also confirmed that the aetiology, epidemiology, and control of the *bovine theileriosis* disease are more complex than any other veterinary disease. There is still a need for much more extensive studies and more precise model construction in order to understand and control *theileriosis* disease effectively (Dolan, 1999).

Controlling T. parva infections involves dipping vectors like brown ear ticks in chemical acaricides. Dip attendants knew just one dipping chemical, Amitraz, and were unaware that it needed be replaced every six months to prevent tick resistance. Dip attendants couldn't judge the intensity of a dip in water. Extensionists say dipping is getting less reliable as acaricide resistance builds. New strategies to postpone acaricide resistance must be introduced (Dolan, 1999). Extensionists agreed they can't identify and quantify acaricide resistance and aren't aware of modern decoy tactics to postpone tick resistance. The veterinary extension staff have no understanding of other therapeutic medications save Hitet and Butachem, which they regularly administer to farmers. It would be imprudent to dismiss antimicrobial resistance. This malpractice can be explained by a lack of understanding of the mode of action of AIs in acaricides and therapy medications (Mutavi et al. 2021), poor knowledge of antibiotic stewardship measures (Afakye et al. 2020), and the absence of research into novel anti-theilerial treatments (Dolan, 1999). Afakye et al. (2020) advocate making antimicrobial resistance (AMR) a key component of veterinary and agricultural education, training, certification, and development.

The extensionists also pointed out that while the possibility of vaccinating against *T. parva* would bring hope of an alternative method of control, such an approach was still limited in Zimbabwe. Dolan (1999) is of the view that an integrated control strategy that includes vaccination and fewer acaricide applications would allow limited tick challenge, slow emergence of acaricide resistance and immunity boosting in cattle. The extensionists cited as well that the issues which involve the link of the disease to climate change, the possibility of cattle from a combination of tick-borne diseases, and variation in susceptibility of different cattle types and breeds to *T. parva* infection require further study in order to generate and provide new knowledge on tick control and treatment of the disease.

This demonstrates that veterinary officials have also knowledge about the health management of *bovine theileriosis* disease. The aetiology and epidemiology of the disease are not yet fully understood, and because ignorance reigns among all actors, the environment is ripe for the spread of Bovine theileriosis disease (Mwatwara, 2013).

7.4 Imagined experts and imagined lay-people in the prevention and control of the *Bovine Theileriosis* disease

Using the "imagined experts, imagined lay-people" model (Blok et al. 2008), the study discusses how different actors' imaginations of how other actors view and handle treatment and control of *Bovine Theileriosis* disease have created a fertile environment for conflicts and, indeed, for the spread of the disease in communal cattle.

7.4.1 Communal farmers' imagined experts

Farmers, as "lay people" in this study, expressed some strong concerns about how extensionists and agrovets, here referred to as "experts," handled *theileriosis* disease in the study area. The communal farmers in the study area may be classified as "critical" laypeople. "Critical" laypeople tend to have poor trust in experts, see expert conflicts as cognitively "illegitimate," and rely negatively on expert systems (Blok et al., 2008). Farmers voiced concerns regarding the trustworthiness and competence of extensionists and agrovets in terms of disease management. According to them, the knowledge of extensionists and agrovets regarding control of *theileriosis* in communal cattle includes various limitations and ambiguities. As a result, to them, extensionists and agrovets failed to satisfy the "expert" standard of all-encompassing competence but demonstrated limited understanding of disease management (Blok et al. 2008). This is not to say that the necessity for extensionists and agrovets as disease control experts among communal farmers should be dismissed. This does not mean that the services provided by extensionists and agrovets should be denied by farmers. The farmers admitted their ignorance (lack of understanding) in terms of scientific knowledge for the health management of bovine theileriosis, relegating them to cognitive reliance on extensionists and agrovets as "experts." This section shows how the farmers perceive the extensionists' and agrovets' expertise and contribution towards management of the disease in the area.

Farmers' imaginations towards extensionists' expertise

Farmers think extensionists don't comprehend theileriosis since their guidance hasn't saved animals. The history of theileriosis in Zimbabwe shows state-farmer conflicts due to the disease's complexity (Mwatwara, 2013). Despite the disease's intricacy, farmers' harsh and

impatient attitudes are economic and socially understandable. Given the importance of cattle in Zimbabwe's community lands and their relationship to communal living, farmers would lose everything if a solution isn't found promptly. Mika and Mudzimiri (2012) found that the loss of highly qualified, experienced, and competent professionals devastated DVS in Zimbabwe. The replacement employees, while theoretically trained, lacked practical and technical skills and were less informed than the farmers they were intended to train. When government specialists respond to public needs and wants, people trust them (Blok et al. 2008). Lack of DVS response to farmers' demands may be why communal farmers distrust extensionists. Farmers requested village-by-village training on tick-borne illnesses in livestock and appropriate medicine delivery, not the awareness they get at dip tanks.

Critical laypeople's mistrust in expertise is set against common experiences of experts disagreeing or saying different things in public over time (Blok et al. 2008). Reports of disagreements between experts (agrovets and extensionists) on the right prescription for treating the disease have been a bone of contention in the study area. Some farmers reported that extensionists' prescriptions are often discarded after being considered as wrong or out-of-date by agrovets. Interestingly, farmers have developed a perception that extensionists wrongly prescribe medications for treatment of the disease. However, farmers are preferring to go straight to agrovet shops where the agrovets diagnose the disease in the shop and prescribe the presumed antibiotics for treatment. The above finding is peculiar since the "Imagined experts, imagined lay-people" theory normally sees institution affiliation and social interests of experts as very crucial, with lay-people tending to trust more government experts than industry experts owing to material or value interests (Blok et al. 2008).

