Risk Management and Market Participation among Traditional Cattle Farmers in Monze District of Southern Province, Zambia

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Abstract

Traditional cattle farmers are the major contributors to the beef industry in Zambia as they account for 85% of the country's cattle population. Traditional farmers however, are reluctant to sell their cattle and are more likely to sell when cushioning against crop production risk. Although some scholars say farmers sell their cattle more when faced with risk, there are other scholars who say the opposite that farmers are less willing to sell their cattle when faced with risk as they are trying to preserve their cattle asset.

This study was therefore done to identify sources of risk, risk management strategies, risk attitudes, cattle market participation and cattle selling channels of traditional cattle farmers in Monze district of Zambia. Mixed methods research was done by first using qualitative research through in-depth interviews to inform the quantitative research done using a questionnaire survey.

Likert scale type of questions were used to capture the farmers' perceptions of risk and risk management strategies. In order to better understand risk perceptions of the farmers, upside and downside risk of the farmers were presented using risk choice matrix. The risk importance index was used to present the perceptions of risk and risk management strategies of the respondents.

Regression tree analysis was used to investigate relationships between market participation and the respondents' perceptions of risk and risk management strategies of the farmers and their risk attitudes. Pearson's chi-square was also used to investigate these relationships.

The results showed that the majority of surveyed farmers from Monze were risk averse. It was also found that these farmers mainly perceived production and market risk to be the most important sources of risk. These farmers did not perceive risk to be an opportunity but rather saw it more as a threat.

It was also found that the farmers exhibited four types of market behaviour based on how they participated in cattle markets. These were traders, sellers, buyer and holders. A farmer's market behaviour was affected by different perceptions of risk and other farmer characteristics such as the main income generating activity of the farmer and the number of

cattle owned by the farmer. It was therefore seen that there was some influence of risk perceptions on market behaviour of farmers. These perceptions were affected by the risk attitude of farmers which were affected by the location of the farmers. It is therefore important to understand risk attitudes and perceptions of individual farmers from different farming areas.

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CHAPTER ONE

1 INTRODUCTION

1.1 Research Background

Zambia is a landlocked country neighbouring Democratic Republic of Congo to the north, Tanzania to the north-east, Malawi to the east, Mozambique, Zimbabwe, Botswana and Namibia to the South and Angola to the west. Located in South-central Africa, Zambia covers a total area of 752,618 km^2 of which 9,220 km^2 is water and the remaining 743,398 km^2 is land (CIA, 2013). Of the 743,398 km^2 land area, 4.52% is used as arable land, 0.05% used for permanent crops and the remaining 95.4% used for other activities (CIA, 2013).

The main economic activity in Zambia has historically been mining, however through the government promoting economic diversification, gross domestic product (GDP) in 2012 was higher in other sectors compared to the mining sector (ZDA, 2013). In 2012, GDP contribution was 8% from mining while agriculture, construction and manufacturing reported higher contributions at 12.2%, 13% and 11.2% respectively (ZDA, 2013). In 2013, GDP contribution from agriculture increased to 19%, (CIA, 2013; Mucavele, 2013) with the livestock sector contributing a total of 3.2% to national GDP.

Livestock production in Zambia is dominated by cattle production (World Bank, 2011b) which includes both dairy and beef production. Cattle production in Zambia is mainly done in the Southern, Eastern, Central and Western provinces of Zambia, with the Southern province dominating in number of cattle keeping households (Lubungu & Mofya-Mukuka, 2012). The major contributors to the country's cattle population are the traditional farmers at 80% of the country's total cattle population of 3 million cattle in 2012 (Chikazunga, Ndiyoi, & Muloongo, 2008). The beef industry in Zambia is characterised by a low off-take rate of 12.6% and disequilibrium in market participation with lower participation from the traditional farmers that command the largest population (Lubungu & Mofya-Mukuka, 2012; World Bank, 2011b). Off-take rate refers to the proportion of animals leaving a herd for slaughter, sale or any other form of transaction (Muma et al., 2009; Seyoum). In 2012, Lubungu and Mofya-Mukuka (2012) reported traditional farmers as having an even lower cattle off-take

rate of 5%. This off-take rate and that of the country as a whole is below the international standard of 25-35% (World Bank, 2011b). Improving performance of Zambia's beef industry requires improving the traditional cattle farmers' performance which command the largest cattle herd (Lubungu & Mofya-Mukuka, 2012; Sidahmed, 2010).

One of the contributing factors to the low off-take rate is that most of these traditional farmers do not keep cattle for the absolute purpose of selling but rather sell to absorb shock during times of poor crop harvests and other emergency needs (Ilri, Freeman, Kaitibie, Moyo, & Perry, 2008; Lubungu & Mofya-Mukuka, 2012; Tembo, Kapekele, Tembo, Goma, & Sambo, 2014). Market risk is another reason for the low off-take rate by traditional farmers (Lubungu & Mofya-Mukuka, 2012; World Bank, 2011b).

Liberalisation of Zambia's economy in the early 1990s increased market opportunities for cattle sales (Chikazunga et al., 2008; Mwanaumo, 1999) through increased participation of private companies such as Zambeef Products PLC. But this also increased the vulnerability of farmers to macroeconomic risks that come with liberalization and industrialization of agriculture such as price risk (Bailey, Barrett, Little, & Chabari, 1999; Hardaker, Huirne, Anderson, & Lien, 2004; Mwanaumo, 1999). Agricultural liberalisation in Zambia also meant the government no longer controlled prices and marketing of agricultural inputs and products, including cattle. The private companies that came with market liberalisation had strict high quality and food safety standards that the traditional cattle farmers found challenging to meet (Chikazunga et al., 2008). For this reason, most of these farmers preferred selling their cattle to cattle traders that were opportunists and bought at low prices. The challenges of transporting animals to abattoirs or feedlots also attributed to the traditional farmers selling at farm gate price to the cattle traders (Lubungu & Mofya-Mukuka, 2012) Selling to cattle traders exposed the cattle farmers to price risk as prices varied depending on what the trader buying from the traditional farmer was prepared to pay (Chikazunga et al., 2008). These poor market conditions and low prices resulted in traditional cattle farmers participating less in cattle markets and only selling when they had urgent needs to be met (World Bank, 2011b).

Price risk is just one of the types of risks traditional cattle farmers in Zambia are exposed to. Traditional cattle farmers in Zambia are also exposed to production risk due to climate variability which is characterised by drought periods and livestock disease outbreaks (Mwenya, Breed, & Breed, 2001). The International Livestock Research Institute, ILRI,

ranked livestock diseases, alongside floods and droughts, as one of the most important sources of risk among livestock farmers in Zambia (Ilri, Fao, et al., 2008). Barrett, Bellemare and Osterloh (2004) suggest that livestock markets can be used by livestock farmers to manage climatic risk by selling off their livestock to reduce the number of animals that need feed and water, therefore reducing deaths. The same livestock markets would then be used to re-stock when climatic conditions are more favourable. This means risk will be used to the benefit of the farmer by allowing him to re-stock with what might even be better livestock breeds. Barrett et.al. (2004) suggests that increasing the responsiveness of pastoralists to temporal variation in range conditions is likely to make livestock marketing systems more independent of donor funding thereby making the traditional pastoralists more self-reliant. This suggestion by Barrett et.al (2004) means encouraging farmers to consider upside risk rather than downside risk only.

There are currently some contradictions in the literature on how pastoral farmers in Zambia respond to risk through livestock markets. While some of the literature reports increased livestock market participation in response to risk, other literature report reduced market participation (Chifuwe, 2006; Lubungu, Chapoto, & Tembo, 2013; Tembo et al., 2014). There needs to be a better understanding of how the traditional cattle farmers in Zambia perceive risk in order to better understand how they respond to risk. Identifying whether their perceptions of risk and the risk management strategies they use have an impact on their participation in livestock markets will justify the statement by World Bank that market risk has an impact on their market behaviour. Because there are other risks these traditional cattle farmers are exposed to, it also becomes important to understand how these various risks and risk management strategies affect market participation of the farmers.

Agricultural risk management in Zambia is not well documented nor understood ("Challenges facing financial agricultural market," 2012). Some strategies have been identified in management of risk in crop farming in Zambia (Ilri, Freeman, et al., 2008; Tembo et al., 2014) but literature on risk management in Zambia's pastoral farming is still scarce (D. C. Hall, Knight, Coble, Baquet, & Patrick, 2003). A good understanding of risk exposure and risk management also plays an important role in understanding market participation by farmers (Hucks, Todd, Burney, & Secrest, 2011). To gain a better understanding of risk management strategies, it is important to understand risk perceptions and attitudes of farmers as these influence the risk management strategies applied (Akcaoz,

Kizilay, & Ozcatalbas, 2009; Beal, 1996; Flaten, Lien, Koesling, Valle, & Ebbesvik, 2005). Given risk sources and severity differ with location, farm type, farming system and government policies (Aditto, Gan, & Nartea, 2012; Gebreegziabher & Tadesse, 2014), it is important to look at risk in specific locations, business environments and farming systems.

As the Zambian government is working on improving traditional farmers participation in livestock markets (MACO, 2004), knowledge of how various risks these farmers face may or may not be related to their cattle market participation would help the government know how to intervene in risk management while promoting the farmers' market participation.

1.2 Problem Statement

Livestock is important for 60% of livelihoods in Southern Africa (Ilri, Fao, et al., 2008). In Zambia, livestock accounts for approximately 6% of household income and 45% of the poorest smallholder household income (Lubungu & Mofya-Mukuka, 2012). Cattle make up the largest proportion of livestock in Zambia with traditional farmers managing the larger population (Lubungu & Mofya-Mukuka, 2012; World Bank, 2011b).

Cattle production is used as a risk coping strategy through distress selling during farming seasons of poor crop harvest, such as in times of drought. This is particularly true amongst traditional farmers (Lubungu & Mofya-Mukuka, 2012; Tembo et al., 2014). This distress selling results in increased poverty due to loss of assets without replacement and increased dependence on external aid. Contrary to these reports, other researchers found that in drought periods livestock sales reduced rather than increased (Chifuwe, 2006). Barrett et al. (2004) suggested that increasing the marketing responsiveness of pastoralists to uncertainty would make the livestock marketing systems more effective in risk coping and therefore reduce poverty among the traditional farmers. For example farmers could sell some of their animals to reduce the burden of feeding in times of climatic shocks such as droughts and then using the same livestock markets used for selling to purchase replacement stocks to boost their livestock numbers when conditions become more favourable.

A study by World Bank (2011b) states that rather than utilizing livestock markets, traditional cattle farmers in Zambia are discouraged from participating in livestock markets due to market risk. Other literature on crop production risk report the use of livestock markets to manage crop production risk by selling off cattle to cushion against shocks mainly during poor crop harvest (Tembo et al., 2014). From literature, it is clear that traditional cattle

farmers in Zambia are affected by agricultural risk such as climate, market and livestock disease risks (Chifuwe, 2006; Kalinda, 2014; Lubungu & Mofya-Mukuka, 2012; Mubaya, Njuki, Mutsvangwa, Mugabe, & Nanja, 2012; World Bank, 2011b). The largest cattle keeping district in Zambia, Monze District (Mumba, Pandey GS, & der, 2013), has not been spared from these risk. Monze district is one of the districts in Zambia that are prone to droughts and livestock diseases that are threatening the cattle population and hence livelihoods of the traditional cattle farmers (Chifuwe, 2006; Lubungu & Mofya-Mukuka, 2012). However, there is limited documentation on how these traditional farmers and the traditional farmers in Zambia as a whole perceive the various sources of risks, their attitudes to risk and how these affect their market behaviour. There is limited and contradicting literature on how farmers use livestock markets to cushion against shocks in their livestock enterprises. (Chifuwe, 2006; Lubungu & Mofya-Mukuka, 2012).

This study will help us understand whether market risk and other sources of risk influence the market decisions traditional farmers make. By looking at the farmers' perceptions of upside and downside risk, this study will also be informative on what risks farmers can capitalize on to benefit their farming enterprises e.g. as suggested by Barrett et al (2004) and what risks need to be mitigated. An approach of understanding both upside and downside risk perceptions and how they influence market behaviour has not been done in Zambia, thus making this information necessary for both policy makers and farmers.

1.3 Research Question

This study seeks to answer the following questions:

1. What are Zambian traditional cattle farmers' attitudes to risk, how do they perceive it, and how do they rate different risk management strategies?
2. How do these factors then affect the farmers' cattle marketing decisions?

1.4 Research Objectives

1. To identify the types of risks traditional cattle farmers in Zambia are exposed to, and the risk management strategies they use.
2. To identify the market channels used by traditional cattle farmers in Zambia.
3. To explore attitudes to, and perceptions of, risks among these traditional cattle farmers in Monze District, Zambia.

4. To explore the perception of these traditional cattle farmers to the risk management strategies they use.
5. To explore the relationship between attitudes to, and perceptions of risk and risk management strategies, and cattle market participation and choice of market channel among traditional cattle farmers in Zambia.

1.5 Research Report Outline

This thesis report is made up of five chapters. The first chapter is the introduction which is gives an introduction to the research and is made up of five sections. These sections are the research background, the problem statement, the research question, the research objectives and the research report outline itself.

The second chapter reviews the literature on sources of risk and risk management; and cattle markets in Zambia. This chapter also looks at the background study site and agriculture in Zambia. This chapter is followed by chapter three which covers the methodology. The methodology chapter covers research strategy and design used in the study, the survey process, data analysis and tools and techniques used, the study limitations and ethical consideration.

The forth chapter is a combination of the results and the discussion of the results of the study. This chapter is followed by the last chapter, five, which is the conclusion and recommendations. Policy recommendations and recommendations for future research are in this last chapter.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction

This chapter describes agriculture and pastoral farming in Zambia and goes on to explain and define agricultural risk management and what it involves on the global aspect and in Zambia. The chapter reviews various studies on risk and risk management in different parts of the world and later narrows it down from risk and risk management in Africa to Zambia. It reviews previous studies on risk and risk management perceptions and also looks at how these might be related to market participation. This section also looks at beef marketing in Zambia and reviews some literature on market participation.

2.2 Background on Study Site

2.2.1 Country Description

Zambia is a landlocked country neighbouring the Democratic Republic of Congo to the north, Tanzania to the north-east, Malawi to the east, Mozambique, Zimbabwe, Botswana and Namibia to the South and Angola to the west. Located in South-central Africa, Zambia covers a total area of 752,618 km2 of which 9,220 km2 is water (CIA, 2013). Of this area, 4.52% is used as arable land, 0.05% used for permanent crops and the remaining 95.4% used for other activities (CIA, 2013).

For administrative purposes, Zambia is divided into 9 provinces which are further divided into districts as shown in Figure 2.1. In 2010, Zambia had a population of 13 million people (CSO, 2013), 60.5% of which live in rural areas. Agriculture is the main source of employment for this rural population, providing employment to 92% of rural Zambians (Humphrey, 2009). With 80% of the rural population living in poverty (Humphrey, 2009; Sitko et al., 2011), agriculture is seen as a key player in poverty alleviation and food security in Zambia.

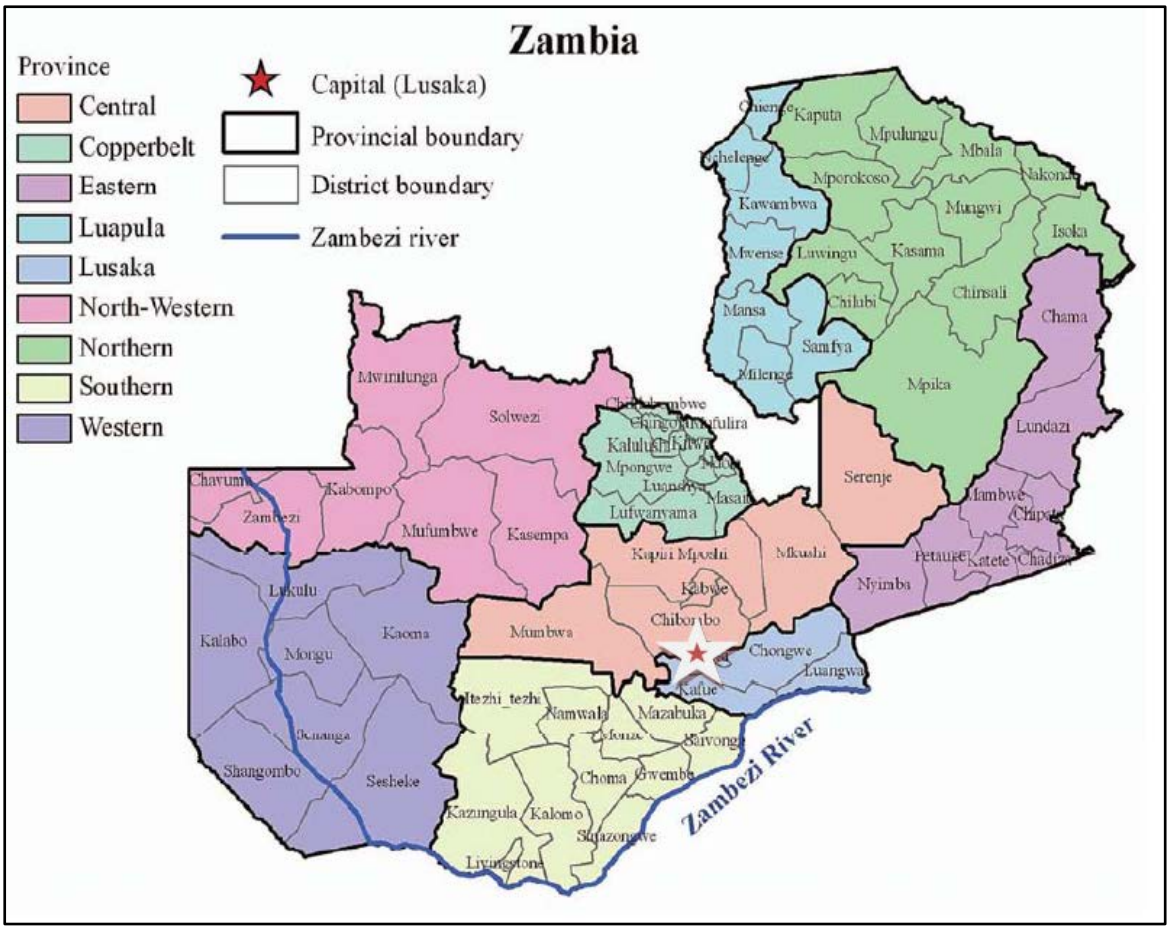

Figure 2.1: Map showing provinces and districts in Zambia. Source: CSO, Zambia

2.2.2 Monze District

Monze is a district located in Southern province of Zambia, 180 Km south west of the country's capital Lusaka. It lies along one of Zambia's main roads, Great East Road which runs from the Southern province through Lusaka and Central provinces of Zambia to the Eastern province (Chifuwe, 2006). Monze falls within agro-ecological zone IIa which is characterized by fertile plateau soils and rainfall of 800-1000mm per annum (Jain, 2007). Monze receives rainfall that ranges from 650-815 mm annually (Kalinda et al., 2014), with a temperature range of 4°C to 42°C. Monze, like the rest of Zambia, experiences three seasons in a year. These are the hot-dry season from September to October, the warm-wet season from November to April and the cool-dry season from May to August. Monze can be divided into three physiographic regions where both livestock and crop production are practiced (Kalinda et al., 2014). See Figure 2.2 for the physiographic regions.