However, in this study, extensionists, though they are government experts, have lost the trust of farmers as they perceive them as "interested experts" due to their financial demands and the conflicted advice they give. Some extensionists are more interested in personal gains than assisting farmers. Farmers were disgruntled as they believed extensionists assisted those who could afford their transportation fees. Farmers also believe the extensionists were conflicted in their treatment of the disease. Farmers mentioned that when the extensionist is notified about sick cattle, her advice is sometimes to slaughter the cattle not drug administration. Farmers were skeptical of this advice since some are on the beef committee that bought such cattle. Judging from the farmers' knowledge gap, this is expected as the advice by extensionists is wrongly interpreted and gives other meanings.

Block et al. (2008) point out that "critical" laypeople even question the possibility of ever trusting experts whom they do not know personally. The communal farmers perceive that the extensionists' tendency to provide advice over the phone shows a lack of responsiveness and no empathy to farmers' loss. The findings relate to Ghanaian farmers' frustration over the perceived inadequacy of professional veterinary care services (Afakye et al. 2020). Mwatwara (2013) adds that the disillusionment of the public is rooted in an administration that appears to show a lack of responsiveness during times of problems. We can relate that failure to reveal expected attributes of a particular group led to a loss of trust and strained relationship.

Farmers' imaginations towards agrovets' expertise

"Critical" laypeople trust in experts they know personally (Blok et al. 2008). Unlike extensionists, who were inaccessible, agrovet shops were open 24/7, including weekends and holidays. Farmers appreciated agrovet stores' flexibility since they could buy pharmaceuticals without a prescription and stockpile them for emergencies (Caudell et al., 2022). This relates to the Caudell et al. (2022) findings. Agrovet is gaining from the fractured connection between farmers and extensionists because they dismiss extensionists' suggestions to farmers while being responsive to farmers' wants and concerns. "Critical" laypeople regard expert conflicts as cognitively "illegitimate" and thus exhibit a negative reliance on expert systems (Blok et al. 2008). Unknowingly, communal farmers questioned the advice of extensionists and now think that agrovets know more about modern veterinary drugs than extensionists.

Agrovet shops are efficient and cheaper than extensionists. Farmers think they save money by treating livestock immediately and eliminating extensionist travel fees. Blok et al. (2008) found that "lay-people" trust professionals more when they're receptive to public needs and wants. Friendly, easily accessible agrovets that listen to farmers' issues and give help are more popular. The agrovets gives updated medicine information to farmers compared to extensionists. Farmers prefer current setup because in agrovet shops they may meet and exchange ideas with other farmers. Thus, if properly instituted, agrovet shops can play an important role in tick control and tick-borne disease prevention (Mutavi et al., 2021). Even when agrovets show "more trust," farmers don't believe they have total or infinite knowledge (Blok et al. 2008). Farmers in the study area were hesitant to use cheaper antibiotics advised by agronomists when they couldn't afford veterinary medications.

7.4.2 Experts' imaginations towards lay-communal farmers

In this study, veterinary extensionists and agrovets as "experts" expressed different perspectives on communal farmers as "lay-people." There are two distinct overall patterns of expert–imagined lay–expert relations, which are "bureaucrat" and "partisan" expert positions (Blok et al. 2008). As expected, veterinary extensionists took a "bureaucratic" expert position since their positions are affiliated with the regulatory system under their control (Blok et al. 2008). The extensionists have the overall view that if the farmers heed their advice on how to manage the theileriosis disease, the situation will be under control. Agrovets took a more "partisan" expert position as they viewed knowledge and values in the management of the disease as intimately linked (Blok et al. 2008).

Extensionists' imaginations towards farmers

A fairly dominant model of experts' imagined lay-people ascribed by the extensionist respondents to communal farmers was a "deficit" view of cognitive non-competence. Veterinary extension specialists feel that farmers' lack of scientific knowledge influences bad decision-making about theileriosis control. Thus, laypeople's lack of insight and relevant knowledge would emerge as a barrier to rational decision-making (Blok et al., 2008). Farmers are known by extensionists to be condemning of extension advice. This aligns with the Caudell et al. (2022) study on perceptions of animal health professionals who fail to adopt new information due to misconceptions of veterinary drugs. The extensionists added that farmers act "irrationally" and autonomously by treating cattle without expert supervision, which is confirmed by (Blok et al. 2008) outcomes. Extensionists claimed that past work experience with farmers has resulted in their seeking clarity on whether the farmers have administered antibiotics to the cattle before treating the cattle. They risk mishandling the livestock and being criticized by the same farmers afterwards. Extensionist state that farmers should be informed as a formality as they already have a solution in place. Their concern is that all farmers assume that all sick cattle have theileriosis disease. The interview response of animal health professionals, Caudell et al. (2022), noted that the knowledge gap among the communal farmers and a reticence to accept new knowledge led to misuse of veterinary drugs. We can say that a knowledge gap gives birth to misconceptions and bad relationships among actors. However, from a technical standpoint, this only exacerbates the already existing problem of knowledge gap.

According to extensionists, witchcraft influences the spread of the disease as farmers fail to report the occurrence of the disease earlier, assuming it to be witchcraft. This supports the bureaucratic expert opinion that laypeople can become overly emotional, as evidenced by their being "easily frightened, confused, and concerned in risk matters" (Blok et al. 2022).Mwatwara (2013) concurred that one of the reasons the development of an effective drug for treating *Theileriosis* disease was difficult to develop was the new 'unscientific' theories that emerged from amongst the farmers, in the process adding to the confusion and misunderstanding of the disease's aetiology and epidemiology.

A widely held belief among animal health professionals was that ad hoc experiments by 'expert' farmers in communal areas were an 'impediment' to disease control and are viewed as one of the major reasons why farmers have remained stagnant and have failed to advance to the next level (Masere and Worth, 2021). Extensionists believe the disease is spreading because many farmers believe that dipping their cattle in local dip tanks promotes the disease, whilst other farmers only send their animals to the dip tank when they have a lot of ticks on them. And, despite the restriction on transporting cattle, extensionists believe farmers are contributing to disease transmission by paying bribes to unlawfully transfer their animals across provinces, districts, and communal regions. This confirms a widely held belief among animal health professionals that communal farmers do not observe recommended treatment guidelines (Caudell et al., 2022), and animal health experts often find it difficult to convince the farmers to adopt certain measures meant to limit the spread of the disease (Mwatwara, 2013).