1. The south eastern part which is hilly with steep slopes.

2. The central high plateau with undulating old plains is ideal for growing maize and other crops in the district.
3. The North West low flat plains where the Kafue flats and Kafue National Park fall.

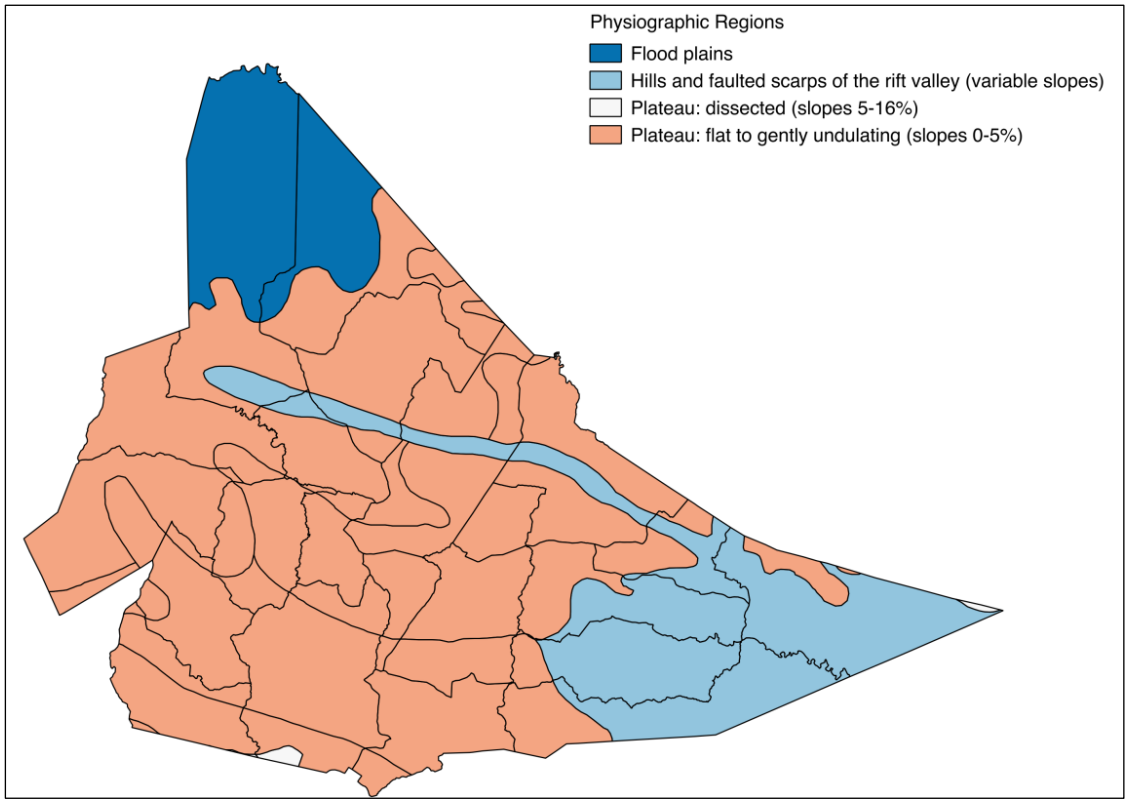

Figure 2.2: Map of Monze showing Physiographic regions

For administrative purposes, Monze is divided into 20 wards as shown in Figure 2.3. In 2010, Monze had a household population of 32,849 (CSO, 2013) of which 20,211 where agricultural households. The majority of these 20,211 agricultural households owned cattle, i.e. a total of 14,300 households owned cattle in Monze by 2010 (Mumba et al., 2013). This shows the importance of agriculture in the district where more than half the household population are farmers and almost half the population own cattle. Dominated by the Plateau Tongas, the main economic activity in Monze is agriculture (Chifuwe, 2006). Although the district has both commercial and traditional farmers, the majority of the farmers in the area are the traditional farmers in the rural areas whose production is mainly for home consumption (Chifuwe, 2006). Crops grown include crops such as maize, sorghum, millet, sweet potatoes, vegetables and cash crops like cotton.

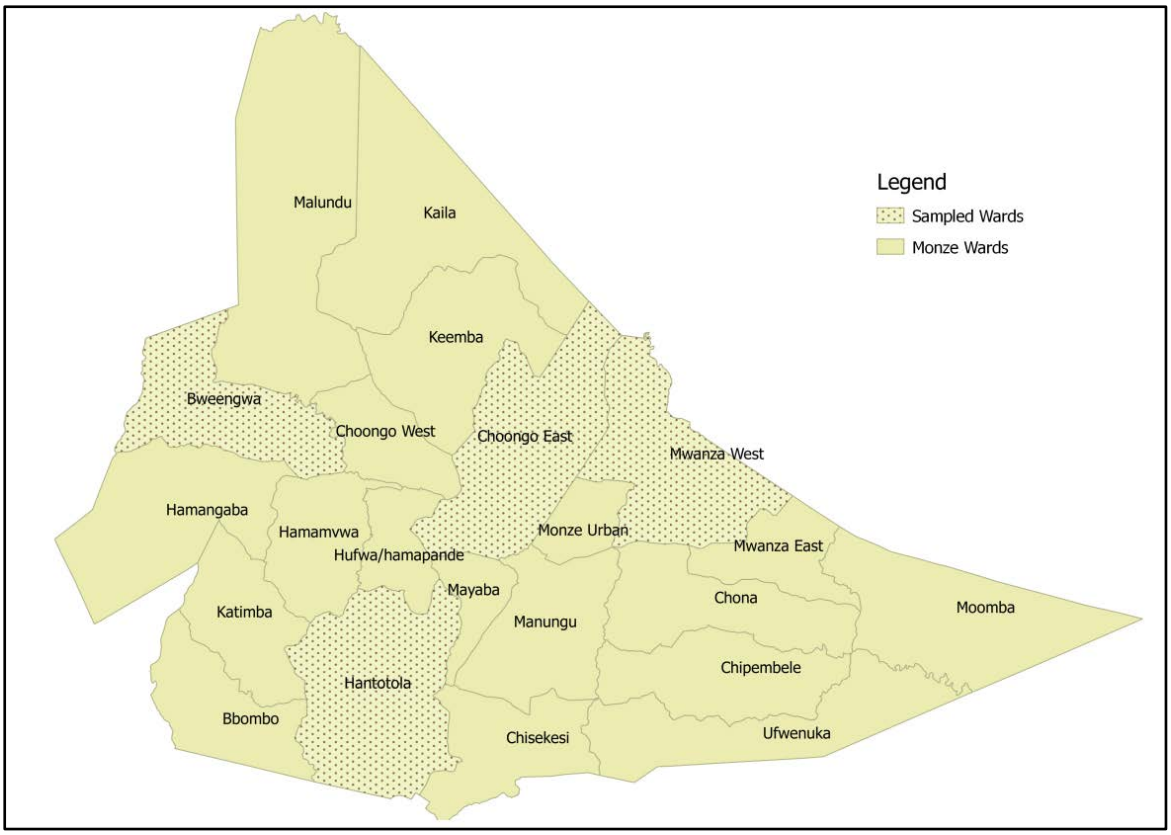

Figure 2.3: Map of Monze showing wards and study sites

Traditionally, the people in Monze are associated with cattle rearing, and by 2010 they had the highest cattle numbers at 143,000 (Mumba et al., 2013). The cattle kept by the traditional farmers are more multi-purpose than specialized. They are used for draught power, milk for consumption and selling, slaughter during special functions, payment of bride price, for manure, for prestige as an asset for social status, as well as a store of wealth, (Prestegard, Moen, & Norad, 2007) and as a livelihood risk management strategy where cattle are sold as a household risk coping measure particularly in times of draught (Kalinda et al., 2014).

However, cattle keeping in Monze has been very challenging due to livestock diseases and the drought problems over the past decades (Chifuwe, 2006; Mumba et al., 2013). To survive seasons of poor rainfall, and therefore low pasture availability, some of the traditional pastoralists have developed a coping strategy of moving their cattle to the Kafue flood plains from May to October during the dry season and then moving them back to the village in the rainy season when pastures are available (Munyeme et al., 2009). This strategy is used not only by Monze farmers, but by farmers from other provinces such as Mongu and Senanga in Western province, and Kafue from Lusaka province (Munyeme et al., 2009). This makes

control of livestock disease difficult resulting in a continuous cycle of exposure to livestock disease risks due to risks associated with pasture availability and draught.

2.3 Agriculture in Zambia

Zambia has a large natural resource base for its agriculture, boasting 75 million hectares of land, of which 42 million hectares has medium to high potential for agricultural production and 40% of the water in Central and Southern Africa (Zambia Development Agency ZDA, 2011). Zambia is divided into four agro-ecological zones based on rainfall pattern as shown in Figure 2.1 (Jain, 2007). Zone I receive less than 800mm of rainfall annually and constitute 12% of Zambia's total land area. This zone covers part of the Southern, Eastern and Western provinces. This Zone is suitable for extensive cattle production and cultivation of drought resistant crops such as cotton, sorghum and millet.

Zone II consist of areas that receive between 800-1000mm of annual rainfall and constitutes of 42% of the country's total land area. This zone is subdivided into Zone IIa which covers parts of Central, Lusaka, Southern and Eastern provinces. This makes up the fertile plateaux in Zambia and can be used to grow a variety of crops which include maize, cotton, tobacco, sunflower, soya beans, irrigated wheat and ground nuts. Zone IIb covers parts of the Western province and differs from the previous Zone in that it has sandy soils that make it suitable for production of cashew nuts, cassava, rice and millet. The Zone is also suitable for beef, dairy and poultry production.

The fourth zone is Zone III which receives between 1000-1500mm of annual rainfall. This consists 46% of the country's total land area comprising the Copperbelt, Luapula, Northern and North-western provinces. This Zone is characterized by highly leached soils.

Most of the Southern province lies within Zones I and IIa, with over 50% of the province lying within zone IIa (Jain, 2007).

Agriculture in Zambia is divided into three categories based on farm size; farms that are less than 5 ha are categorised as small-scale farms, farms between 5 to 20 ha are categorised as emergent farms while those that are 20 ha or more are categorised as commercial farms (FAO, 1990). The majority of farmers in Zambia are small-scale farmers making up 76% of the farming population (Mucavele, 2013). These small-scale farmers are located in rural and peri-urban areas.

Agriculture in Zambia is key to economic development, diversification and poverty reduction (Mucavele, 2013), contributing to national GDP and household income generation through employment in agriculture. Agriculture contributed 19% to national GDP in 2013 (CIA, 2013; Mucavele, 2013). In 2010 70% of the national labour force was employed in agriculture (Mucavele, 2013; Zambia Development Agency ZDA, 2011).

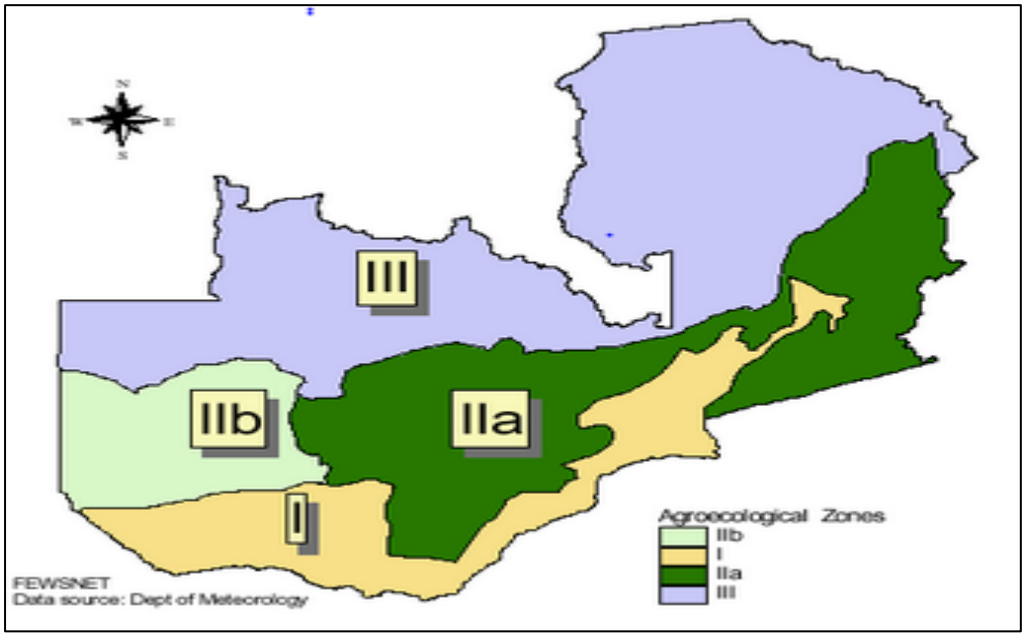

Figure 2.4: Map showing Agricultural Zones in Zambia. Source: (Jain, 2007)

2.3.1 Pastoral Farming in Zambia

Livestock production plays an important role in poverty alleviation in Zambia (Humphrey, 2009). With 60.5% of the population living in rural Zambia and 80% of which are living in poverty, livestock production has been seen as one of the means of improving the standard of living for the rural Zambian (Humphrey, 2009; Lubungu & Mofya-Mukuka, 2012). There has been a lot of political influence in the development of agriculture and the livestock sector in Zambia which has exposed the sector to risk such as market and production risks.

2.3.1.1 Livestock Production during the colonial days in Zambia

Prior to independence, the main livestock producers were the white farmers coming in from nearby countries like South Africa, while the indigenous Zambians were more inclined to work in the mining companies (Chaabila, 2012). There were no deliberate policies aimed

at increasing livestock production, particularly among the indigenous Zambians. After Zambia gained independence in 1964, this changed as the new government felt the need to invest in agriculture which included livestock. The need came with increasing population and therefore increasing demand for food, and a need to create other sources of employment for the citizens and revenue for the country (Chaabila, 2012).

2.3.1.2 Livestock Production Post-Colonial days in Zambia

After independence, the realisation of the importance of agriculture led to the new government putting up measures and policies to promote livestock production. There was a deliberate move by government to increase cattle numbers and improve cattle breeds (Chaabila, 2012; Humphrey, 2009). Government opened up research and state ranches whose main purpose was to encourage cattle keeping in Zambia by providing cattle to farmers and extension services to promote cattle keeping. Farmers living close to the state ranches were given cattle to keep on behalf of the government state ranches and cattle were given to them as payment. This helped farmers who could not afford to import cattle have easier access to cattle.

Credit facilities were also available to help farmers purchase other inputs. Government provided veterinary services and other extension services required by the farmers, e.g. dip tanks to ensure control of ecto-parasites were all maintained by the government. Other than subsidizing inputs, the government also took care of the marketing of beef by buying cattle from all farmers who were willing to sell through the state owned Cold Storage Board (CSBZ). The CSBZ was present in every provincial capital and other major towns. This organisation bought cattle from farmers and sold to consumers thereby ensuring there was ready market for the farmers' beef. All this meant government had control over input supply and product prices (Chaabila, 2012; Chikazunga et al., 2008; Hichaambwa, 2012). With time, and the adversities of bad weather and livestock diseases, government incurred debt in sustaining this system.

In November 1991, Zambia voted in a new president and a new party with new ideas. The new president, Dr Fredrick Chiluba, brought in the idea of liberalizing the Zambian economy (Chaabila, 2012; Mwanaumo, 1999; Seshamani, 1998). With the backing of the International Monetary Fund (IMF) and the World Bank, Zambia begun to implement the Structural Adjustment Program (SAP) for the agriculture sector. The SAP meant government

withdrawing all input subsidies, liberalising agricultural markets and removing government control over prices. However, implementation of the SAP was not well executed particularly with regard to the livestock sector. There was now a gap in the provision of veterinary and other extension services to the farmer as these were now solely left to the farmer. The government no longer played any role in providing extension services and disease control. This resulted in an outbreak of livestock diseases that the farmers failed to control without government intervention, resulting in reduction in cattle numbers worsened by the drought conditions (Chaabila, 2012; Seshamani, 1998).

The free markets were not working well for the traditional farmers either. Farmers were used to an assured market which they sold to at a set price. However with the free market, traditional farmers were left to find their own buyers and negotiate price with buyers. This resulted in the farmers being exploited by traders who usually bought at farm gate prices which were lower than the farmers had been selling to the CSBZ (Chikazunga et al., 2008).

In 2002 a new president, Dr Levy Mwanawasa, was voted in with his "new-deal-government". A new National Agriculture Policy (NAP) was put in place with a focus on increasing production in order to increase the depleted livestock numbers. The Mwanawasa government promoted public-private partnerships (PPPs) which involved both public and private organisation participation in promoting agriculture (Chaabila, 2012; Mwanaumo, 1999). Although markets for selling cattle were still liberalised, the government was once again providing extension services. The government had now divided livestock diseases into diseases of national importance, and management diseases that government was not involved in preventing and controlling. The government controlled and prevented diseases of national importance such as Contagious Bovine Pleauropneumonia (CBPP) and other trans-boundary diseases. Deliberate policies where put in place aimed at increasing productivity of cattle and improving marketing of cattle. The government set out to establish disease free zones in order to increase the market potential of Zambian beef to reach the international market (World Bank, 2011b).