Agrovets' imaginations towards farmers

Agrovets adopted a "partisan" expert stance toward community farmers, referred to herein as "lay-people." The agrovets appeared to be more likely to express explicit values inherent in expert knowledge (Blok et al. 2008). Agrovets' "biased" expert stance appears to be working in their favour. The agro-shops say that the majority of farmers are familiar with and trust the personnel, which is why there are more lines at their stores. If specialists were more receptive to public needs and desires, laypeople would be more likely to trust them (Blok et al. 2008). Agrovets believe farmers respect them because their entire effort is directed toward rescuing farmers' animals from perishing.

Agrovets described community farmers as "competently imagined lay-people," opposing the veterinary extensionists' typical "deficit" notion (Blok et al. 2008). This demonstrates that extensionists have prior experience working with communal farmers. Agrovets speak of

community farmers in particular "in language implying cooperation, mutual benefit, and understanding" (Blok et al. 2008). Agrovets bestow "lay expert" rank on community farmers. Farmers do not need to carry the extension officer's prescription, according to most agro-grocery stores, because the majority of them already know what they are looking for. They said they end up providing theileriosis medications to farmers even without a prescription because of the precarious state of their livestock. Agrovet shops frequently excuse their actions by claiming that they are filling a gap left by the absence of government veterinary services in the area (Afakye et al., 2020).

Some agro-chemical shops say they advise farmers to get the most affordable drug, while others say they frequently urge farmers to buy prescriptions given in small quantities since they are less expensive. Caudell et al. (2022) noted that some agrovets tend not to explain the full impact in fear of the customer perceiving the drug as "weak." According to Agrovets, they explain how to administer medications to farmers so that they are not held liable if the drug does not function. Although Agrovets understand the importance of the dose-weight relationship in drug administration, they claim that the majority of farmers believe that weighing cattle is superfluous. According to the agrovets (Caudell et al., 2020), new ideas are not always well received by the farmers. As a result, farmers frequently misuse drugs, especially if they do not have weighing belts. Some farmers in the villages, according to Agrovet shops, who claim to know about veterinary care but don't, are making it impossible to control bovine theileriosis. Even though some lay people make bad decisions, agrovets tend to like farmers more because they think farmers are smart enough to make some good lay decisions.

7.5 Communal cattle - an object at risk

Applying the "*Relational Theory of Risk*" (Bolholm and Corvellec, 2011), the study examines how identified actors participating in the prevention, control, and treatment of *Bovine Theileriosis* disease have become *threatening objects* to communal cattle, which are here referred to as "*valued and vulnerable objects at risk*". This section delves deeper into identifying the risk relationships between *threatening risk objects* and *objects at risk* (Christoffersen, 2018), as well as how the causal relationships between them are contributing to the ongoing prevalence of *Bovine Theileriosis* disease in the study area. The goal of the discussion is to show how the ways that actors actually try to prevent, control, and cure the disease, which are linked to known knowledge gaps and bad relationships between them, are actually making the disease worse.

7.5.1 Risk relationships in prevention and control of *Bovine Theileriosis* disease

The study reveals how actors involved in the prevention, management, and treatment of Bovine Theileriosis disease have become threatening objects to communal cattle, referred to here as "valued and vulnerable objects at risk" (Bolholm and Corvellec, 2011). This section digs deeper into finding the risk links between threatening risk items and objects at risk (Christoffersen, 2018), as well as how the causal relationships between them contribute to the disease's continued prevalence in the study area.

7.5.1 Risk relationships in prevention and control of *Bovine Theileriosis* disease

Farmers tolerate and understand mandatory livestock dipping because it limits the spread of tick-borne diseases. Cattle are mandated to be dipped weekly in the summer and twice a month in the winter (DVS, 2021). The community dip tanks in the study area were however normally open once a month, and they were closed from May 2021 to September 2021 due to acaricide shortages. As a result of the high expense of acaricides, dipping has become less reliable (Dolan, 1999). The time when the community dip tanks were not operational coincided with the outbreak of theileriosis in the area. A similar situation occurred in Zimbabwe in the 1970s, when communal dipping programs were disrupted by the liberation struggle, resulting in an outbreak of theileriosis illness that killed thousands of cattle (Lawrence et al. 1980).

When the communal dip isn't working, producers must treat their cattle with acaricides and apply cow grease to concealed areas like the ears and tail (Mwatwara, 2013). Farmers cited the high cost of acaricides and knapsack spray as reasons for not spraying livestock. Extensionists also didn't educate farmers on how to utilize knapsack sprayers. Without experienced supervision, spraying equipment tends to fail and clog, making this approach less reliable (Norval et al. 1992).

Farmers don't regularly dip livestock in the community dips. Extensionists say just 1 in 10 farmers regularly dips cattle. The elderly lamented the sparsely distributed community dip tanks. A significant portion of farmers held perceptions that community dip tanks were spreading the disease. These narratives of communal farmers usually stem from reductions in veterinary extension services (Caudell et al. 2022). In fact, if cattle are not dipped regularly enough, the sickness can spread.

All community dip tanks in the area have used one dipping acaricide since 2015.The study also noticed that DVS dip attendants were not properly mixing acaricides and not checking dip strength before dipping. Inadequate acaricide applications often result in ticks building

resistance (Mutavi et al., 2021). The malpractice observed at community dip tanks may have made brown ear ticks immune to acaricides, thus spreading Theileria parva. Dolan (1999) recommends proper usage of acaricides to prevent tick resistance.

The researcher also observed farmers spraying their livestock with ethnoveterinary Lipia Javanika. The effectiveness of this practice was not seen. It seems when farmers cannot access proper extension, they tend to resort to ad hoc experiments, which puts their cattle at danger. Mutavi et al. (2021) also found a risk relationship that was similar to this in Kenya, where farmers would mix acaricides to make them "more effective."