To date the livestock sector is still working under the same system of promoting public private partnerships, with the government controlling diseases of national importance while the farmer manages the rest. A number of private organisations have come up, both commercial and non-governmental organisations, that are working with farmers in improving their productivity and/ or marketing of cattle. Although the general objective remains to

increase productivity and improve marketing of cattle, the specific government policies to act towards the achievement of those goals change with changing governments and presidents. Agriculture is still highly affected by political changes in the country making government policies one of the uncertainties farmers face in Zambia (Mwanaumo, 1999). The liberalisation of agriculture markets continues to be a challenge for traditional farmers who preferred government assured markets for their cattle at a fixed price that was not determined by cattle traders (Mwanaumo, 1999).

2.3.1.3 Livestock Production Systems in Zambia

Livestock production in Zambia has two distinct production systems based on use of rangeland and feedlot systems (Mwenya et al., 2001). The commercial production system is characterised by modern husbandry methods that emphasise disease prevention, good veterinary care and use of feed rather than grazing. The commercial farmers use fenced ranching systems or feedlots and practice zero grazing as one of the ways of preventing livestock disease transmission. (Mwenya et al., 2001; World Bank, 2011b). The other system is the traditional farming system, sometimes called small-scale or small-holder farming. These are characterised by low input and low output production. Livestock under this system are dependent on open communal grazing making them more susceptible to livestock diseases and pasture shortages resulting in losses in the dry season (World Bank, 2011b). The traditional pastoralists keep cattle and other livestock for prestige and as a way of storing wealth. Some literature also mentions a third production system which is the emergent pastoralist that utilizes the elements of both the commercial and traditional systems (Lubungu & Mofya-Mukuka, 2012; Mwenya et al., 2001; World Bank, 2011b). The emergent pastoralists consider cattle to have both cultural value and monetary value as a source of income which they are willing to invest in, though not as much as the commercial pastoralists.

For the purpose of this study, farmers will only be classified either as commercial or traditional. The majority of farmers in Zambia are traditional farmers making up 76% of the farming population (Mucavele, 2013). These are located in rural and peri-urban areas. These traditional farmers command 80% of Zambia's cattle population, which stood at 3 million as of 2012 (Chikazunga et al., 2008; Lubungu & Mofya-Mukuka, 2012). These traditional farmers use cattle for cultivation and transportation of their farm inputs and outputs (draught power), making cattle an essential asset for traditional farming (Lubungu & Mofya-Mukuka,

2012). The traditional farmers also contribute 40% to the domestic beef supply, with most of these sales being done through middle men rather than direct sales by the farmers which would ensure better prices for the farmers (Eroarome, 2009). This 40% is achieved from the 80% cattle population coming from the traditional cattle farmers, as the actual number of animals sold by each traditional farmer per year is only an average of 2 animals per year (Lubungu & Mofya-Mukuka, 2012). Greater potential can be achieved by the traditional farmers thereby increasing their livestock income contribution to national GDP and making the country's agricultural sector more productive (World Bank, 2011b).

Cattle production in terms of cattle numbers in Zambia is dominated by the Southern province, particularly among the Ila people of Namwala and the plateau Tongas who are found in Monze district (Lubungu & Mofya-Mukuka, 2012). Following the Southern province are the Western, Central and Eastern provinces while the rest of the provinces have less than 100,000 herds of cattle, accounting for less than 5% for each province. This means Southern, Eastern, Central and Western provinces account for 88% of the cattle population in Zambia (Eroarome, 2009). With over 70% incidence of poverty in these four provinces, as noted by Mulemba (2009), livestock can play an important role in poverty alleviation in these provinces. Cattle and goats provide about 39% income generation to the rural poor in Zambia as a whole and hence livestock importance in poverty alleviation in Zambia cannot be over emphasized (World Bank, 2011b).

2.3.1.4 Pastoral Farming among the Traditional Farmers

Traditional cattle farmers in Zambia account for 80% of the country's cattle population (Lubungu & Mofya-Mukuka, 2012; World Bank, 2011b). These farmers are mainly located in Eastern, Central, Southern and Western provinces with the Tongas and Ilas of Southern province and Lozis of Western province being the major traditional cattle keeping populations (World Bank, 2011b). Cattle production among the traditional farmers is characterised by low input and low output (Lubungu & Mofya-Mukuka, 2012). Traditional farmers use low cost and low input animal husbandry practices that have poor livestock disease management, poor feeding and poor reproductive management resulting in low productivity and low reproductive performance.

Although cattle are the most important livestock type in Zambia, traditional farmers also keep other animals such as goats, sheep, pigs and various types of poultry (Lubungu &

Mofya-Mukuka, 2012). Of all the animals kept by these traditional farmers, cattle play the most roles in the livelihoods of these traditional farmers. The roles of cattle among traditional farmers include (Chaabila, 2012; Humphrey, 2009; Lubungu & Mofya-Mukuka, 2012):

1. Draught power for crop production and transportation of farm inputs and products.
2. A symbol of wealth, particularly among the Southern and Western province tribes where someone's social status is tied to their cattle herd size.
3. Traditional use such as payment of bride price or slaughtering during traditional ceremonies.
4. A store of wealth which is liquidated in times of shocks by farmers e.g. when crop yields are low.
5. Cow dung is used as manure for the vegetable gardens.
6. Cattle production provides employment for 60% of rural women who constitute 67% of rural population.
7. Cattle play an important role in poverty alleviation particularly among the poorest small-scale farmers where livestock accounts for 45% household income.

However, traditional cattle farmers face a number of challenges in cattle production. Cattle diseases (resulting in high adult cattle mortalities) are one of the challenges that have reduced cattle populations in Zambia and hindered the growth of cattle numbers amongst these traditional farmers and the country as a whole (Chikazunga et al., 2008; Lubungu & Mofya-Mukuka, 2012). Cattle production in Zambia is also faced with challenges of low production through low conception and calving rates with long calving intervals (Chikazunga et al., 2008; World Bank, 2011a). The high cost of feed, particularly in the dry season when there is little pasture for grazing, and slow growth rates (it takes five to eight years for cattle to reach market weight) also hinder growth of the traditional cattle sector in Zambia (Chikazunga et al., 2008).

Other than the challenges in cattle production, traditional farmers also face problems in marketing their cattle. This results in these farmers mainly selling their cattle to cattle traders who then sell to slaughter facilities and feedlots at higher prices than they get at farm gate from the traditional farmers (Lubungu & Mofya-Mukuka, 2012). According to Lubungu and Mofya-Mukuka (2012), of the 80% of cattle contributed by traditional farmers to the beef sector, only 5% enter the value chain through slaughter facilities, while the remaining 75% goes through cattle traders.

Some of the challenges faced by the traditional farmers in cattle markets are the cost of transportation of either carcasses or live animals resulting in traditional farmers opting to sell at farm gate price which is lower (Lubungu & Mofya-Mukuka, 2012; World Bank, 2011b). These lower returns due to selling at farm gate discourage most traditional farmers from selling cattle except when it is really necessary that they do (World Bank, 2011b). Poor cattle production and livestock diseases mean that cattle will usually be below recommended market weight and therefore fetch lower prices.

The failure by traditional farmers to efficiently control livestock diseases on their farms has made it hard for these farmers to access some cattle markets (Lubungu & Mofya-Mukuka, 2012). For example due to CBPP being endemic, live cattle cannot be moved out of the Western province into other provinces be it for immediate slaughter or any other reason. This means farmers cannot fetch higher cattle prices in towns outside western province. The low off-take rate by traditional farmers can also be attributed to the cultural value the farmers place on cattle (World Bank, 2011b).

Another challenge in market participation are the government policies and laws that make it unattractive for traditional cattle farmers to sell their cattle to feedlots or slaughter facilities (World Bank, 2011b). To sell or slaughter their cattle, farmers need to obtain permits, certificates and licences and pay a number of fees to different government departments (World Bank, 2011b). Such policies do not support livestock marketing in Zambia, and is even more discouraging for traditional cattle farmers who are not as business-oriented as the commercial farmers. There are limited marketing centres for livestock in Zambia which limits cattle farmers. Cattle diseases are another challenge not only for the productivity of cattle but the marketing as well (Chikazunga, D., Louw, A.., Muloongo, O., & Haankuku, 2007; Lubungu & Mofya-Mukuka, 2012; World Bank, 2011b). Due to cattle diseases, traditional farmers cannot sell live animals when livestock movement bans are imposed in their areas to control or restrict spread of a particular disease. An example is the previously described example of CBPP on the Western province. The nation as a whole cannot export beef to the EU because of cattle diseases.

2.4 Agricultural Risk

The world's understanding of agriculture has changed from what it used to be in the 1950s when it was viewed as a source of food. Agriculture is now seen as the means to

achieve global food security, ensure human health and nutrition and improve livelihoods particularly among the rural population. Risk is differentiated from uncertainty by the fact that risk is considered to be imperfect knowledge where the probabilities of the possible outcomes are known, whereas in uncertainty they are unknown (K. Smith & Barrett, 2000). Some literature however argues that there is no distinction between risk and uncertainty; rather the two are interchangeable (Chavas, 2004; Newbery & Stiglitz, 1981). Our study will follow the views of Chavas (2004) who defines risk as "*representing any situation where some events are not known with certainty*" and will, therefore, use risk and uncertainty interchangeably. Agriculture is a dynamic industry faced with uncertainty in both inputs and outputs which results in probability of outcomes that can either be upside potential or downside exposure that can be utilized or avoided by the affected enterprises (Antón, 2009; Shadbolt, Olubode-Awasola, Gray, & Dooley, 2010; Yoe, 2011). Over the years scholars have defined risk as either having both negative and positive outcomes or as having only negative outcomes. Smith and Barrett (2000) define risk as uncertainty with known probability of an event happening resulting in negative consequences. On the other hand Detre *et al*. and Pascale *et al.* (2006; 2000) view risk as having the probability for both the positive (upside potential) and the negative (downside exposure) outcomes.

Risk management should involve assessing both upside and downside risk (Pascale et al., 2000; Talavera, 2004), looking at the likelihood of either happening in order to make well informed assumptions and decisions about risk (Baldoni, 2001).

2.4.1 Risk Attitude

Risk attitude refers to the mental view with regards to risk (Bard & Barry, 2000). Bard and Barry (2000) describe four basic attitudes to risk:

1. Risk Averse- those individuals who view risk as a threat and are generally uncomfortable with risk. The response in risk averse individuals is to avoid or reduce threats. Smallholder farmers are usually risk averse as they are usually unable to withstand financial losses associated with risk (Kahan, 2013).
2. Risk Seeking- those individuals who are comfortable with risk, view it as an opportunity and would be comfortable with an uncertain outcome.
3. Risk Tolerant- those individuals who view risk as neither an opportunity nor a threat but tolerate risk when exposed to it.

4. Risk Neutral- those individuals who are uncomfortable with risk in the long term and are prepared to take short-term measures to avoid long term risk.

Other literature on agriculture only suggests three types of risk attitudes. These are risk averse, risk takers or risk seekers and risk neutral (Kahan, 2013). These attitudes towards risk can be affected by market orientation of the farmers, family commitment (a person with family commitments and responsibilities may be more willing to take on risk than one who is not) and age of the farmer which may be tied to experience as older and more experienced farmers may be more willing to take on risk than the inexperienced farmers (Kahan, 2013).

2.4.2 Risk Perceptions

Risk perception looks at an individual's judgement on the probability of a specific risk happening and how concerned they are with the severity of that risk (Sjöberg, Moen, & Rundmo, 2004). For example, an individual may perceive market risk to be more important or more likely to occur on their farming enterprises than financial risk. Perceptions of risk have a bearing on one's approach to managing risk (Legesse & Drake, 2005). It is therefore important to understand farmers' risk attitudes and perception in order to have a better understanding of their management strategies.

2.4.3 Sources of risk

There are various classifications of sources of agricultural risk in the literature. OECD (2000) identified production risk, ecological risk, market risk and regulatory or institutional risk as risk that is specific to agriculture. Hardaker et al. (2004) classified agricultural risk into two major types. The first type is business risk which includes production, market, institutional and personal risk. The second type is financial risk which results from financing the farm business. Shadbolt & Martin (2005) equally distinguish the two major types of risk but added policies and regulations, labour force and technology risks as types of business risks. This classification of risk into two major sources appears to be the most common classification amongst scholars whether it is in a developing or developed country (Aditto et al., 2012; Hardaker et al., 2004; Shadbolt & Martin, 2005; World Bank, 2000). Although some scholars do not split sources of risk into the two business and financial risks, the actual sources of risk remain the same in agricultural risk as production, financial, marketing, institutional and personal risk. A few additions or subtractions may be seen in some studies depending on which sources of risk actually affect the farm enterprise. A study done on risk

perceptions and management in smallholder dairy farming in Ethiopia classified risk sources in agriculture as production, marketing, financial, and technological risks (Gebreegziabher & Tadesse, 2014).

Classification of sources of risk therefore does not differ with location, but rather the types of sources of risk affecting an enterprise, and the severity of the risk, are what differ with location and farming system (Aditto et al., 2012). Risk perception therefore is expected to differ with location and farming system. With these differing perceptions of risk, understanding the types of risks farmers are exposed to and the perceptions and attitudes the farmers have towards risk is important in order to, understand their risk management (Flaten et al., 2005; Gebreegziabher & Tadesse, 2014; Meuwissen, Huirne, & Hardaker, 2001).

2.4.4 Risk Management Strategies

Responses to risk can be classified in two ways (Hess, Skees, Stoppa, Barnett, & Nash, 2005) with the first classification based on whether they are formal and informal risk management strategies or mechanisms. Hess et al. (2005) defines informal risk management mechanisms as those mechanisms implemented by individuals or groups of individual such as livestock diversification on a farm. He then defines formal risk management mechanisms as mechanisms that are either market based or publicly provided.

The second classification of risk management strategies is based on the time when response to risk occurred. Under this classification, risk response can be seen as *ex-ante* risk management strategies and *ex-poste* risk coping strategies (Antón, 2009; Hess et al., 2005; Lekprichakul, 2009). Ex-post risk coping strategies have been defined as responses that relieve impact of risk after it has occurred. The *ex-poste* strategies are therefore risk coping strategies that focus on survival after risk has already occurred.

Ex-ante risk management strategies focus on managing or preventing occurrence of risk before it occurs. Under this classification, risk management strategies can be further classified into risk mitigation strategies and risk prevention strategies as shown in Figure 2.5 (Antón, 2009; Cervantes-Godoy, Kimura, & Antón, 2013; G. F. Patrick, 1998). Risk mitigation strategies refer to strategies that reduce the impact of risk and risk prevention refers to those that reduce the likelihood of the particular risk occurring. Risk prevention has been used synonymous with risk reduction (Kalinda, 2014) but some authors prefer to group these as two different strategies where risk reduction refers to reduction of impact of risk and

reduction of likelihood of risk occurring (G. F. Patrick, 1998). Patrick (1998) in his classification therefore sees risk prevention and risk mitigation as both being part of risk reduction. This idea that risk prevention and mitigation are both forms of risk reduction strategies seems to hold when the definitions of risk prevention and risk mitigation are considered. Both risk prevention and risk mitigation refer to reduction of a particular aspect of risk; reduction of likelihood of risk occurring (risk prevention) and reduction of impact of risk (risk mitigation) (Antón, 2009; Cervantes-Godoy et al., 2013; Kalinda, 2014).

Some literature classifies risk management strategies based on the risk source types the strategy is responding to (Legesse & Drake, 2005). Under this classification some of the risk management strategy categories are financial responses, marketing responses, disease control responses or diversification responses to risk.

		Farm/ Household	Market	Community/ Informal	Government
Ex ante Risk Manage-ment	Risk Reduction	-Technological choice **Developing countries** -Avoiding risk -Household size -Income diversification -Low-risk, low-return cropping patterns -Production techniques	-Training on risk management	Crop sharing	- Macroeconomic policy - Disaster prevention (e.g. flood control) - Prevention of animal diseases
	Risk Mitigation	-Diversification in production **Developing countries** -Savings in the form of liquid assets (crops) and buffer stocks -Crop diversification -Inter-cropping -Plot diversification	- Futures and options - Insurance - Vertical Integration - Production/marketing - Contracts - Spread sales - Diversified financial investment - Off-farm work	Common property resource management -Social reciprocity -Informal risk pooling -Rotating savings/credit	- Tax system income smoothing - Counter-cyclical programmes - Border and other measures in case of contagious disease outbreak
Ex post Risk coping	Risk Coping	- Borrowing from neighbours / family - Intra-community charity **Developing countries** -Sale of assets -Reallocation of labour/child labour -Reduce consumption -Borrowing from relatives -Migration	- Selling financial assets - Saving/borrowing from banks - Off-farm income	-Sale of assets -Transfers from mutual support networks	- Disaster relief - Social assistance - Other agricultural support programmes

Figure 2.5: Agricultural Risk Management Strategies: Source: (Cervantes-Godoy et al., 2013).

2.4.5 Agricultural Risk Management in the Global context

Risk or uncertainty in agriculture has been a concern since the 1970s and is increasingly becoming more so due to changes in agriculture and the world we operate in (Young, 1979). Governments have been responding by forming policies and regulations aimed at reducing and controlling variations in production, prices and income at farm level. However, these policies that are aimed at managing risk have also contributed to risk in agriculture as they are a source of institutional risk (Young, 1979).

To have a better understanding of risk, a number of studies have been done across the world on agricultural risk management. Most of this work has stressed on risk analysis to determine how farmers should behave or respond to risk and although less, some work has been done to understand how farmers perceive risk and the risk management strategies they are using (Flaten et al., 2005). The approach of understanding risk behaviour through perception rather than predicting it has been commended by scholars as a better approach to understanding risk among farmers (Flaten et al., 2005; Yoe, 2011).