If cattle were vaccinated, theileriosis might be easily handled. While the DVS sop recommends that cattle be inoculated against tick-borne diseases every three months, practically all farmers claimed they do not vaccine their livestock. Most people were unaware, while others blamed the prohibitively expensive cost of vaccines. Although the study was unable to pinpoint the cause of the absence of vaccination, the researcher believes it was intentional, particularly by agrovet retailers. According to Caudell et al. (2022), certain agrovets are opposed to vaccination since it impacts the sales of other medications. When agrovet store owners are also government veterinary professionals, the urge for immunizations is essentially non-existent because they would not extend vaccine advise in order to increase demand for veterinary drugs.

DVS bans cattle movement to manage foot-and-mouth disease, anthrax, and theileriosis. Despite the spread of the disease in the study region, illicit livestock transportation to and from neighbouring provinces was prevalent. Farmers paid corrupt DVS extensionists and police officers to illegally move their animals out of the theileriosis red zone. The last two theileriosis epidemics in the 1920s and 1970s were similarly caused by illegal livestock transfers and dishonest DVS staff (Mwatwara, 2013). This practice might have also contributed to the spread of the disease in the study area. Mwatwara (2013) well explains that the reason is that cattle movement paperwork is now given without a cow inspection, hence getting a permit to move livestock has become a formality.

DVS suggested controlled veld burns in pastures to remove ticks that carry Theileriosis. Burning pastures is a common notion for tick control on farms with easily handled livestock (Norval et al., 1992). Farmers in the research opposed controlled veld fires on grazing fields because, during the dry season, most people in the area make their living selling traditional African brooms. This shows that policy attempts to break the vicious path to conflicting livelihoods need to address both poverty and environmental issues (SIDA, 2000).

The declining discipline in tick control and the laxity in cattle movement control, developing acaricide resistance and increasing cost of acaricides, poor management and maintenance of dips and spray races, changing management patterns and knowledge gaps of farmers and extensionists, have allowed *Theileriosis* to become prevalent in the study area. The blame can be equally apportioned to farmers, extensionists, and the agrovets.

7.5.2 Risk relationships in diagnosis and treatment of *Bovine Theileriosis* disease

DVS expects a farmer to contact an extensionist to identify a sick cow and prescribe treatment. Farmers in the research region seldom contact extensionists for livestock illness diagnosis. In Kenya as well, Afakye et al. (2020) found that veterinarians were infrequently consulted for livestock disease diagnosis. Farmers don't engage extensionists because they regard them as conflicted. Some of extensionists are on beef committees that acquire such sick animals at giveaway rates for resale to butcheries. Thus, extensionists have now become "interested experts," as Blok et al. (2008) name them. Due to prior failures to respond quickly, farmers no longer engage extensionists as well. Mwatwara (2013) argues that if the disease could be identified early with proper inspection, it could be readily treated and mortality kept minimal. Farmers fail to disclose the sickness and extensionists don't respond, so both are risk objects from the start.

Farmers in the research region therefore diagnose the disease themselves, and the agrovets confirm it. Farmers justify this approach as they say they get prompt help due to the sick cattle, where the sickness is identified, and treatment is prescribed and purchased. Agrovet shops are becoming a veterinary one-stop shop. Caudell et al. (2022) reported this shift in Kenya and Tanzania as well. Despite having the technological know-how, remote diagnosis of livestock diseases by agrovets remains doubtful. Mukasa et al. (2012) noted that farmers without access to extension services tend to misinterpret diagnosis which often leads to wrong prescriptions. Thus, the paucity of DVS extension services in the study region meant diseases are being diagnosed too late, insufficiently, or incorrectly.

DVS extensionists are mandated to prescribe medications for livestock diseases. However, they seldomly prescribe treatments for the same reasons that they do not diagnose livestock diseases. Rather, farmers often contact "vet-experienced" neighbours, who prescribe treatment, or they bring an empty container to an agro-food store to indicate the cattle medication they require. The farmers justify this practice by saying treatment of a specific disease does not change. Afakye et al. (2020) corroborated a similar trend in Kenya, where farmers sought cattle drugs

at agrovet shops without prescriptions. Hence, there is a high possibility that farmers are buying wrong or inadequate treatments. This also risks buying a drug that should be reserved as a last option (Kiambi et al. 2021). Moreover, farmers are likely to stock medications, which they often use until empty despite expiration dates (Mukasa et al. 2012). Kwesiga et al. (2020) point out that the mere practice of where farmers buy pharmaceuticals themselves to cure their livestock suggests poor veterinary technical and extension services. Hence, the extensionist inaccessible to giving prescriptions, the farmer who insists on buying cattle drugs without a prescription, and the agrovet who sells the drugs without prescriptions are all depicting relationships of risks to cattle.

When they visit the agrovet shop for the "recommended" medicine, they are often told a better treatment is available or that the "recommended" drug is out of stock but they have an alternative. According to registered agrovet shops, farmers often buy medication from cheaper and unregistered stores because, it is alleged, they dilute it with water, rendering it useless. Given that illegal drug outlets are not registered, it means they are not inspected. Hence, drugs are often stored in poor condition, harming medicine quality (Mukasa et al.2012). Thus, pharmaceuticals are marketed based on farmers' ability to pay, not what's best for them. In the end, there is a possibility that farmers are buying the wrong, inadequate, and poor-quality drugs for treating their cattle.

Antibiotic treatments are mandated to be given by a veterinarian and must be administered according to the manufacturer's instructions. Farmers in the study region gave antibiotics to livestock without veterinary oversight. Delivery of medicine in the study area is haphazard. Farmers make ad hoc treatment procedures. Regardless of the ailment, they treat their cattle with whatever they have. If the situation worsens, they call a local ‘knowledgeable’ farmer who administers his own drugs. This hired farmer will evaluate the animal and decide whether to give the remaining doses, adjust the dose, or provide a new treatment. No additional shots are provided if the animal looks like it has recovered despite the label instructions of the drug. Farmers in Tanzania (Caudell et al., 2022), Uganda (Mukasa et al., 2012), and Kenya (Kiambi et al., 2021) provide animals with veterinary drugs in a similar pattern as well. This unwise experimental strategy implies a lack of veterinarian diagnostic input (Caudell et al. 2022). The investigation found that farmers had been administering the same antibiotics, Butachem and Hitet, since 2018 and lacked a record of their cattle's health history, which specified the prescriptions they had previously supplied to each animal. Antimicrobial resistance may have happened because the same drug was given to animals for their whole lives.

Some farmers often don't check drug expiration dates, names, or container contents because they assume the drugs are genuine. They also do not use weighing belts or scales during drug administration. Many cattle may have died from overdosing, underdosing, or ineffective drugs. Poor, imprecise, and varied farmer estimates of animal weight cause widespread overdose (Mukasa et al. 2012). Locals who were employed often double-dosed drugs. Most farmers were unclear which portion of the cow to inject the drug into, so they often injected into the thigh. Farmers say that when locals administer the medicine, each cow is shot at least three times, which is not in the prescription. Farmers admitted using the same syringe for many animals. Thus, syringes may also be transmitting theileriosis from one cow to another. Thus, incorrect application of treatments contributes as well to the disease spread (D'haese et al. 1999).

Thus, veterinary extensionists who are frequently absent to diagnose, prescribe, and treat the disease; cattle owners' haste to treat the cattle; and negligent agro-forestry personnel who fail to follow proper animal health management procedures have all become threatening risk objects to the communal cattle. All of the identified actors are contributing to the late, inaccurate, or inadequate diagnosis, prescription, and medicine, and thus to the late, incorrect, or insufficient treatment of ill cattle suspected of having Bovine Theileriosis disease. The cattle in the communal are now under danger, not just from the illness, but also from the livestock owner, veterinary extensionists, and agrovet shop staff.

8. CONCLUSSION

This study was undertaken to find out what was causing the continued prevalence of *Bovine Theileriosis* disease in communal cattle in Zimbabwe. The study findings show that between 2015 and 2021, the communal farmers in Gutu communal lands lost approximately 70% of their cattle to *Bovine Theileriosis* disease. The decimation of cattle in the communal lands has resulted in the loss of a main livelihood source. This is happening at a time when poverty is getting worse because of persistent macroeconomic underperformance.

The study used a technical perspective approach to detect scientific knowledge gaps in bovine theileriosis disease management. The study found that technical knowledge shortages contributed to the prevalence of Bovine Theileriosis on Zimbabwean communal lands. Farmers couldn't differentiate between tick-borne illnesses after identifying them. Early diagnosis, which requires a careful check for the disease's early signs, was still a problem for farmers to identify. Farmers didn't grasp the need of reporting notifiable diseases to DVS (DVS). Agrovets knew only antibiotics, not disease vaccines. The relevance of acquiring animal health antimicrobials with a prescription seems to be underappreciated across agrovet shops. Agrovet sellers lacked expertise about acaricide and veterinary medication AI compounds. Dip attendants couldn't evaluate the strength of diluted dip in community dips. Veterinary extensionists don't know much about the disease's relation to climate change, whether cattle may develop many tick-borne infections at once, or which breeds are more prone to suffer bovine theileriosis.

Using the "imagined experts, imagined lay-people" theory, the study found that actors' imaginations on how others see and handle Bovine Theileriosis sickness has fueled tensions between actors and led to its proliferation in communal areas. Farmers think veterinary extensionists don't comprehend theileriosis since their guidance hasn't saved animals. Due of financial pressures and biased advice, farmers perceive extensionists as "interested experts." Farmers believe extensionists administer incorrect treatments for livestock ailments. Veterinarians believe farmers' lack of scientific information affects theileriosis management decisions. Veterinary extension staff say farmers often ignore their recommendations. Extensionists say farmers' belief in witchcraft spreads livestock diseases quickly. Farmers liked agrovets because they sold animal medications without a prescription and because they're efficient and cost-effective. Farmers say they save money by not paying for extension workers' transportation and get treatment faster. Farmers value agrovets because they put an effort to save their livestock from dying. Most agrovet retailers say farmers don't need a prescription

since they know what they need. This "amicable" interaction between agrovets and farmers shortcuts essential animal health processes, exposing communal cattle to erroneous diagnoses and treatments.

Using the relational theory of risk, the study found that communal farmers, veterinary extensionists, and agrovets have become dangerous risk objects to communal cattle due to their direct or indirect behaviours in preventing, controlling, and treating Bovine Theileriosis disease. The study found risk linkages between them, making communal cattle a risk object. The report observed that DVS extensionists shut down community dip tanks for five months during the Bovine Theileriosis outbreak, claiming a scarcity of acaricides. Farmers didn't treat their livestock when the communal dip wasn't working due to exorbitant acaricide and knapsack spray expenses. Since 2015, district community dip tanks have used only one dipping acaricide, and there was no way to validate dip strength before dipping livestock. This suggests tick resistance to acaricides. Lack of veterinary extension guidance on acaricide usage and ad hoc farmer tests placed animals at danger. Almost all community farmers didn't vaccinate their cattle against Bovine Theileriosis, instead treating sick animals. Farmers are also suspected of bribing unscrupulous extensionists and police authorities to unlawfully shift livestock from theileriosis red zone zones, exposing study cattle to illness. Declining tick management and weak livestock movement control caused Bovine Theileriosis to spread in Gutu communities. All actors share culpability.

When communal farmers identify a sickness in their cattle, the veterinary extensionists are frequently absent to diagnose the disease, prescribe treatment, and administer medication to the cattle. The agrovets are not following proper animal health management procedures as they are diagnosing cattle diseases in the shops and selling cattle medications to farmers without a prescription. Farmers in haste are administering cattle medications using any cattle medication at their disposal, not applying the right dosages and using the wrong methods of administering specific drugs. This all contributes to the delayed, inaccurate or insufficient diagnoses; wrong prescriptions; and, in the end, delayed, incorrect, or insufficient treatment of communal cattle *suspected* of having *Bovine Theileriosis* disease. So, the communal farmers, extensionists, and agrovets have all become threats to the communal cattle, which are now an object at risk.