Studies to understand risk perception have been done by different researchers in different parts of the world, indicating different perceptions towards risk. A study conducted in 1992 on New Zealand farmers indicated that there was a general consensus among most farmers in New Zealand (both livestock and horticultural farmers) perceiving market risk, specifically changes in product prices as the most important sources of risk (Martin, 1996). More recently, it was found that New Zealand dairy farmers have added global supply and demand, technological changes and skills of people that are involved in their farming businesses as other important risk sources (Shadbolt & Olubode-Awasola, 2013). Harwood et al. (1999) found that farmers in the United States perceived commodity price risk, production risk and risk due to changes in government laws and regulations to be most important. Four years later, Hall et al. (2003) found that beef farmers in Texas and Nebraska perceived severe droughts and varying cattle prices as the most important sources of risk. On the other hand Meuwissen et al. (2001) found that Dutch livestock farmers perceived price and production risks as the most important sources of risk. Differences in risk perception with different locations can be noted. Further investigation of the Dutch livestock farmers revealed a difference in risk perception between different types of farmers; dairy farmers perceived price risk as the most important while mixed farmers considered production risk as the most

important one (Meuwissen et al., 2001). This indicated a difference in risk perception based on farming system as expected.

In developing countries where access to information that can forecast prices, market trends and weather patterns is limited, agriculture is even more uncertain for farmers (Aditto et al., 2012). This makes agricultural risk complex and understanding it is important not only for farmers but for policy makers too. A study done to understand risk and risk management in Thailand as an example of a developing country revealed that the farmers generally perceived market risk as the most important source of risk.

Although some are similar such as the farmers in the United States and the Dutch mixed farmers who perceive production risk as the most important, differences in risk perceptions can be seen in these studies. This is evidence that risk perception is affected by geographical location and farm type as noted by (G. R. Patrick, Wilson, Barry, Boggess, & Young, 1985). This study also indicates the individualistic nature of risk perceptions as echoed in other studies (Flaten et al., 2005; Wilson, Dahlgran, & Conklin, 1993). Farmers' perceptions of risk vary between individuals based on variation in factors affecting the farmers' operating environments such as geographical location or type of farming enterprise. The severity of risk differs with type of farm and farming system in use, geographic location, weather conditions and government policies (Aditto et al., 2012).These studies also demonstrate how risk is changing over time which can be attributed to changing policies and market liberalization and industrialization (Meuwissen et al., 2001).

Since perceptions of risk are changing, it is therefore true to say choices of risk management strategies amongst farmers are equally changing because the perceptions on risk drive the risk behaviour (Wauters, van Winsen, de Mey, & Lauwers, 2014). It is therefore not surprising that risk perceptions will equally differ among farmers. In the study done in Thailand, the most important risk management strategies were those related to production and financial strategies as compared to market strategies (Aditto et al., 2012). This finding is similar to what was reported in another developing country, Ethiopia where study of risk management strategies amongst small-scale farmers revealed that diversification and financial risk management strategies were more important than marketing strategies (Gebreegziabher & Tadesse, 2014). These two study findings are contrary to what was found among farmers in New Zealand where few farmers considered diversification as the most important strategy. Rather the farmers in New Zealand perceived insurance, business

planning strategies and maintaining feed as some of the most important risk management strategies (Shadbolt & Olubode-Awasola, 2013). Meuwissen et al. (2001) found that use of insurance was one of the most important risk management strategy among Dutch livestock farmers. However, it is important to note that perceptions of risk management strategies are very personal and one should be careful not to generalise them (Meuwissen et al., 2001). With these differences in risk perceptions and risk management strategies based on location and type of farming systems, it becomes necessary to look at risk in Africa and Zambia.

2.4.6 Agricultural Risk Management in Africa

Literature on risk and risk management perceptions among farmers in developing countries, particularly Africa, is still scanty as compared to developed nations (Gebreegziabher & Tadesse, 2014). This is particularly true for risk management among livestock farmers. These studies are however necessary in Africa due to differences in both risk exposure and perceptions of risk and risk management strategies that should be expected due to farming system, socio-economic and environmental/ geographical differences that exist within the world and within Africa (Gebreegziabher & Tadesse, 2014; Quinn, Huby, Kiwasila, & Lovett, 2003).

Although livestock is considered important in livelihoods and risk management among smallholder farmers in Africa (Ilri, Fao, et al., 2008; Tembo et al., 2014), comprehensive studies on risk perceptions among smallholder livestock farmers who practice both arable and pastoral farming in Africa is scanty. The majority of literature on risk management in African countries generally looks at identifying risk and risk management strategies among farmers with some being specific to a particular type of risk or risk management strategy, e.g. climate risk and diversification (Ayodapo, 2010; Little, Smith, Cellarius, Coppock, & Barrett, 2001). However, to have a more comprehensive understanding of risk and therefore make more informed risk management policy recommendations, a holistic approach to understanding risk is required due to the multi-dimensionality of agricultural risk (Antón, 2009; Mubaya et al., 2012).

A recent study by Bishu (2014) found that general cattle farmers in Tigray, Ethiopia perceived production risk, particularly livestock disease risk, as the most common and severe source of risk. Livestock disease control and feed management were considered to be the most important risk management strategies by these farmers. When specified to dairy farmers

within the same area, Tigray, it was found that dairy farmers perceived a number of risk as the most important risk sources (Gebreegziabher & Tadesse, 2014) and these included technological, market, production, financial, human and institutional risks. They perceived reduction in diseases, diversification, financial management and improving market networks as the important risk management strategies. This was more evidence that perceptions of risk and therefore risk management strategies used are affected or differ with different farming systems. This study by Gebreegziabher and Tadesse concludes by echoing Meuwissen's conclusion that perceptions of risk and risk management strategies are farmer specific (Gebreegziabher & Tadesse, 2014; Meuwissen et al., 2001).

2.5 Agricultural Risk in Zambia

Agriculture in Zambia, particularly among traditional farmers, is characterised by poor risk management (Taylor, Dougherty, & Munro, 2009). Research has been done characterising risk among Zambians in rural areas, with some specific to risk in agriculture (Kalinda, 2014; Lekprichakul, 2009; Tembo et al., 2014) and risk management strategies, but this knowledge on risk has not been explored nor communicated to farmers exhaustively. As a result of this poor communication between the farmers and researchers, risk management has been poor, which has in turn resulted in poor productivity and performance. There is poor implementation of risk management strategies among the traditional farmers (Taylor et al., 2009). As a result of this poor risk management, it is difficult for the traditional farmers to access finance through lending institutions, such as banks, that consider them to be highly risky borrowers with poorly managed risk (Taylor et al., 2009).

2.5.1 Sources of Agricultural Risk in Zambia

Traditional farmers in Zambia are known to be exposed to various sources of risk that can broadly be classified into production, environmental/ weather, price/ market risks and change in policies (Taylor et al., 2009). Mubaya et al. (2012) was more specific and identified agricultural risk in Monze district as variability in access to input, livestock diseases, access to finance, access to information on weather and variability in weather patterns. Except for financial risks, all the other risks identified by Mubaya fit into the classifications of sources of risks as identified by Taylor et al (2009)

In his description of sources of risk in agriculture that are found among Zambia's traditional farmers, Kalinda (2014) clearly outlines the various types of risk and gives

examples of these various sources of risk. Environmental risk and Climate variability were found to be one of the important sources of risk among traditional farmers. Climate variability was seen as responsible for increased poverty over the years. Climate varied with between seasons of high rainfall where there would be droughts to seasons of drought.

Production risk was also outlined and involves poor crop and livestock performance. Poor crop performance was mainly attributed to environmental risks, specifically droughts and floods coupled by climate variability in the form of erratic rainfall patterns. Crop diseases and limited access to inputs such as fertilizers are another source of crop production risk (Kalinda, 2014). In terms of livestock production risk, the major source of production risk was identified as livestock diseases that reduce livestock productivity in terms of numbers and in terms of performance. Livestock thefts were also identified as another source of production risk (Kalinda, 2014) among the traditional farmers who did not have as much security for their livestock as the commercial farmers.

Market risk has become more obvious to the traditional farmers due to the effects of market liberalization policies in Zambia (Kalinda, 2014). Prior to liberalization, farmers where assured of ready markets for their farm products through government institutions. However, market liberalization meant the private sector and the farmers were solely involved in setting prices and getting farm products to the market, this was more so for livestock markets than it was for selected crops (Humphrey, 2009; Mwanaumo, 1999). This exposed the farmers to exploitation and increased their transport and transaction costs without an assured market for their products (Kalinda, 2014).

Human resource risks identified were risk due to deaths, long term illnesses and marital disputes (Ansell, Robson, Hajdu, van Blerk, & Chipeta, 2009) and risks associated with crime . Diseases such as HIV/ AIDS were considered responsible for increasing poverty levels due to reduced productivity in the rural farming community.

Government laws and policies are another source of risk identified among the rural farmers in Mazabuka (Kalinda, 2014). One of the policies that changed the face of agriculture in Zambia is the liberalization policy which has seen farmers struggling to adjust and find market for their produce. Changing government policies and laws make the environment unstable for the farmers. Some of these government laws and regulations are not supportive

of farmers e.g. the complex process farmers have to go through to sell their cattle discourage some farmers from selling (World Bank, 2011b).

2.5.2 Agriculture Risk Management in Zambia

Kalinda (2014) classified risk management among smallscale farmers in Zambia into three main categories namely risk prevention, risk mitigation and risk coping strategies. He defined risk prevention strategies as strategies that are implemented to reduce the likelihood of occurrence of risk. Examples of such strategies is carrying out disease prevention activities such as spraying crops with pesticides or livestock with ecto-parasiticides (Kalinda, 2014) and any other activities that mean preventing potential risk from occurring. Risk mitigation strategies refer to strategies that are implemented to reduce the impact of risk before it occurs e.g. giving prophylactic treatment to animals or slaughtering of sick animals to reduce impact of disease risk before it occurs, while the risk coping strategies are implemented post exposure to risk with the intention to reduce the impact after it occurs e.g. having an off-farm source of income as a risk management strategy to reduce impact of financial risk after it occurs (Kalinda, 2014).

Other researchers however do not differentiate risk management strategies that reduce potential impact from those that reduce likelihood of occurrence but simply classify risk management strategies as either post or pre exposure to risk. In another study on risk management among Zambian farmers, risk management strategies were classified into strategies before exposure to risk, ex ante risk coping strategies, and risk management strategies after exposure to risk, ex post risk coping strategies (Lekprichakul, 2009).

Lekprichakul described ex-ante risk coping strategies as focusing on income smoothing. He groups these into risk avoidance, risk transfer and risk reduction strategies. Farmers practice risk avoidance by avoiding or moving away from situations that expose them to risk. Traditional cattle farmers in Monze are known to avoid risk of lack of pastures for their cattle by moving their cattle to the Kafue flood plains in the dry season between May and October (Munyeme et al., 2009). This is because the pastures around their residences dry up and the Kafue flood plains are a nearby source of fresh pastures and water for their cattle. This risk management strategy exposes the cattle to livestock disease risk because of the aggregation of large cattle numbers (and sometimes wildlife) at communal water bodies (Hamoonga, Stevenson, Allepuz, Carpenter, & Sinkala, 2014; Munyeme et al., 2009). Risk

transfer refers to transfer risk to a third party which is done mainly through insurance. Insurance in agriculture is not very common among traditional farmers in Zambia (Lekprichakul, 2009). However, a program under the Zambia National Farmers Union is currently promoting the use of risk transfer among traditional farmers (Farm Risk Management for Africa (FARMAF), 2014). Farm Risk Management for Africa (FARMAF) is a project whose overall goal is to improve food security and livelihoods of the rural poor in Africa by making available a wide range of farm risk management tools and instruments for smallholder farmers. The project is currently operational in Burkina Faso, Tanzania and Zambia (Farm Risk Management for Africa (FARMAF), 2014). Acknowledging that farm risk is multi-dimensional (Tembo et al., 2014), this project uses three risk management strategies that are linked in managing various types of farm risks. These three strategies are (FARMAF, 2014):

1. Weather indexed Crop insurance scheme. This will be linked to credit access because most banks are not willing to lend to farmers without insurance to assure them of repayment of their money leant out. In the same way, farmers require incentives to pay for insurance and increasing access to credit for insured farmers provides that incentive.
2. Providing credit which is linked to insurance and supply of inputs and extension services.
3. Improving market access through marketing institutions and dissemination of market information. The project is promoting use of forward contracts and the Warehouse receipt system. The warehouse receipt system is being implemented through the already existing Zambia Agricultural Commodities Exchange (ZAMACE) Limited. Established in 2007, ZAMACE is Zambia's sole commodities exchange mainly in grains. ZAMACE offers services in transparent, secure and efficient commodity trading, grading of commodities and warehouse inspection and certification.

The third group in risk prevention strategies is risk reduction which includes strategies such as diversification (Chifuwe, 2006; Lekprichakul, 2009).Most traditional farmers in Zambia have diversified farming activities that range from growing various types of crops to keeping various types of livestock.

Ex-poste risk coping strategies involve smoothing of assets and consumption (Lekprichakul, 2009). This can be implemented through income diversification by those

traditional farmers who work off farm in formal employment or have other private businesses that are independent of their farming systems (Chifuwe, 2006).

The categorization of risk management strategies is not exclusive because some risk management strategies can be used as both *ex -ante* and *ex-poste* risk management strategies (Lekprichakul, 2009). Looking at the above risk management strategies being used in Zambia it is evident that risk management among Zambian farmers is concentrated on crop production with livestock being used in risk coping by selling off livestock in times of poor crop harvests or sales (Kalinda, 2014; Tembo et al., 2014). There remains a need for more research on understanding risk and risk management in pastoral farming in Zambia.

2.5.3 Empirical Research on Agricultural Risk Management

Farm Risk Management for Africa (FARMAF), a project working towards increasing available risk management tools/ instruments for Smallholder farmers in Burkina Faso, Tanzania and Zambia acknowledges the multi-dimensionality of agricultural risk (Farm Risk Management for Africa (FARMAF), 2014). The project stresses on the need to consider different types of agricultural risk to understand risk and risk management among farmers. This study will therefore endeavour to investigate not only one type of risk in agriculture but different types of risks that the traditional cattle farmers in Monze, Zambia at are exposed to. This requires a holistic rather than a linear approach to understanding agricultural risk (Antón, 2009) by understanding attitudes to risk and perceptions of various sources of risk and risk management strategies.

A study on risk perception and risk attitudes of Flemish farmers (Wauters et al., 2014) conceptualized risk perception in three ways as subjective probability, subjective impact and as subjective influence on severity of a series of risk sources. To do this, a mixed methods research was used, with the in-depth interviews being done first to identify the most important sources of risk among the respondents. This resulted in biased results that had all the listed sources of risk having high risk scores and therefore being identified as threats. According to Wauters et al. (2014) the biggest threat for farmers were risks due to land availability, prices and costs. The least important threats were from personal risk and risk related to diseases and pests. There was no opportunity considered in understanding risk perceptions among these Flemish farmers. This is similar to other studies done on livestock farmers that only reflect the threats arising from risk without investigating the opportunity of

risk (Meuwissen et al., 2001). Hall et al. conducted a study to investigate perception of risk and risk management strategies among beef producers in Texas and Nebraska (2003) using the Likert scale to capture perceptions of risk and risk management strategies. The perceived negative impact of risk was rated on a scale of 1 to 5 with 1 being low and 5 the highest. Using Likert scale, perceived importance of risk management strategy was also rated on a scale of 1 to 5 with one being the least important and 5 the most important. It was found that the most important sources of risk were severe drought and variability in cattle prices, while risk due to cattle diseases, land price variability, availability of rented pasture and variability in labour availability and price were perceived as having the least impact on their farms. These beef producers were found to perceive maintaining animal health, being a low cost producer, maintaining financial reserves and having off farm investments as being the most effective risk management strategies. The least important risk management strategies were using futures markets, using forward contracting, diversifying ranch and farm enterprises and having off farm employment.

Studies done on risk and risk management in Africa have also focused on risk as a threat. Gebreegziabher and Tadesse (2014) used factor analysis and descriptive statistics to understand risk perception and attitudes towards risk of smallholder dairy farmers in Tigray, Northern Ethiopia. Factor analysis identified technological, price, production, financial, human and institutional risks as the major sources of risk among the sampled farmers. Using factor analysis, it was also found that these smallholder dairy farmers from Tigray perceived disease reduction, diversification, financial management and market network as the most important risk management strategies (Gebreegziabher & Tadesse, 2014). According to this study by Gebreegziabher and Tadesse (2014), perceptions of sources of risk and risk management strategies cannot be generalised but rather are specific to individual farmers. A complete picture of risk requires an exploration of both opportunities and threats that come with risk (Talavera, 2004). However, the majority of research on risk in Zambian agriculture has similarly failed to capture opportunities that may arise from risk (Kalinda, 2014; Lekprichakul, 2009; Tembo et al., 2014). There is need for a tool that analyses both upside (opportunity) and downside (threat) risk.

Score-carding (Detre et al., 2006) provides such a tool which looks at risk from two dimensions, understanding both threat and opportunity. Score-cards allow us to analyse how individuals perceived risk both as an opportunity they can exploit and as a threat they need to

minimize or eliminate and include the extent to which they see opportunity or threat. This gives a full picture of risk perception. A study done on New Zealand dairy farmers used score-carding to investigate risk perceptions amongst these farmers (Shadbolt & Olubode-Awasola, 2013). Farmers' risk perceptions were captured using Likert scale type questions rating potential and likelihood of potential and threat and likelihood of threat of various types of sources of risk. Sources of risks that offered the greatest potential for farmers to exploit were those that had high scores for both potential and likelihood to occur while those that were the greatest threats had a high score in rating as a threat and likelihood of the threat to occur (Shadbolt & Olubode-Awasola, 2013). This method of analysing perception is ideal as it achieves what is required of this study to capture both upside and downside risk. In their survey, Shadbolt and Alubode-Awasola (2013) found that most of the New Zealand dairy farmers perceived most sources of risk as providing opportunity rather than threat. New Zealand dairy farmers perceived opportunity in global supply and demand, variability in product prices, technology changes and skills of individuals associated with their businesses (Shadbolt & Olubode-Awasola, 2013). The highest perceived threat by these New Zealand dairy farmers was due to changes in input prices and availability followed by changes in local body regulations, the global economic and political situation and changes in local government laws and policies. This was despite the finding that the majority of these surveyed farmers were risk averse. Similar methods using Likert scale were used to capture perception of risk management strategies. It was found that the New Zealand dairy farmers perceived debt management as the most important risk management strategy which was followed by planning of capital spending, using practical planning steps in business, strategic purpose and maintaining feed reserves. The least important strategies were using futures markets, working off-farm, having more than one enterprise, geographic diversification of the farming business and property and spreading sales (Shadbolt & Olubode-Awasola, 2013).