Thus, the overall ignorance that characterized the study region among farmers, DVS extensionists, and agrovets produced a ripe atmosphere for disputes, which Bovine Theileriosis quickly exploited.

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ANNEXES

Annex A: Interview Consent Form

Dear Madam/Sir

My name is **Angeline MUPFURE**, and I am enrolled in the master program of Development and Rural Innovation at Wageningen University & Research, The Netherlands. I am conducting research on: **Risk Knowledge, Attitudes and Related Practises of Different Actors on Prevention and Control of Bovine Theileriosis (Theileria Parva) Disease in Communal Lands of Zimbabwe**. I would like to interview you for your insights on this subject.

Your participation in this interview is voluntary and requires your consent (verbal / written). Therefore, before you decide whether you want to participate in this research, I wish to explain the guiding ethical conditions so that you make an informed decision.

1. **Purpose of the Research**
   - To understand the causes of continuous prevalence of the *Bovine Theileriosis* disease in Gutu communal lands.
2. **What your participation involves**
   - An interview (conversation) of approximately 30 minutes.
   - The researcher will record the interview **if you give permission**.
   - The researcher will take minutes of the interview.
   - After the interview, you may provide the researcher any extra information you think may help in this research (e.g., pictures, policy documents, referral to other key stakeholders or participants)
   - You may contact the researcher anytime if you have any questions regarding this research.
3. **If you do not want to participate or you want to withdraw from the research**
   - Your participation in this research is voluntary. If you decide not to participate in this research, please inform the researcher. **You do not need to give reasons for your decision**.
   - If you would like to withdraw your participation during the interviews, inform the researcher immediately and **you do not need to give reasons for your decision**.
   - The data collected until the time of your withdrawal will still be used for the research, unless you state otherwise.
4. **Confidentiality and Storage of your data**
   - None of your personal details collected during the research (e.g., name, contact details) will be used in the research report.
   - If you give permission, the name of your organisation may be mentioned in the research report.
   - Your identity will be kept anonymous and the research report will omit any information that may directly identify you.
   - The recording of the interview will be done only for purposes of the research, that is, to transcribe and analyse the content of the interview.
   - The record will be stored safely using an encrypted and secure storage facility of Wageningen University until the end of the study period.
5. **Researcher's Contact details**: +31 6 20181423 /angeline.mupfure@wur.nl

Having read or verbally informed of these conditions, do you agree to participate in this research?

YES_____ NO _____

Date and Place _____

Signature _____

Annex B: Interview Guide Questions

Questions are expected to be modified and addressed in relation to the portfolios of the participants involved, which include (farmers, DLVS, stakeholders, and agrovert shop owners). The main aim is to understand the risk knowledge and related practices among the experts (DLVS and the Agrovert) and the general public (farmers) on the practices and control of theileriosis disease.

Questions for communal cattle owners

1. How many cattle did you lose to typhoid?
2. When did you become a cattle farmer?

   [***Follow up questions:]*** What made you become a cattle farmer? The practical knowledge you possess came from attending an agriculture college or working as an extension worker. Did any of your family members teach you any ways of keeping livestock?
3. Do you know the different tick-borne diseases that affect cattle in this area? In your experience of cattle keeping, who gave you the knowledge of these tick-borne diseases? Probe clues: foot and mouth, theileriosis, anaplasmosis, heart water, babesiosis. Is it because of the extension worker or because of dip attendance?
4. How do you diagnose theileriosis disease?
5. What kind of knowledge and practices do you practically use to control the T. disease to prevent its spread? Probe clues: use local knowledge or scientific knowledge? Why do you prefer to use such knowledge in disease control? [Is it efficient or inexpensive?
6. Where did you obtain the knowledge about tick-borne diseases?
7. When you identify that your herd of cattle has been affected by disease, what did you do first? ***[Follow up questions***: Do you first obtain a prescription from the DVLS officer before visiting the Agrovert shops?]
8. Do you think it is better to go straight to the Agro shop than call the vert officer?
9. Which drug were you using for the treatment of the disease? ***[Follow up questions]:*** Do you know the right time to shift from continuous use of one product to use of another product?
10. How do you choose which shop to purchase your drugs from? Probe clues: price, availability, legality (illegal), past experience ***[Follow-up questions: How much do the drugs cost?*** If you cannot afford it, what do you do?
11. Which shop do you usually like to buy drugs from? ***[Follow up questions:]*** Do you inform each other about the shop? Which drugs do you often buy from the preferred shops?
12. Who recommends you buy the drugs that you buy in most cases, even when you do not have money? If you cannot afford the drug, why don't you call the extension worker to be given better advice?
13. Do extension workers provide farmer training within the farming area? [***Follow up questions*** What do you think needs to be improved in these animal health farmer training programs?
14. What do you think about the information that extension workers give to control theileriosis? [***Follow up questions:*** What do you think need to be improved in the work that the extension services are providing to livestock owners?]
15. When you visit the Agrovert shops, do they assist in reading the instructions on the container of the drug? [***Follow up questions]*** Like if you are on the counter, does the Agrovert shop owner ask about storage? Do you read the expiry date before you use the drugs? At the Agrovert shop, do the Agrovert personnel inform you about the storage of the drugs at home?