The risk attitudes of farmers were assessed in this survey by Shadbolt and Alubode-Awasola (2013) using Likert scale type of questions that were scored on a scale of one to five. The same method of assessing risk attitudes was used by Wauters et al. (2014). Wauters et al. (2014) used two methods to assess risk attitudes; an expected utility framework and a psychometric method that measures attitudes using the Likert type questions. From this survey and subsequent analysis, Wauters et al. (2014) found that the farmers were more risk neutral than risk averse. However, he noted that their risk averseness was uniform across different farm production types but different with different farm sizes. Farmers with smaller

farms were more risk averse than the ones with bigger farms. The most common method of assessing risk attitudes of respondents is using the psychometric method that uses scale types of questions such as the Likert scale to rank risk attitudes (Bard & Barry, 2000; Meuwissen et al., 2001; Wauters et al., 2014). Other methods have been used to capture risk attitudes among farmers that did not employ ranking of Likert scale items. A study of risk attitudes among small-scale producers in Nigeria employed Paired comparison to understand risk attitude among small-scale farmers (Ayinde, Omotesho, & Adewumi, 2008). Paired comparison measures an individual's preference of one item over the other (Brown & Peterson, 2009; Maydeu-Olivares & Böckenholt, 2005). Ayinde et.al (2008) employed the paired comparison method to compare three types of risk attitudes (risk averse, risk neutral and risk taking) after which he ranked the preferred attitudes of the farmers on a scale of one to three. The findings where that the farmers were mostly risk averse. Although relatively simple, using paired comparison method can be both time and resource consuming as compared to using rankings which allow several items or options to be compared at the same time (Bramley Tom, 2005; Maydeu-Olivares & Böckenholt, 2005). The use of Likert scale ranking of questions related to risk attitudes is the most common and easy way of capturing risk attitudes (Bard & Barry, 2000; Wauters et al., 2014) and is the method that will therefore be adopted for our survey.

Literature on how Zambian livestock farmers perceive risk as a threat or opportunity they can capitalize on is scanty. However some work has been done reporting the use of livestock markets to manage production risk (Chifuwe, 2006; Kalinda, 2014) by traditional farmers that own cattle. This may be the closest to literature indicating how Zambian livestock farmers may capitalise on production risk through livestock markets. But even this literature has some contradictions and therefore requires clarification through further research on how market behaviour of cattle keeping farmers is affected by their perception of and attitudes to risk which shapes their risk behaviour. To investigate this relationship, there is need to determine market behaviour amongst the surveyed farmers.

2.6 Cattle Markets in Zambia

2.6.1 The Beef Industry in Zambia

Zambia's beef industry is comprised of two sectors; the formal and the informal sector (Chikazunga et al., 2007.). The formal sector is monopolised by beef processing firms

that have integrated input supply, production, processing and retailing of beef and beef products (Chikazunga et al., 2008; Chikazunga et al., 2007.). These firms have integrated commercial farms that are responsible for the production of their cattle, however due to increased demand for beef and beef products these integrated firms also rely on independent commercial and traditional farmers for more cattle supplies (Zambeef PLC, 2012). Commercial farmers buy cattle from traditional farmers which they put on independent or integrated feedlots before slaughtering (Chikazunga et al., 2007.). Some of the beef from the formal sector is sold through independent butcheries and supermarkets. The formal sector mainly supplies urban consumers and some of the beef also reaches consumers in rural and peri-urban areas. (Chikazunga et al., 2007.; Sidahmed, 2010). Figure 2.2 below shows the Zambian beef value chain which also shows the flow of beef products to the urban consumers through the integrated firms that dominate the formal beef sector. Some of the beef from the formal sector is exported (Lubungu & Mofya-Mukuka, 2012).

The informal sector is composed of the traditional farmers making up 75 to 80% of the cattle supply which are usually sold through cattle traders or directly by the farmers to independent abattoirs or other slaughter facilities such as slaughter slabs (Lubungu & Mofya-Mukuka, 2012; Sidahmed, 2010). Some of the cattle is sold directly to rural consumers after processing at slaughter slabs although the majority passes through cattle traders (Lubungu & Mofya-Mukuka, 2012). Although not indicated on the value chain, other buyers from the traditional farmers are Private buyers who are individuals that buy for various reasons and will range from fellow traditional farmers to retailers at open markets or supermarkets (and buyers for personal consumption or use e.g. traditional ceremonies) (Chikazunga et al., 2008).

From the beef value chain in Figure 2.2 it can be noted that the market channels for selling beef in Zambia are Feedlots, Abattoirs, Cattle traders, Butcheries, Private buyers and Supermarkets.

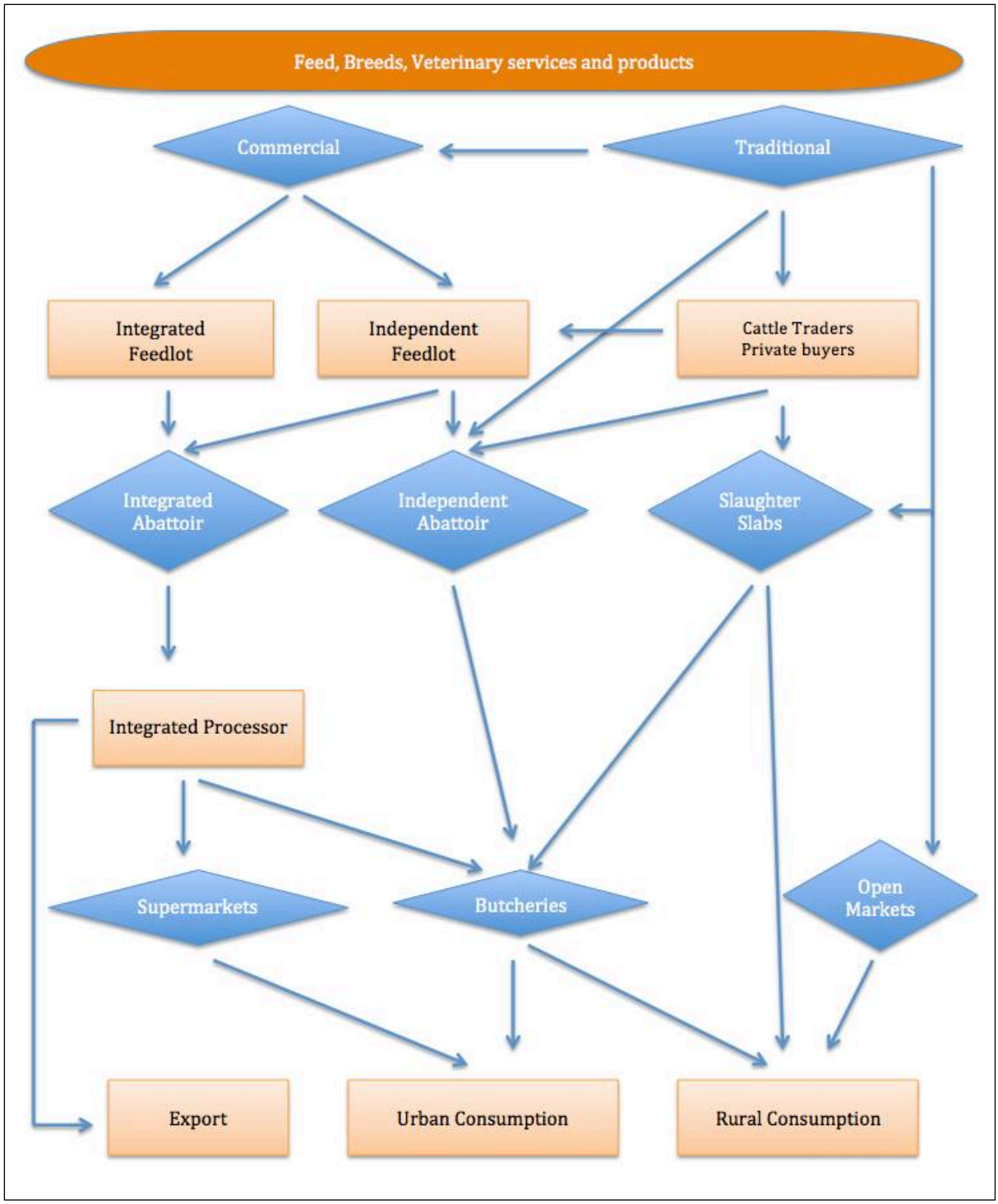

Figure 2.6: Zambia Beef Value Chain (Chikazunga et al., 2008; Lubungu & Mofya-Mukuka, 2012; Sidahmed, 2010).

2.6.2 Empirical Research on Market Participation

There are contradictions in reports on market response to risk by traditional farmers. While Tembo (2014) reports increased cattle sales during times of droughts, Chifuwe's

(2006) time series analysis of drought occurrence and livestock sales in Monze district of Zambia revealed that livestock sales reduced in years of drought between 1980 and 2003. Chifuwe reports an increase in cattle mortalities with reduction in cattle sales due to reduced cattle numbers in drought periods (Chifuwe, 2006). This may be true as traditional farmers sell less when they have fewer cattle numbers (Barrett et al., 2004; Lubungu et al., 2013). Other factors known to affect farmers' decision to sell cattle relate to the cost of selling such as transport, storage, market information and risk management costs (Bailey et al., 1999). An increase in these costs will result in reduced selling behaviour among farmers. The value of cattle to pastoralists is also affected by the value of cattle to farmers which includes cultural and nutritive value (Bailey et al., 1999). Bailey et al (1999) writes that as the nutritive value of cattle lowers in the dry season, farmers are more likely to sell their cattle then than when they have greater nutritive value.

Using a three-year panel survey data from smallholder livestock farmers in Zambia, it was found that the number of cattle a farmer had, had an effect on their market participation in that those who owned more cattle sold more than those who did not (Lubungu et al., 2013). The survey by Lubungu et al. (2013) was done to understand market participation among smallholder livestock farmers in Zambia. Lubungu et al. (2013) found that the education level of the household head influenced the likelihood to participate in cattle markets. More educated farmers were able to utilise market information making them participate more in cattle marketing. Farmers with larger cattle herd were also found to sell more cattle in livestock markets than those with fewer cattle (Lubungu et al., 2013). Lubungu also noted that farmers who were less involved in crop production and other off farm activities to earn money were less likely to sell their cattle. According to Lubungu, the smallholder farmers sold their cattle when there was a threat of increasing mortality. For example in times of cattle diseases, farmers coped with cattle disease by selling off their diseased cattle where the prognosis was poor. This is a contradiction to her earlier findings that cattle farmers were less likely to participate in cattle markets if their cattle numbers were depleting. She uses random utility framework to measure market participation. Random utility frameworks or models are a method of measuring discrete choice behaviour of individuals by making them choose among a set of options (Baltas & Doyle, 2001). Recent developments have brought to light, concerns about the complexity of using random utility frameworks and resulting difficulties in interpreting and forecasting.

A study was done relating farm productivity to household market participation of crop farmers from Tanzania, Vietnam and Guatemala (Rios, Shively, & Masters, 2009). In his survey, Rios et.al. (2009) defined market participation using sales index. Sales index was defined as the summation of crop sales divided by the summation of crop production. If the sales index was equal to zero, then such a farmer was considered to be a non-seller and if greater than zero then the particular farmer was considered to be a seller. This definition of market participation by sales index does not take into account the fact that market participation involves purchasing too. It is therefore not suitable for our investigations of market participation where the intention is to capture both selling and purchasing behaviour of the farmers.

In his study relating livestock market behaviour of pastoralists in northern Kenya and southern Ethiopia, Barrett et al. (2004) defines market participation as the selling or buying of animals in livestock markets. He uses total livestock units (TLU) to standardize total number of animals sold or purchased across the different livestock species. This definition suits our study whose interest is in the buying and purchasing behaviour of cattle during the study period. Further analysis on market behaviour of respondents will involve understanding choice of market channels used to sell cattle. In his study Barrett et al. (2004) found that the surveyed pastoralists used livestock markets to sell their livestock more often in the periods of environmental stress such as droughts. Although livestock markets were used to sell livestock, it was found that the same could not be said for restocking. Restocking was left more to natural births with little purchases taking place. These findings by Barrett were similar to other studies and found that pastoralists with larger numbers of animals sold more animals than those with less (Lubungu et al., 2013).

CHAPTER THREE

3 METHODOLOGY

3.1 Introduction

This chapter looks at the methodology used to carry out this research. As distinguished from research method by Sahu (1996), research methodology does not only outline the tools and techniques used in collecting data and analysing the data, but goes further to explain the rationale behind the techniques used. This section explains the choice of research strategy and design, choice of data collection tool, sampling strategy, site selection and the data collection process. It also explains the tools and techniques used to analyse the data collected.

3.2 Research Strategy

Mixed methods research was used for this study. The aim of the study requires attitudinal responses that will be compared with market behaviour in order to draw conclusions on relationships between market behaviour and risk management in the study population. Mixed method research was used for this study because it allowed for preliminary investigations to be done through literature and in-depth interviews (qualitative) that were used to inform the questionnaire used for the survey. The questionnaire survey had both quantitative and qualitative types of questions.

As defined by Bryman and Bell (2011), mixed methods research simply means research that utilizes both qualitative and quantitative approaches in the same research project. According to Bryman and Bell Smith (2011), qualitative and quantitative research strategies complement each other when used together. Qualitative research can facilitate quantitative research in research design as will be explained further in the sampling process used for this research. Qualitative research can also facilitate interpretation of quantitative research, while quantitative research is argued to be useful in validating qualitative research, e.g. by using statistical modelling to validate results obtained through qualitative research methods (Bryman & Bell, 2011).

Smith and Heshusius (1986), however argue that the integration of qualitative and quantitative research strategies transforms qualitative inquiry into procedural variation of quantitative strategy.

Despite the contradiction in views among scholars, combining the strengths and weaknesses of qualitative and quantitative strategies is believed to develop a broader insight into the research problem (Venkatesh, Brown, & Bala, 2013) and the use of the mixed methods research is becoming increasingly common in all research disciplines (Bryman & Bell, 2011).

There are three main ways in which mixed methods research can be done (Bergman, 2008; Bryman & Bell, 2011; Starr, 2014). The first is a one phase design combining both qualitative and quantitative methods in the same study and analysis, the second involves qualitative research being done in the first phase and used to inform the second phase which is quantitative, and the third method involves starting with quantitative research which is used to inform the qualitative research which to be done in the second phase. These methods are split even further by some researchers. However, Bryman and Bell (2011) caution against making an absolute distinction between qualitative and quantitative research when using a mixed methods research in order to get a broad perspective of the subject under study.

This study was more inclined towards the second method which used qualitative research to inform the second phase of the research which was quantitative.

3.3 Research Design

Sahu (1996) defines the objectives of a good research design as being able to achieve the objectives of the study while achieving reliability, validity and generalization. Bryman and Bell (2011) classify research design into Experimental, Cross-sectional, Longitudinal, Case study and Comparative research designs. This study uses a cross-sectional study which is defined as a study that involves collection of data from more than one group or cases at a particular point in time in order to understand variation between cases or groups (Bryman & Bell, 2011). Cross-sectional study defines the study being done for this research, which will be on more than one household of traditional cattle keeping farmers and will be done at a single particular point rather than repeated at different periods as would a longitudinal survey. Hence a cross-sectional survey was applicable for this research.

3.4 Site selection

Monze district was selected because it has the highest number of cattle keeping households in the country and in Southern Province at 14,300 households in 2012 (Lubungu & Mofya-Mukuka, 2012; Mumba et al., 2013) and hence provided the required study population. It was also chosen because Southern Province, and Monze district in particular, is one of the provinces that experiences adverse weather conditions, specifically droughts, that affect agricultural activities in the province (Kalinda et al., 2014; Lekprichakul, 2009; Tembo et al., 2014).

3.5 Qualitative Research

The first phase of this study was qualitative data collection from key informants to inform the second part of the study which was a survey.

Qualitative research can be done by using In-depth interviews, focus groups or projective techniques (Sreejesh, Mohapatra, & Anusree, 2014). In-depth interviews were chosen for this research over the other two methods because they are useful as a preparatory to developing analytical questionnaires for quantitative research (Sreejesh et al., 2014). This is because in-depth interviews allow for specific individuals selected for the interview to have a one-on-one interaction with the interviewer, giving the latter the opportunity to probe for information required to inform the survey. They also allow a mutual interaction between the interviewer and the interviewee, making it easier to discuss questions that may otherwise be sensitive and difficult for the interviewee to respond to. This is, however, not possible with focus groups and projective techniques (Sreejesh et al., 2014).

3.5.1 Unit of Analysis

The unit of analysis for the first phase of the study was the key informants who work closely with the traditional cattle keepers. These included the following individuals.

1. The District Veterinary Officer (DVO) and District Livestock Officer (DLO). These are district representatives of the Ministry of Agriculture and Livestock in Monze district and are responsible for facilitating all livestock extension services for livestock farmers in the district. Two officers were interviewed from these government offices.

2. The field extension officers for Parmalat, Musiika, SNV Zambia, Land-O-lakes and Heifer International. These work closely with farmers in the rural areas supplementing government efforts in providing extension services. Organisations like Musiika are proactive in promoting livestock marketing among traditional livestock farmers. Although five officers were listed to be interviewed, only two officers were available during the time of the interview; the field extension officer for Musiika and the one for Parmalat in Monze district.
3. The chairperson for Zambia National Farmers Union in Monze district was also interviewed for information on how the traditional cattle farmers operated and marketed their livestock.
4. To get more information on Marketing of cattle, interviews were also done with two abattoir owners in Monze, two cattle traders and one butchery owner.

Purposive sampling was used for the selection of the key informants who came to a total of 10 key informants. The strength of purposive sampling is that it allows one to choose information rich participants that will be relevant to the interest of the study (Patton, 1990). Purposive sampling however, has a lot of bias because it is made based on the judgement of the researcher hence has researcher bias.

3.5.2 In-depth Interviews

These interviews were semi-structured with general guidelines on questions to be asked. These questions ranged from demographic questions on typical traditional cattle farmers' characteristics, their geographical location and marketing. Questions on marketing ranged from pricing to selling patterns that may have been observed in terms of season or anything significant that they may have noticed. Questions were also asked on farmers' attitudes to risk management strategies that were provided by government such as cattle vaccinations. A more comprehensive list of the interview guidelines is attached in the appendices.

3.6 Quantitative Research

The second phase of the research was the quantitative research done using a cross-sectional household survey. This was done after the interviews with key informants.

3.6.1 Unit of Analysis

The unit of analysis for the second phase of the study was a traditional cattle keeping household in Monze district. The Farm Manager, who for the purpose of this study was defined as the person in charge of the day to day operations and decision making on the farm, was interviewed for this study on each traditional cattle keeping household.

3.6.2 Sampling Frame

The sampling frame used was a list of traditional cattle keeping farmers compiled from the list obtained from the district veterinary offices, the police services and the district offices for the Zambia National Farmers Union, ZNFU.

3.6.3 Pilot Survey

A pilot survey was first done on 10 Farm Managers from traditional cattle keeping households. This was done to test the questionnaire and get feedback on how effective the data collection tool was prior to using it in the main survey. The questionnaire was translated to the local dialect in the district, Tonga, before the pilot survey. These farmers were picked at random from the sampling frame.

During the pilot survey, it was also discovered that the sampling frame compiled using the list of traditional cattle keepers was incomplete. This is because the list from the government offices mainly comprised those farmers that were accessing animal health services such as vaccinations from the government offices. This meant risk behaviour of traditional cattle keepers who could not access these services or who did not desire to participate in animal health activities like vaccinations would not be captured. The list from Zambia National Farmers Union was equally biased in that it only captured those farmers who were its paid up members. On advice from the DVO's office we also acquired a third list from the Zambia Police Service based on individuals who went to get clearance[1] prior to selling their cattle. However this list was also biased towards those farmers that took part in cattle markets. Those that did not sell in the past year would not be captured, making the information incomplete. It was then concluded that the combined list was still missing

[1] It is required by law in Zambia to get police clearance when selling an animal for the purpose of tracing and verifying that the animal is not stolen.

necessary input from cattle keepers that may not be selling their cattle, nor participating in animal health intervention activities and were not members of the farmers union.

After the pilot survey, it was decided the sampling frame would not be used to sample for respondents.

3.6.4 Sampling

Prior to the pilot survey, sampling was going to be done using Simple Random Sampling from the sampling frame described in 3.6.2. However, the pilot survey revealed that the sampling frame we had was incomplete hence there was need to come up with a different sampling strategy.

The interview with stakeholders also revealed that the study population was too large and widely dispersed and sampling from such an area would be costly and time consuming. Another sampling strategy had to be used that could overcome the challenge of distance between households.

Without a complete list of traditional cattle keeping farmers in the study district, limited time and financial resources and households that were widely spread across the study area, it was decided that we use a sampling strategy that took these factors into consideration, while maintaining a precise probability sampling method. Cluster Random Sampling was used. Cluster Random Sampling is used to cut costs where the population is large or widely spread (Alreck & Settle, 2004; Musser et al., 1996). Like simple random sampling, it is also a probability sampling method but has higher sampling error than simple random sampling. To implement the cluster sampling, Monze district was divided into 20 clusters based on already existing wards. From these wards, four wards were picked at random as the clusters form which sampling would be done. The sampled wards were Bweengwa, Haatontola, Choongo East and Mwanza West. Figure 3 shows the wards in Monze district and the study sites. Because we could not obtain the total number of cattle keeping traditional farmers for each ward, the total number of traditional cattle keeping households in Monze (11,440) was divided by the total number of wards in the district (20) to give an estimate of 572 traditional cattle keeping households per ward in Monze district. To get the number of respondents to be selected for the interview for each selected study ward, 4 was divided into the total number of respondents required in the survey, 189, to give approximately 47 respondents for three wards and 48 for one ward. The total number of traditional cattle keeping households per

wards, 572, was then divided into the number of respondents required per ward, 47, to give 1/8. This means for each of the wards to be sampled as clusters, the 8th traditional cattle keeping households were selected for the survey until they reached 47 households for each selected ward and the total target of 189 households.

3.7 Data Collection

A semi-structured questionnaire with both open and closed ended questions was used to carry out face to face interviews with the respondents. The survey was done as a face to face survey because this has the advantage of the enumerators guiding the respondents and also achieves a higher response rate than self-administered surveys (Check & Schutt, 2012)

These questionnaires were translated to the local language of the area, i.e. Tonga to ensure full understanding of the questionnaire and therefore participation by the respondents. A total of 4 enumerators were trained to assist with conducting the survey. Four enumerators were used in order to have one enumerator covering each of the four sampled wards, thereby reducing on both monitory and time costs that would arise from one enumerator covering different wards that were distant from each other.

The questionnaire had four main parts. The first part collected demographic information. The second part had farm and farming characteristics such as farm size, farming system, farm activities, land tenure system etc.

The third part of the questionnaire had questions relating to risk management. The respondents were asked to rate, on a scale of 1 to 5, the risk/uncertainty they were exposed to on their farming enterprise based on a list of sources of risk adapted from Gebreegziabher and Tadesse (2014), Aditto *et al*. (2012) and Shadbolt *et al*. (2010). This was uncertainty as experienced over one farming season, July 2013 to July 2014. The respondents were then asked to assess the sources of risk for likelihood for their businesses to benefit from these risks as opportunities and the likelihood for these opportunities to occur. Similarly they will be asked to assess the likelihood for these sources of risk to disadvantage their enterprises as threats and the likelihood for these threats to occur. These were all rated on a scale of 1 to 5 as with the Likert scale.

The respondents were then asked to identify the strategies they use from a list of risk management strategies compiled from literature, and to rate the importance of these risk

management strategies and (Aditto et al., 2012; Gebreegziabher & Tadesse, 2014; Shadbolt & Olubode-Awasola, 2013).

The respondents were also asked to assess their view of risk. They were asked to rate their risk attitudes (averse, tolerant, neutral or risk seeking) when faced with uncertainty on their enterprises. This was also a scale question.

The fourth part of the questionnaire was on cattle markets. Respondents were asked to assess their participation in cattle markets by rating their willingness to sell cattle, the number of cattle they had sold in the past farming season, to whom they had sold in terms of market channel.

Some open ended questions were also asked at the end of each of the three parts to give the farmer opportunity to comment on any other risk they were exposed to and risk management strategy they were using that was not covered by the researcher. For more details on the questionnaire, see the appendices.

3.8 Data Processing

From the questionnaires that were retained for analysis it was noted that the additional questions on marketing in Section D of the questionnaire lacked variation and provided limited data. It was therefore decided that these would not be used in data analysis. Therefore the only questions that were used on the market section were from Tables I on cattle sales and Table II on cattle purchases. From this information on marketing, the respondents were described as having four main types of market behaviour; the Traders, the Sellers, the Buyers and the Holders. Traders were defined as respondents who sold and bought cattle during the study period, Sellers as respondents who only sold cattle during the study period, Buyers as respondents who only bought cattle and Holders as those respondents who neither bought nor sold cattle during the study period.

Market channels for selling cattle, which in this study will just be referred to simply as market channels, were described using findings from section D of the questionnaire. Each of the six market channels identified in literature (Chikazunga et al., 2008; Kruijssen, Longley, & Katjiuongua, 2014; Lubungu & Mofya-Mukuka, 2012; Sidahmed, 2010), was confirmed by the respondents in this study as Abattoir, Butcheries, Cattle traders, Feedlots, Private buyers and Supermarkets. The market channel Abattoir represents cattle sold directly

to all types of slaughter facilities such slaughter slabs, slaughter houses and abattoirs. Butchery represents sales that are made directly to butcheries that are retailing beef to rural, urban and peri-urban areas. The Cattle traders channel represents cattle sales made to middle men called Cattle traders who buy cattle from the traditional farmers and sell it to third parties, such as feedlots, abattoirs or butcheries, at a profit. These third parties may be buying for immediate consumption or slaughter for sale e.g. butcheries or abattoirs, or they may be buying to keep the cattle for various reasons such as increasing herd size or to fatten the cattle to market weight for sale at a later stage. The market channel Feedlots represents cattle sales made to feedlot farmers who are mainly commercial farmers. These buy from traditional farmers to fatten and retail or slaughter to retail at a higher price when the cattle reach market weight. According to the beef value chain in the literature review, supermarkets are the retailers of processed beef from the integrated agribusiness firms. However, the preliminary in-depth interviews revealed that some of the traditional farmers sold their cattle directly to some supermarket owners, particularly in times when demand outstrips supply. In this regard, Supermarkets are those beef retailers that bought cattle and had it processed before retailing to the rural consumers and some urban consumers. Private buyers represent other individual buyers that include other non-commercial farmers buying to increase their herd sizes or private individuals that may be buying for their own consumption. The Cattle traders differ from the private buyers in that the Cattle traders always buy to sell to third parties as middle men, while the Private buyers are non-commercial farmers and individuals who usually buy for their use.

It was noted that some market channels had fewer respondents than others making quantitative analysis difficult. It was therefore decided that for the purpose of quantitative analysis only, the identified market channels be re-grouped based on the number of respondents for each market channel and common elements shared between market channels. In this case Feedlots and Private buyers were grouped into one group as Private buyer because they both involved other farmers buying off fellow farmers either onto feedlots or other types of farming system for private buyers. The Butchery, Cattle traders and Supermarkets where also grouped into one as an overall Butchery. These three where grouped together because they bought cattle for the main purpose of having it slaughtered for beef retailing. Abattoir was then left as a channel on its own because it had sufficient responses for analysis. The market channels identified where therefore narrowed down to, Abattoir, Butchery and Private buyer. All questions containing “others” where also removed

because they did not provide enough responses. For example when farmers were asked to provide other sources of uncertainty they encountered on their farming enterprises, only two people identified an additional source of uncertainty which was death. This was not enough for data analysis.

Data was presented in frequency and percentage distribution tables and histograms for categorical data, and measures of spread, shape and average for ratio and interval data. The demographic information was all treated as categorical data including the age and household numbers which were grouped into categories to show frequency. Interval and ratio data can be ordered into categories and treated as ordinal data as was done in this case for age, household composition and years of experience of the farm manager (Weisberg, Krosnick, & Bowen, 1996). This allowed for the frequency distribution of the demographic characteristics across the study sites of the population to be presented. All the responses on farm characteristics, except the question on livestock number on the farm at the time of the interview, where also treated as categorical data and were presented using frequency tables and histograms. Interval and ratio data, such as total number of cattle owned, was presented using measures of spread such as the standard deviation, shape such as the kurtosis and average such as mean. The age, household number and years of experience as a farm manager data was also presented in this manner, in addition to presenting it as categorical data.

3.9 Analytical Tools and Techniques

Risk can be approached in two different ways, subjective or frequentist (Smith & Barrett, 2000). Subjective risk approach focuses on the farmers' views, looking at perceptions and preferences whereas the frequentist approach focuses on standardized measurable occurrences and severities of risk. Our study will focus on the subjective approach to understanding risk. The subjective approach is more practical particularly in this case where the study population are traditional farmers with low level of literacy and numeracy. This makes it more practical to ask these farmers what worries them the most as risk or uncertainty rather than asking them according to statistical criteria (K. Smith & Barrett, 2000).

Our study seeks to capture both upside (opportunities) and downside (threats) risk. A study done by Shadbolt and Olubode-Awasola looking at risk perceptions, attitudes and management and performance under risk of the New Zealand dairy farmers (Shadbolt &

Olubode-Awasola, 2013) captured both upside and downside risk. This study by Shadbolt and Olubode-Awasola utilized analytical tools as described and developed by Shadbolt *et al.* (2010) and Detre *et al.* (2006). These tools also captured the likelihood of the opportunities or threats to occur.

Our study will therefore utilise some of the analytical tools described in the study on New Zealand dairy Farmers by Shadbolt and Olubode-Awasola (2013). The analytical tools and technique to be used are described below:

3.9.1 Uncertainty Score cards

The uncertainty scorecards were used to record the respondents' rankings of risk sources and risk management strategies. Scorecards as shown in Figure 3.1 below transform qualitative data into quantitative data by rating the potential to either benefit or lose due to various risk sources and the likelihood of either happening on a scale of 1 to 5 (Detre et al., 2006; Shadbolt & Olubode-Awasola, 2013). Three scorecards were made in the questionnaire used in this survey. The first scorecard was for potential to benefit and likelihood to benefit from various sources of risk. Using the same sources of risk, a second scorecard was made for potential to lose from risk and likelihood of that threat to occur. The last scorecard was made for rating importance of risk management strategies.

Ranking on the scorecards was done on a scale of 1to 5 for all the three scorecards used, where 1 was the lowest potential to benefit from risk for upside risk and the lowest exposure ranking for downside. For the ranking of the perception of risk management strategies, 1 was the lowest ranking for the risk management strategy importance ranking. The results of the scorecards were plotted onto risk choice matrices.

		THE POTENTIAL TO BENEFIT FROM THIS CHANGE					THE LIKELIHOOD OF THIS POTENTIAL HAPPENING				
	Sources of change	Very low	Low	Medium	High	Very high	Rare	Unlikely	Possible	Likely	Almost certain
1	Climate variation	1	2	3	4	5	1	2	3	4	5
2	Pasture/crop/animal health	1	2	3	4	5	1	2	3	4	5
3	Interest rates	1	2	3	4	5	1	2	3	4	5
4	Land values	1	2	3	4	5	1	2	3	4	5
5	Product prices	1	2	3	4	5	1	2	3	4	5
6	Input prices and availability	1	2	3	4	5	1	2	3	4	5

Figure 3.1: Scorecard for Potential to Benefit from Uncertainty. Source: (Shadbolt & Olubode-Awasola, 2013)

3.9.2 Risk Choice Matrix

The Risk Choice Matrix is very important as it provides a visual tool for farmers, showing which opportunities and threats have the most impact on the farm enterprise. This will help farmers know which opportunities to make use of and which threats to avoid.

Because the Risk Choice Matrices could not be plotted for each of the 155 respondents used after the survey and data cleaning, the respondents were grouped into two groups based on location and market behaviour. Based on location, a total of four groups were realised (Mwanza West, Choongo East, Haatontola and Bweengwa. Based on market behaviour, the respondents were grouped as Sellers, Buyers, Traders and Holders. The Risk Choice Matrices were plotted for each of the mentioned groups by combining the median ranking scores for both threats and opportunities as shown in Figure 3.2. On the left side, the scores for threats were plotted by putting the negative impact on the bottom and the likelihood to happen on the left hand side of the matrix. The right hand side of the matrix had the positive impact at the bottom and likelihood of that happening on the right side of the matrix. For each of the groups, the risk score and likelihood scores plotted were the median scores for each group rather than the mean as this is recommended for ordinal data (Lavrakas, 2008).

An arrow of attention was then put as shown in Figure 3.2 which indicated which sources of risk were the most important threats and which ones were the most important

opportunities. The most important sources of risk that require the most attention are within the red coloured regions of the matrix. Looking at Figure 3.2 below, the most important threats due to their high scores as threats and likelihood of threat to occur are those represented by the letter "1" and those that are the most important due to having the high benefit score and likelihood of benefit to occur are those represented by "A". An additional key was therefore included in the analysis to indicate which sources of risks fell under which number or letter.

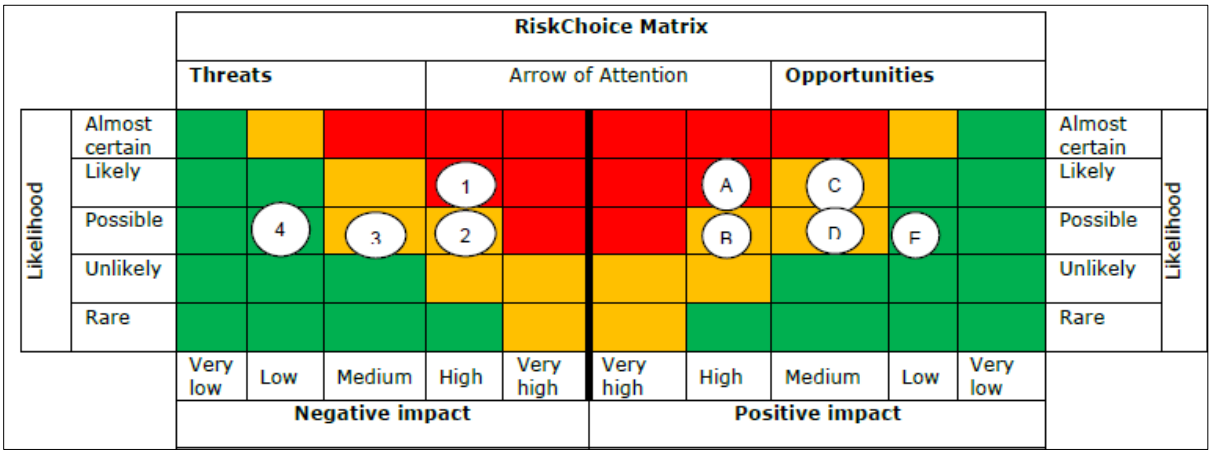

Figure 3.2: Risk Choice Matrix: Source: (Shadbolt & Olubode-Awasola, 2013)

3.9.3 Risk Importance Index

The Risk Importance Index was used to determine the relative importance of each of the risks the respondents are exposed to. This will be useful information for policy formulation and farm level decision making. This shows the perceptions of risk that the farmers have.

The Risk Importance Index was once again presented in the groups as described in the Risk Choice Matrix (Bweengwa, Choongo East, Haatontola, Mwanza West, Buyers, Seller, Traders and Holders).

For each of the eight groups above, the Risk Importance Index was calculated for risk sources that created opportunity and for risk sources that created threats. To calculate the risk importance index, the risk potential score was multiplied by the corresponding likelihood score. Medians were used rather than arithmetic means to calculate the average potential and likelihood score for each source of risk for each of the eight groups. The product of the risk potential score and the likelihood score is the risk score which is then multiplied by the

proportion of respondents that assessed a risk source at a risk score of 15 or greater. The final resulting product is what is then called the Risk Importance Index.

Appendix 5 shows the risk importance index for risk sources that create opportunity and those that create threats for each of the eight groups as previously discussed. A pie chart was used to represent risk importance index for risks that create threats for each of the eight groups. These sources of risks that created threats were put in order of the most important threat to the least important one as shown in Figures 4.5 to 4.8 for Risk Importance Index based on Location and Figures 4.9 to 4.12 for Risk Importance Index based on market behaviour.