16. There is the issue of dose weight when one is considering administering the drugs. What do you use to scale your cattle? [***Follow up questions:*** in situations where there is no scale, what do you do?]
17. Do you know how to administer the drug in the absence of veterinary supervision? [***Follow up questions:]*** How do you know the right dosage for administering the drug? Where did you obtain the knowledge? (syringe)]
18. Do you treat the cattle only when they are sick?
19. What control measures do you practice to prevent the disease's occurrence? [***Follow up questions:*** Are you sending the cattle for dipping weekly?
20. Which veterinary extension officer is carrying out farm visits to assist you? [***Follow up questions:*** Do the extension workers and the Agrovert shop personnel work together to assist you as the farmers?
21. Do you use local knowledge to help your cattle as a farmer? Probes: ethnoveterinary drugs or alternative ways to control disease? [***Follow-up question***: Does the drug work to treat theileriosis?]
22. Do the extension workers allow you to use traditional herbs in treating this disease? [***Follow up question:*** In most cases, do you use both the recommended drugs and the ethnovert drugs?]
23. Do you think you'll be able to work with an extension worker in the future to control and treat cattle for this disease?
24. Are there other people that are administering the drugs who are not the veterinary officers? Do people live in this neighbourhood they charge you a fee? Do they save the cattle?
25. Do you think that what these virtual assistants are doing is mainly to make more money?
26. What is your perception of the support provided by government workers on the issue of controlling livestock diseases? [***Follow up question***: Do you think there is a need for improvement? Does the extension worker need money? Is it the reason you left them?
27. Do you think the extension workers, Agrovert shop sellers, hired personnel, and farmers should work together in the control of the disease?
28. Do you think that the high prevalence of theileriosis disease is caused by different actors like farmers, agrovert sellers, and extension workers not working together?
29. What do you think needs to be done by the government to solve this problem of theileriosis?
30. What do you think needs to be done so that the disease can be controlled?

Questions for the DVS extensionist

1. How many communal livestock farmers do you work with within this area? *Follow up:* What mode of transport do you use? Is fuel provided?
2. What kind of animal diseases do the farmers within this area often complain about to you?
3. Who do you believe farmers contact first when they discover a disease? Probing: the extension workers, farmers, or agro-vert shop owners? [***Follow up question:*** What has happened in the past that makes you think that way? Do you believe this is one of the factors contributing to the high prevalence of theileriosis disease? What has happened in the past that makes you say that?
4. What are the causes of theileriosis? Do you think the farmers in this area who have livestock know the causes of the disease?
5. What are the symptoms of the disease theileriosis? Can farmers in this area diagnose theileriosis disease?

6. Are there other tick-borne diseases that affect cattle in this area? [***Follow up question:*** Can farmers differentiate the disease from other tick-borne diseases? From where do you think that they possess the knowledge? [Insights from experts and local knowledge]
7. What is the best way to treat theileriosis? Do farmers follow the recommended animal health requirements set by the government? Probe clues: dipping cattle, spraying cattle. What might the reasons for the farmers' not attending the dip tank programs be? [Probe clues: finance, lack of knowledge, time, distance].
8. What is the recommended way to treat cattle with theileriosis? [***Follow up question]:*** Do farmers follow the recommended way of treating cattle?
9. Do farmers control their livestock from disease before they get sick?
10. Do you think that farmers, in most cases, attempt to treat the cattle when sick before informing the extension workers? Probing: What has happened in the past for you to think that way?
11. When farmers have problems, do they visit your home or call you on the phone? Do you help them over the phone or visit, depending on the condition of the livestock?
12. If you, as a farmer, do not have transport, what do you do?
13. In case of the drug being administered where for consecutive days and the farmer do not have transport what can be done?
14. Do extension workers charge farmers for the services they provide?
15. When recommending the right drug to use, do you often give them a prescription? Probing: written or the word of the mouth. (A) [Follow-up question: Do you recommend that farmers purchase drugs from a local shop of your choosing] Is there a reason why you sent them to those stores?
16. Do you sell drugs?
17. Is it these reasons that might be leading to long queues at the veterinary shops?
18. Before treating a sick cow, do you weigh the cattle? Do you think that after obtaining the drugs from the veterinary shops, the farmers can then administer the drugs properly? Probing: dose-weight relationship, mixing the drugs
19. When a farmer identifies a sick cow, is he supposed to go straight to the vert shop without informing the veterinary officer?
20. How reliable is the diagnosis that is done over the counter by an Agrovert seller to a farmer without visiting the farmer's place?
21. Do you think about the job that is being done by the Agrovert shops in the control of theileriosis? [***Follow up question:*** Do you think that this might be causing the prevalence of the disease?
22. Do farmers use traditional remedies to combat theileriosis? What is the purpose of using these remedies? Probing: Price, tradition, and availability locally
23. Do you believe that the farmers' knowledge contributes to the high prevalence of theileriosis?
24. Do you recommend that farmers use their local knowledge to control theileriosis diseases? Probing: local knowledge, experience.
25. 25. Do you think that the local knowledge (use of ethnoveterinary drugs) that farmers possess might be hindering them from adopting knowledge from experts?

Questions for a Dip in Attendant

1. For how long have you been a cattle dip attendant in this community?

2. Where did you obtain the knowledge from? Probing: local experience, short training, certificate, diploma?
3. What are the most common livestock tick-borne diseases that farmers face in this area?
4. Do you have major problems with theileriosis disease?
5. What are the symptoms of theileriosis? [***Follow up question:*** Do you know how to diagnose the disease? What is the best way to control the infection?
6. When farmers identify a disease do they call you or come to your place? [***Follow up question:*** Do you, in most situations, give farmers instructions over the phone? Do you write down or use words to advice farmers on the right drug to use?
7. Do you charge farmers for treating their cattle?
8. If the treatment of the animal requires farm visits for a consecutive number of days, do you visit within the period of days?
9. If the farmer does not have transport to ferry you to his farm, what do you do?
10. In the case of dose-weight, do you weigh the cattle? Where there is no weighing scale, what do you use? Probing: experience.
11. In mixing and measuring the drug, what do you use to measure the drug?
12. Do you sell drugs? ***Follow-up questions***: Why do you think farmers prefer to buy drugs from you? Probing: price, availability, trust. Do you sell the tick grease provided by the government to distribute to the farmers?
13. For how long should the drugs be used before changing to another drug? Probing: all the time, every year
14. Do you work with the Agrovet shop sellers?
15. How do you feel about the information provided to farmers over the counter by the Agrovert shop?
16. 16. Do farmers dip the cattle regularly? Do you work together with the farmers in this community on the control of theileriosis?
17. Is the community dip tank open regularly for farmers to dip their cattle? [***Follow up questions:]*** What is leading to the shutting down of the community dip tank?
18. The rules in this area for dip tanks are that dipping is from 6-7 am. Do farmers bring their cattle for dipping on time (Probe 6-7am)? [***Follow up questions:]*** What are the reasons for dipping cattle early in the morning? Is it allowed for cattle to dip when there is no one around?
19. What acaricide do you use for the control of ticks?[***Follow up questions:*** Do you think it is effective?]
20. What do you think is contributing to the high prevalence of the disease?
21. With your experience working with farmers, do farmers control the livestock from the disease before the cattle start to show signs of sickness?
22. Do you advise farmers in some cases to use ethnovert drugs? [***Follow up questions:]*** Why do you think they should not use ethnoveterinary drugs?
23. Do you think local knowledge is leading to the increase of the disease?
24. What do you think needs to be done in the control of the disease? Do you think farmers know what to do to control the spread of theileriosis disease?
25. Do you carry out farmer training on animal health management?