3.9.4 Risk Management Strategy Importance Index

Risk Management Strategy Importance Index was used to analyse the importance of risk management strategies based on the farmers' views and their usage of the strategies by calculating the usage percentage. This is also important for policy formulation and government intervention programs for risk among traditional cattle keeping farmers.

The risk management strategy importance index was calculated for each of the identified risk management strategies for the respondents grouped by location (four groups) and by market behaviour (four groups). The risk management strategy importance index was calculated by first calculating the proportion of respondents who scored 4 (high importance) and 5 (very high importance) for ranking of importance of risk management strategy, for each of the risk management strategies in each of the eight groups. The calculated proportion of respondents that scored 4 or 5 was then multiplied by the corresponding median for each of the sources of risk in the groups. The final product of the calculated proportion of responses 4 and 5 and the corresponding median was the Risk Management Strategy Importance Index.

The calculated risk management strategy importance index for each of the eight groups were then ranked in order of the highest importance index and therefore the most important risk management strategy as perceived by the farmers. The proportion of farmers using different types of strategies were also calculated according to the eight groups and tabulated as shown in Tables 7.5.16 to 7.5.23.

The above calculations and presentation of the risk management strategy importance index was repeated for all the respondents as a single group as shown in Table 4.7. The

ranked risk management strategy importance indices in Table 4.7 were then presented in a pie chart as shown in Figure 4.21.

3.9.5 Risk Attitude

The risk attitudes for each of the respondents were calculated based on question (IV) in Appendix 1 which had all the questions on risk profiles. The specific question used for risk attitudes was the last question “when it comes to business, I like to play it safe”. For this question, all the respondents who answered the question with the rankings 1 and 2 were considered to be Risk Seekers as they disagreed with playing it safe when it comes to risk. The respondents who ranked 4 or 5 were considered to be Risk Averse as they avoided risk and the ones who scored 3 were considered to be risk neutral.

3.9.6 Cross-tabulation and Pearson’s Chi-Square

Cross-tabulation and Pearson’s Chi-Square were also used to investigate relationships between market behaviour and other variables, and risk attitudes and other variables prior to regression analysis. Market behaviour was described as “Sellers” (respondents who only participated in cattle markets by selling during the survey period), “Buyers” (respondents who only participated in cattle markets by purchasing cattle during the survey period), “Traders” (respondents who participated in cattle markets by selling and buying cattle during the survey period) and “Holders” (respondents who did not sell nor buy cattle during the survey period). It was later realised that the Buyers and Sellers had fewer number of respondents as compared to the other market behaviour typologies, which would affect the p-value. These were therefore combined into “One-way” in order to get a larger number of respondents.

3.9.7 Regression Analysis

Regression analysis was used to investigate relationships between risk exposure, risk management strategies, attitudes, perceptions of risk among these traditional cattle farmers and their cattle market participation and choice of market channel. Prior to regression analysis, Data imputation was done in order to have all the questions answered and therefore a complete data set to allow for regression analysis. The variables however, needed to be reduced prior to the regression analysis. Principal Component Analysis was used for data

reduction after data imputation. The statistical software “R” was used for analysing the data (R Core Team, 2014).

3.9.7.1 Data Imputation

Data imputation was done on the risk questions (Section C of the questionnaire) for eleven questionnaires that were not fully answered. Because only 11 questionnaires were missing data while 143 were fully answered, imputation was done using replacement with means which is a conventional data imputation method (Saunders et al., 2006). This simply involved imputing the average score of all existing answers for that particular variable to fill in the gaps. This method is recommended for cases where the number of missing data is small. Replacement with means is a quick and easy method and ensures that the estimated sample mean for that particular variable does not change. However, this method results in biased and reduced standard errors due to the reduction effect on the estimated standard deviation and variance (Saunders et al., 2006). We opted to use this method because the number of missing data was small, only 11 questionnaires were missing data and 143 were fully answered. Once the missing data was imputed, Principal Component Analysis was done on Section C, risk questions.

3.9.7.2 Principal Component Analysis

Principal Component Analysis (PCA) was used to reduce the data prior to the regression analysis. PCA can be defined as a statistical variable reduction procedure that is principally used to reduce the number of variables in a data set while maintaining the data variation that was in the original data set (O'Rourke & Hatcher, 2013; Sreejesh et al., 2014). PCA does this by grouping similar or correlated variables into sets known as principal components that are uncorrelated with each other. It therefore achieves two things, data reduction and grouping of correlated data into uncorrelated principal components without compromising the variability of the data set (Jolliffe, 1990; Smith, 2002). Grouping of the variables into uncorrelated variables is important when the variables are to be used in further analysis such as regression analysis as for this study.

Prior to carrying out the PCA, the questions (variables) on potential to benefit or lose from risk and likelihood for each one to happen, and importance of risk management strategy, were grouped based on the type of risk (for potential to benefit or lose and likelihood to benefit or lose) and type of risk management strategy (for importance and use of risk

management strategy) as shown in Appendix 4. These groups where based on literature on classification of risk and risk management strategies as discussed in the literature review and based on the survey findings. It was found that the strategies used in risk management by the respondents were either risk mitigation or risk prevention strategies. These two groups were therefore used for the classification of risk management strategies in order to carry out the PCA.

PCA was done on the following groups of questions:

1. Potential to benefit from risk as an opportunity for production, market, institutional, personal and financial risks.
2. Likelihood of occurrence of risk as an opportunity for production, market, institutional, personal and financial risks.
3. Potential to lose from risk as a threat for production, market, institutional, personal and financial risks.
4. Likelihood of occurrence of risk as a threat for production, market, institutional, personal and financial risks.
5. Importance of risk management strategy for mitigation and prevention strategies.

3.9.7.3 Logistic Regression Tree Analysis

Regression analysis was done using logistic regression tree analysis which is a non-linear predictive model that is useful where there are a lot of predictor variables (Loh, 2006). A large number of predictor variables require complex models when conducting regression analysis and these models are more difficult to interpret compared to simpler models. However, simple models may result in a compromise in the predictive power of the model (Loh, 2006, 2011). This is where regression trees can be useful as they are able to graphically present simple models while maintaining the predictive power of the regression model. Because the sample size for this study was small compared to the number of variables, and the regression analysis involved both categorical and non-categorical data, the use of logistic regression trees was most appropriate (Godfrey, 2015; Loh, 2006). However, due to the sample size, the results of the regression analysis could not be used to infer relationships between the dependent and the independent variables; rather the analysis indicated which

explanatory variables were of most importance in determining market behaviour among the respondents.

The dependent variable for this analysis was market participation which was defined in "R" in four ways as trader market behaviour (respondents who did not have zero cattle sells and did not have zero cattle purchases), seller market behaviour (respondents who did not have zero cattle sells but had zero cattle purchases), buyers market behaviour (respondents who had zero cattle sells and did not have zero cattle purchases) and holders market behaviour (respondents who had zero cattle sells and zero cattle purchases). These were the dependent variables for the four models in the regression analysis. The explanatory variables used were: the demographic questions, the farm characteristic questions, the risk profile questions and the selected PCs as shown in Tables 4.26 and 4.27.

In order to determine which factors were strong determinants of market behaviour, logistic regression tree analysis implemented in Tree (Brian Ripley, 2014) package in R (R Core Team, 2014) was used. Each model was run twice, such that there is Seller Model 1 and 2, Buyer Model 1 and 2, Holder Model 1 and 2, and Trader Model 1 and 2. The (1) models included all the variables (questions) in the survey, while the (2) models had question B4 (farm characteristics, see Appendix 3) removed as this was directly related to the seller status and hence could have an impact on the results. The two sets of models were compared to see if there was any difference as a result of removing question B4.

3.10 Study Limitations

Some of the limitations of the study are related to the sample used in that there was no complete list of the target population for us to use for sampling. This resulted in cluster random sampling, which increased the sampling error for the study.

The use of face to face survey also presents limitations due to the fact that the quality of the response is highly dependent on how well the enumerator understands the research objectives and the questions, the odds of having the enumerator distort the questions are high (Check & Schutt, 2012). To avoid variations in the way the questions were being asked, the questionnaire was interpreted into the native language for Monze district, Tonga, to avoid the different enumerators having to interpret the questionnaires during the interview process. The enumerators were also trained on the expectations of the research and therefore the survey and on how to conduct the interview.

3.11 Ethical Consideration

This survey was considered to be a low risk notification. Participants were informed of the choice to participate in the survey at their own free will. The identification of the participants remained anonymous as all the results were aggregated without specific farmer identifications.

CHAPTER FOUR

4 RESULTS AND DISCUSSION

4.1 Introduction

This chapter contains the results of the survey. The chapter has seven main sections as follows; introduction, demographic and farm characteristics of respondents, descriptive statistics, risk, marketing, cross-tabulation and Pearson's chi-square test and regression analysis. The last two sections, cross-tabulation and Pearson's chi-square test and regression analysis are the results addressing objective number five, to explore relationships between attitudes to, and perceptions of risk and risk management strategies, and cattle market participation and choice of market channel of the respondents.

4.2 Characteristics of the Respondents

4.2.1 Introduction

This Section 4.2 presents the survey responses. Section 4.2.2 after the introduction looks at the demographic and farm characteristics. This is followed by the descriptive statistics in Section 4.2.3, which is done by location and by market behaviour of the respondents. The four study sites Bweengwa, Choongo East, Hatontola and Mwanza West are used when presenting results by location and presentation by market behaviour refers to the four types of market participation as described in section 3.8 under methodology.

From a total of 189 sampled households, 143 respondents answered all the questions fully. Data cleaning revealed that of the incomplete 46 questionnaires, only 11 could be used after data imputation because they were only missing a few questions. The remaining 35 questions out of the 46 could not be used because they had inconsistent responses and were missing a number of responses in various sections and almost all the responses for Section C. For the retained questionnaires, data imputation was only done for Section C which had questions on risk. Details on data imputation are explained in the methodology section. The total number of answered and useful questionnaires therefore came to 154.

4.2.2 Demographic and Farm Characteristics

The demographic characteristics of the respondents and farm characteristics are presented in Tables 4.1 and 4.2 respectively. The distribution of the age, experience of the farm manager and household size across the sampled population were presented using histograms shown in Figures 4.1 to 4.4.

The majority of farm managers surveyed were farm owners as can be seen in Table 4.1, with only 3% being hired farm managers and 16% comprising of spouses and children of the farm owner. This result is expected in the traditional farmer population as they are non-commercial, low cost and use less hired labour (World Bank, 2011b). Amongst these farm managers only 8% were female while the remaining 92% were male. This is similar to other studies done among traditional cattle farmers where the majority of cattle owners/ managers were male, e.g. Chilonda et.al (2000) found the ratio of male to female traditional cattle owners to be 12:1 which is close to 13:1 found in this survey. Other scholars (Lubungu, 2013) also found less female cattle owners compared to their male counterparts. The majority of these farmers were between the ages of 31 to 50 years, with an average household size of 6 to 10 individuals per household. Both the average age of the farm manager and the household size are similar to what was found amongst traditional cattle keepers in Zambia's Eastern province (Chilonda et al., 2000). The highest level of education attained by majority of the interviewed farmers was primary education and only 5% of the interviewed farmers had received tertiary education. These findings on education status of the interviewed traditional cattle farmers are similar to findings from other studies on traditional cattle farmers in Zambia (Chilonda et al., 2000).

Table 4.1: Demographic Characteristics

Frequency										
Location	**Bweengwa**		**Choongo East**		**Hatontola**		**Mwanza West**		**Total**	
Bweengwa	36	100%	0	0	0	0	0	0	36	23%
Haatontola	0	0	0	0	36	100%	0	0	36	23%
Choongo East	0	0	44	100%	0	0	0	0	44	29%
Mwanza West	0	0	0	0	0	0	38	100%	38	25%
TOTAL	36		44		36		38		**154**	**100%**
Type of Farm Manager										
Farm Owner	30	83%	32	73%	29	81%	35	92%	126	82%
Hired Manager	1	3%	2	4.5%	1	3%	0	0	4	3%
Spouse of Farm Owner	3	8%	2	4.5%	0	0%	0	0%	5	3%
Child of Farm Owner	2	6%	8	18%	6	16%	3	8%	19	12%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**
Gender										
Female	4	11%	3	7%	3	8%	2	5%	12	8%
Male	32	89%	41	93%	33	92%	36	95%	142	92%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**
Age (years)										
20-30	5	14%	13	30%	8	22%	5	13%	31	20%
31-40	15	42%	12	27%	9	25%	7	18%	43	28%
41-50	11	30.5%	12	27%	9	25%	6	16%	38	25%
51-60	2	5.5%	5	11%	3	8%	12	32%	22	14%
≥61	3	8%	2	5%	7	20	8	21%	20	13%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**
Marital Status										

Single	2	5%	3	7%	5	14%	3	8%	13	8.4%
Married	32	89%	39	89%	27	75%	33	87%	131	85%
Divorced	1	3%	2	4%	3	8%	0	0	6	4%
Widowed	1	3%	0	0	1	3%	2	5%	4	3%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**
Educational level										
None	0	0	0	0	0	0	2	5%	2	1%
Primary	10	28%	23	52%	16	44%	29	76%	78	51%
Secondary	26	72%	19	43%	14	39%	7	19%	66	43%
Tertiary	0	0	2	5%	6	17%	0	0	8	5%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**
Household Size										
1-5	4	11%	12	27%	10	28%	2	5%	28	18%
6-10	11	30.5%	21	48%	9	25%	25	66%	66	44%
11-15	11	30.5%	7	16%	9	25%	6	16%	33	21%
16-20	5	14%	2	5%	6	18%	3	8%	16	10%
21-25	4	11%	1	2%	1	3%	0	0	6	4%
26-30	1	3%	1	2%	0	0	0	0	2	1%
≥31	0	0	0	0	1	3%	2	5%	3	2%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**

Looking at their farming enterprises, it was found that the majority of the farmers practiced mixed farming (91% as shown in Table 4.2), no specialised farming systems were found except for one in beef production. This is typical of traditional farmers as these keep cattle for various reasons and are non-specialised in their livestock production and farming (Chilonda et al., 2000; Lubungu & Mofya-Mukuka, 2012; Mwenya et al., 2001). Although these farmers do not specialise in dairy farming, when asked what their main sources of income were, it was found that at least 15% considered dairy sales income to be their main source of income. The majority of the farmers, 21%, relied on other off farm business activities as the main source of income. This was followed by 16% who could not pick out a

distinct activity as their main source of income but instead considered mixed farming as a whole to be their main income source. Even less was the 1% that depended on salaried employment as their main source of income. Combining this 1% to the 32% farm managers who depend on self-employment activities other than farm activities gives a total of 33% of farmers who depended on off-farm activities as their main source of income. This indicates more traditional cattle farmers depending on off-farm activities as their main source of income than on the eastern province which had 22% of traditional cattle farmers (Chilonda et al., 2000). This difference may be attributed to cultural differences between farmers from southern province of Zambia to those from the Eastern province and the geographic differences offering different opportunities for off-farm businesses.

From their farm characteristics, it can also be seen that the common grazing strategy was “village resident herd”. The other grazing strategies used were transhumance and a combination of resident grazing and renting. Only 1% of the respondents used rented grazing areas while 25% used transhumance grazing. This number is close to what was found in another study done among traditional cattle farmers in Monze district which found 22% of the farmers practiced transhumance farming (Kadohira & Samui, 2001). Bweengwa is seen as an exception with 72% of the respondents practicing transhumance and only 28% using resident grazing. This could be explained by the fact that Bweengwa as seen in Figures 2.2 and 2.3 was the nearest to the Kafue flood plains amongst the four study sites. This proximity to the flood plains has made the farmers in Bweengwa more easily adapted to grazing in the flood plain in the dry season when pastures are scarce.

Table 4.2: Farm Characteristics

	Bweengwa		Choongo East		Haatontola		Mwanza West		Total	
Farming System										
Mixed livestock production	0	0	5	11%	3	8%	1	3%	9	%
Mixed farming	36	100%	36	82%	31	86%	37	97%	140	91%
Beef Production Only	0	0	1	2%	0	0	0	0	1	1%
Dairy Production	0	0	0	0	0	0	0	0	0	0%
Dairy and Beef Production	0	0	2	5%	2	6%	0	0	4	2%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**
Main Income Source										
Crop Production	5	14	3	7%	5	14%	9	50%	32	21%
Crop production & self-employed in off farm activities	0	0	2	5%	0	0	11	29%	14	9%
Dairy Production	0	0	11	25%	11	30%	1	2.5%	23	15%
Beef Production	3	8%	2	5%	0	0	0	0	5	3%
Dairy and Beef production	0	0	0	0	1	3%	0	0	1	1%
Other livestock production	1	3%	1	2%	0	0	0	0	2	1%
Mixed farming	14	39%	5	11%	6	17%	0	0	25	16%
Formal salaried employee	0	0	0	0	1	3%	1	2.5%	2	1%
Self-employed	13	36%	19	43%	12	33%	6	16%	50	32%
Beef and Dairy production	0	0	1	2%	0	0	0	0	1	1%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**

Cattle Grazing Strategy										
Village resident herd	10	28%	31	71%	35	97%	38	100%	114	74%
Transhumance	26	72%	12	27%	0	0	0	0	38	25%
Interface	0	0	0	0	0	0	0	0	0	0%
Village resident herd & rented	0	0	1	2%	1	3%	0	0	2	1%
TOTAL	**36**	**100%**	**44**	**100%**	**36**	**100%**	**38**	**100%**	**154**	**100%**

Figure 4.1 below shows the distribution of age across the survey sites. The majority of respondents across all survey sites, except Mwanza West, are within the range of 30 to 50 years. In Mwanza West, the majority of respondents are within the age range of 45 to 60 years of age. For Choongo East and Hatontola the majority of respondents also included farm managers who are in their twenties.