26. Do you believe you will be able to work with farmers, agro-vert shop sellers, and extension workers in the future to control theileriosis disease?
27. Do you combine both local and scientific knowledge when treating the animals?
28. What is your advice on what the government should do to be successful in solving the problem of theileriosis?

Questions for the agrovet shop assistant

1. How long have you been selling drugs to farmers in this area?
2. Do you sell drugs to farmers without prescriptions from the extension worker?
3. What are the most commonly purchased theileriosis drugs by farmers?
4. Do farmers often bring prescriptions from a recommended extension worker?
5. In a situation where a farmer has a cow suffering from theileriosis, do you sell the drugs to the farmer without prescriptions?
6. Do you know what the common symptoms of theileriosis are?
7. In situations where the farmer is looking for a theileriosis treatment drug that you do not possess, do you recommend the farmer buy another drug that is available?
8. If the farmer comes looking for a drug that is outdated, Would you recommend another option that they can purchase? [Follow-up questions: would you recommend another low-cost medication if the farmers couldn't afford the prescribed medication?]
9. After the farmer purchases the drugs, do you read the instructions on how to use the drug? [***Follow up questions:*** Do you read instructions only when requested by the farmer? Do you have advice on the requirements for storage?
10. 1 In the case of a drug that requires dose-weight for administration, Do you inform them that they need to weigh their cattle before buying?
11. Do you provide training in collaboration with the extension workers on how to use the drugs as per instructions given by the drug producer?
12. What is your perception of the information that is provided by extension workers to farmers?
13. Why do you think farmers come to you first when they identify a disease before informing the extension worker first?
14. Farmers suggest that in most cases, you provide a better drug that might make the cattle recover than what the extension worker has suggested. Is there a reason that makes you do so? Probing: Is it because the recommended drug will not be in stock?
15. Where did you obtain the knowledge of livestock diseases and the corresponding drugs to be administered?
16. What do you think might be the reasons that are leading to the increase in the queues at this shop?
17. What is your attitude towards the animal health practices used by farmers to control the T. disease?
18. What are your thoughts on the untrained personnel who assist farmers in the area?[***Follow up questions:*** Do they provide the correct services?
19. If this shop was not available within this area, Do you think that the disease will spread more?

Questions for the key informant

1. What might be the reasons that are leading to the high prevalence of theileriosis disease in Gutu district?
2. Theileriosis was present in the past, but the cases of theileriosis were low. What do you think changed from the way theileriosis was controlled in the past to now?
3. What do you think about how well the communal farmers know how to control and prevent theileriosis? Why do you think so?
4. Do you think farmers practice the knowledge provided by extension workers in the control of theileriosis? Why or why not?
5. What needs to be done to reduce unrestricted cattle movement in order to reduce the high prevalence of theileriosis disease?
6. What is your comment on the relationship between livestock farmers and government extension officers? How can it be improved?
7. Does extension take into account farmer suggestions for theileriosis control?
8. What are your thoughts on the farmers' local knowledge of theileriosis control?
9. It seems farmers tend to consult Agrovert shops first before visiting a veterinary extension worker when faced with animal health problems. Why do you think the farmers do so? [Follow up questions] How reliable is such advice? What is the danger of such an approach? How can the problem be alleviated?
10. The farmers are obtaining drugs from the Agrovert shops without getting a prescription from the veterinary extension worker. Is this permitted? [***Follow up questions:***] Do we have regulations to curb that? Is it being followed? What can be done?
11. The farmers tend to administer the drugs without any expert assistance. Is this permitted? [***Follow up questions:***] Do we have regulations to curb that? Is it being followed? What can be done?
12. Are the drugs used for the control of the disease affordable for communal farmers?
13. There are local untrained personnel claiming that they can treat cattle, moving around and treating cattle for a fee, which farmers trust and often ask for their services. Does the law permit these people to operate? Why do you believe the farmers have faith in them?
14. Is there a two-way conversation between a farmer and the extension worker? Do extension workers teach farmers about how to control theileriosis and also listen to what farmers have to say?
15. Do the veterinary extension worker, the Agrovert shop seller, and farmers work together in the control of the disease? [***Follow up questions:*** If not, do you think they need to work together in the future?]
16. What do you think needs to be improved by the government in the control of theileriosis?

Annex C: An overview of participant roles, gender and education

Participant category	Gender	Education	Total
Farmers	Female Male	Practical experience with cattle Practical experience with cattle	17 13
DVLS Extensionist	Female Male	Diploma in Animal health Degree in Animal health(work in-progress)	2 1
Dip in attendance	Male	Short course on Animal health	2
Agrovert shop assistant	Female Male	Practical experience working in shop Practical experience working in shop Animal science degree	1 3 1
Key informant University Lecturer	Male	Animal health (PhD)	1
Total			41