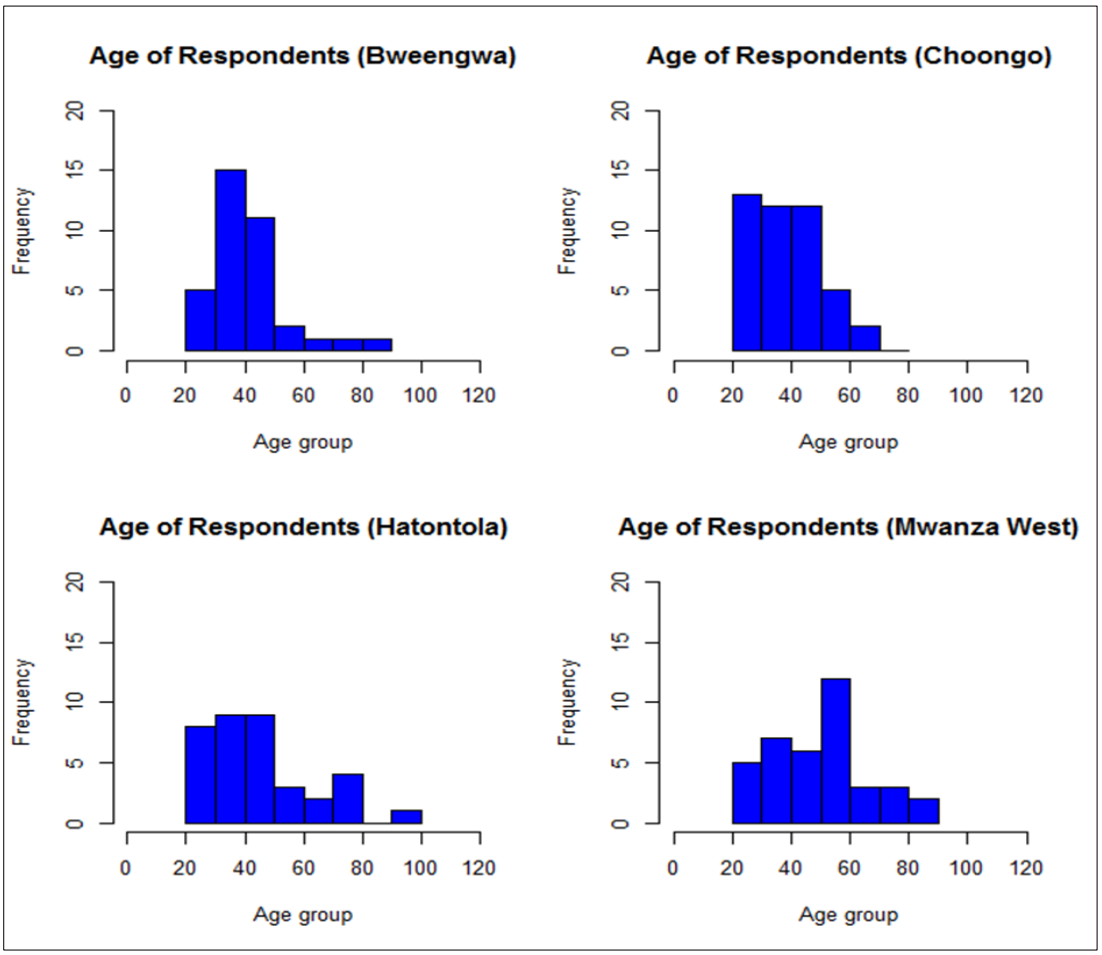

Figure 4.1: Comparisons of age distributions across survey locations

In Figure 4.2 we see that the majority of farm managers had 10 years or less of experience as farm managers. The most experienced farm manager had 60 years of experience while the least experienced had 1 year. Looking at Figure 4.2 on farm experience for the respondents from Mwanza West, it can be seen that amongst the respondents, more than half the respondents had 5 years or less experience as farm managers. These findings differ from what was found in 2001 when the average years of experience of the farm managers for traditional cattle farms was found to be about 27 years of experience (Kadohira & Samui, 2001).

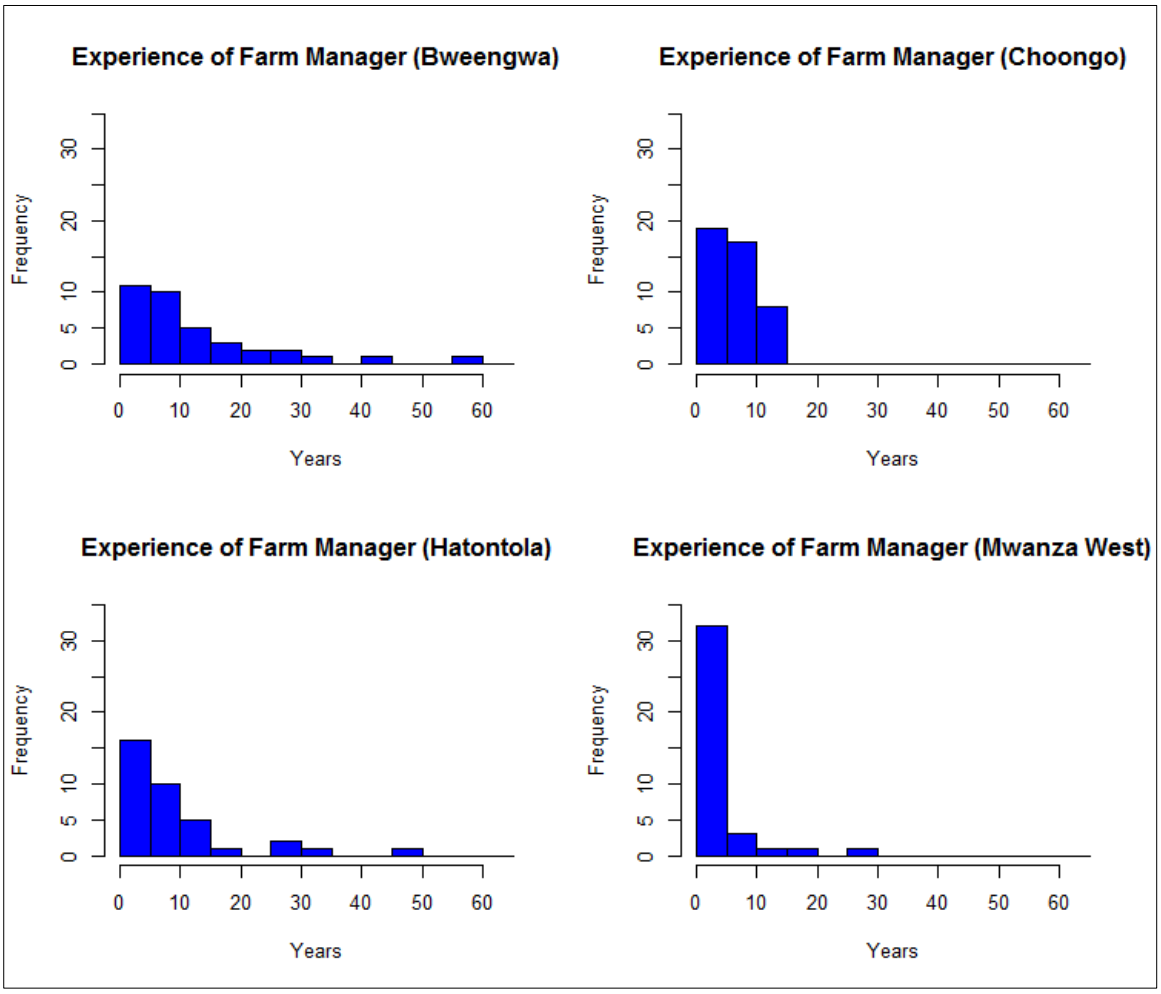

Figure 4.2: Comparisons of Farm Manager's experience across survey locations

Figure 4.3 compares the number of years each farm has been in operation. From this figure it can be said that the majority of farms have been in operation for the past 5 to 20 years.

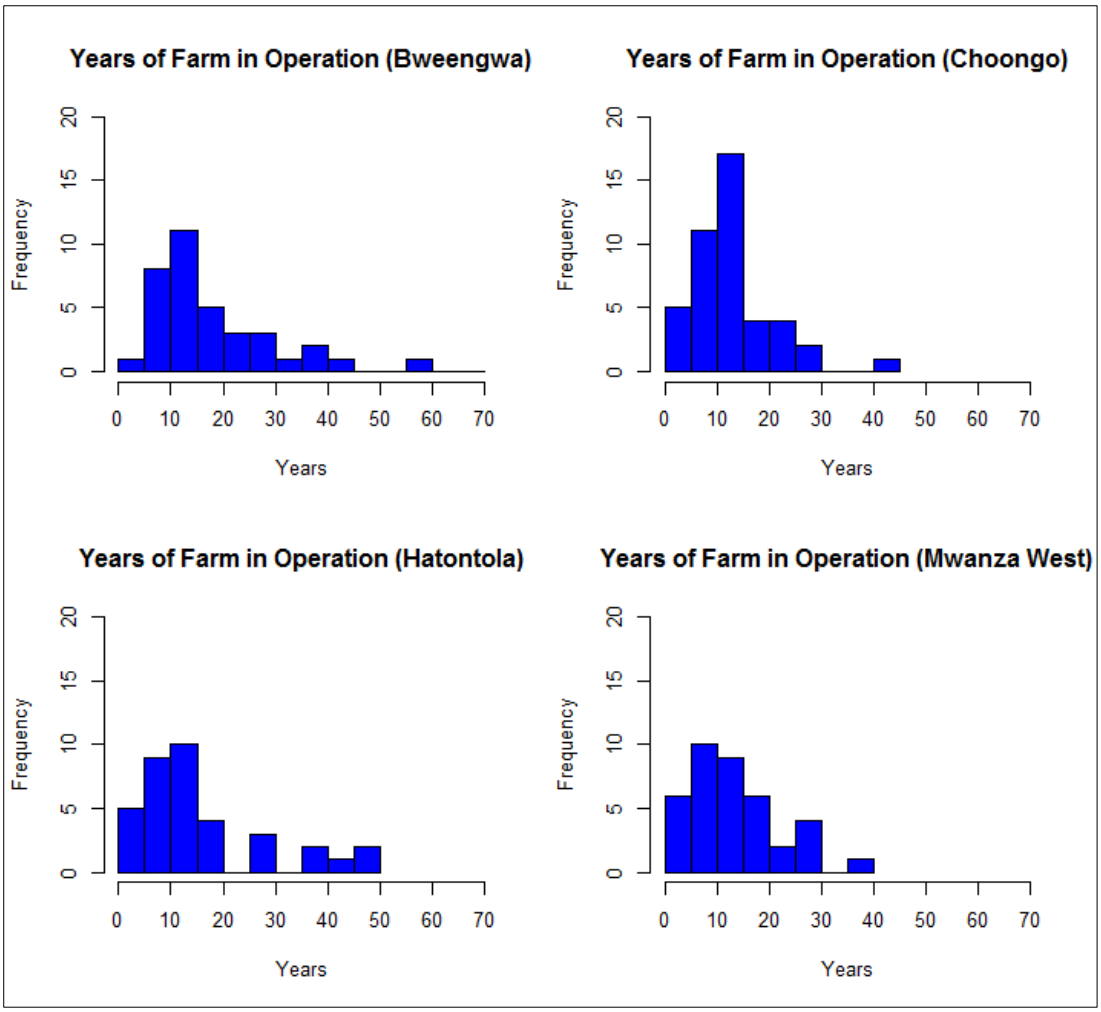

Figure 4.3: Comparisons of years in operation of the farm across survey locations

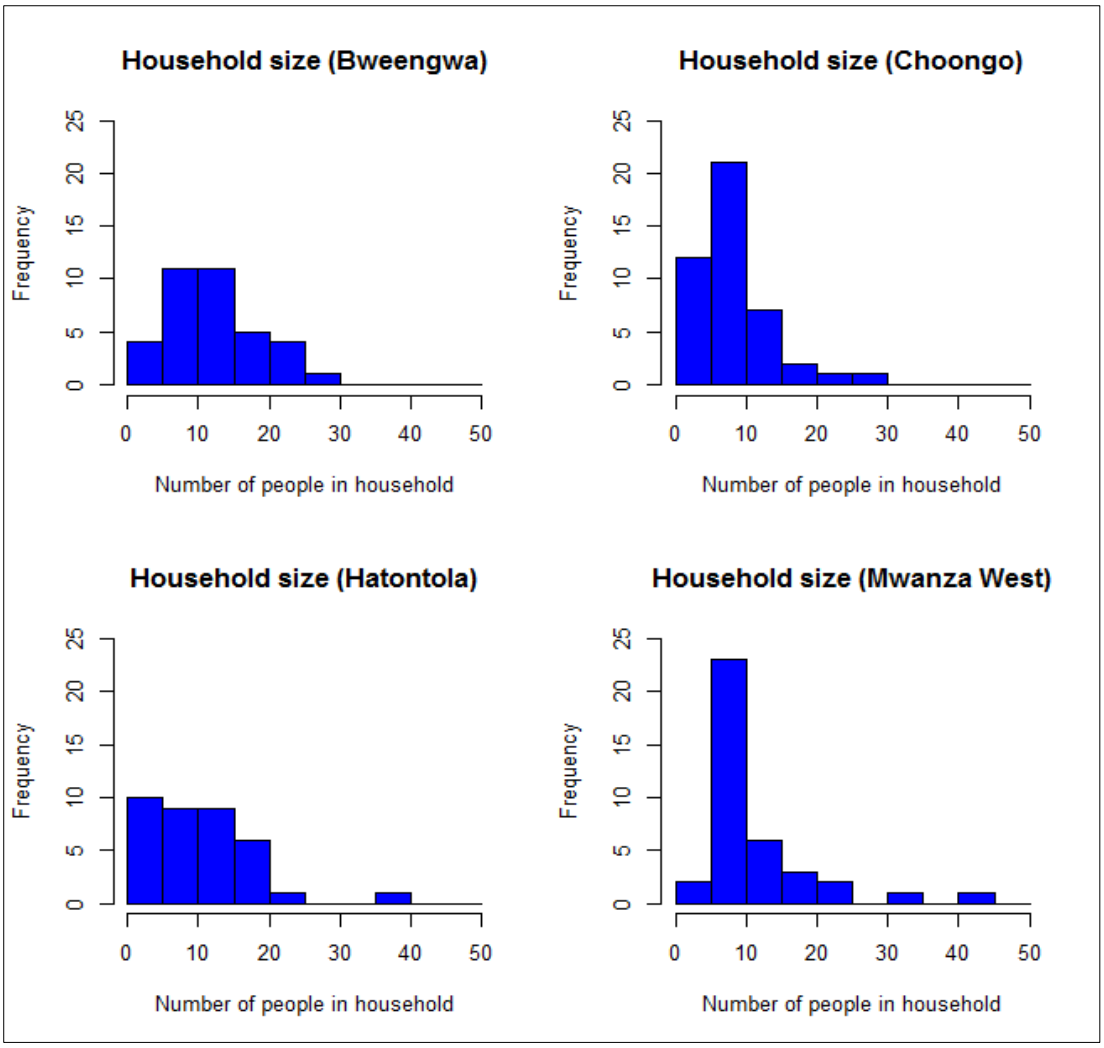

Figure 4.4: Comparisons of farm household size across survey locations

4.2.3 Descriptive Statistics

The descriptive statistics are presented in two tables. Table 4.3 shows the descriptive statistics of the respondents grouped by location and Table 4.4 groups the descriptive statistics of the respondents by market behaviour. These Tables better display any variations that may exist in the characteristics of the respondents among the four study sites and among the four different marketing behaviours.

From Table 4.3 below it can be noted that the average age of the respondents was 44 years, with the youngest being 20 and the oldest being 95 years old. This is within the average age of farm owners (most of the traditional farms are managed by farm owners as confirmed in the results of this survey in Table 4.1). This average age of 44 years was within the findings by Chilonda et al (2000) who found that traditional cattle producers in Eastern

province of Zambia were between the ages of 36 to 55. On average, Table 4.3 below shows the respondents had 8 years of experience as farm managers, the most experienced however had as many as 60 years of experience as farm manager and 1 year as the least experienced. The average household size was 11 people per household. These households owned an average herd size of 57 heads of cattle with the largest number coming from Mwanza West at 441 cattle. These herd sizes vary amongst different studies depending on cattle population dynamics during the time of the survey. Some studies in Monze district have reported an average cattle herd of 24 cattle per household while others have reported 10 cattle per household (Kadohira & Samui, 2001; Mumba et al., 2013).

Mwanza West also had the highest average number of cattle per household (61 head of cattle) compared to the other three study sites. This was followed by Bweengwa with 59 cattle head per household, 56 for Choongo East and Hatontola had the least cattle head at 55 per household. Mwanza West would therefore be expected to have the highest sales according to Lubungu (2013) who found farmers that kept more cattle sold more cattle than those with less, but instead the highest sales are reported in Bweengwa that had an average of 5 head of cattle sold per household for the study period, while Mwanza West had the least average sales at 1 head of cattle per household during the study period.

The low cattle sales in Mwanza West can be due to other factors that influence farmers' decisions to sell cattle such as cultural use of cattle, transaction costs, risks, educational status of farm manager, level of crop commercialization and general use of cattle (Bailey et al., 1999; Lubungu et al., 2013). More detail will be covered on market participation among these farmers in Section 4.4 under marketing. Looking at the standard deviation in the Table 4.3 above, some variation can be seen in cattle sales for Choongo East and Mwanza West while Hatontola and Bweengwa are quite similar. The coefficient of variance however indicates significant variation among all the four sampled wards. Cross-tabulation and Pearson's chi-square was therefore done to check for possible relationships between location and market participation. The results are as shown in Section 4.5 and the appendices.

Table 4.3 Descriptive Statistics grouped by Location

Characteristic	N	Mean	Median	Co efficient of variance	Standard Deviation	Minimum	Maximum	Kurtosis	Skewness
Age of Farm Manager (Years)									
Mwanza West	38	50	51	34%	17	20	90	-0.38	0.38
Choongo East	44	38	37	29%	11	20	63	-0.7	0.4
Haatontola	36	44.8	41.5	39%	17	22	95	0.7	1
Bweengwa	36	43	39.5	29%	12.54	25	86	3.7	1.6
Total	154	43.8	41	34%	15	20	95	0.82	0.96
Household Population									
Mwanza West	38	12	10	64%	7.6	5	43	8.7	2.8
Choongo East	44	8.6	6	62%	5.3	3	26	2.7	1.7
Haatontola	36	11	10	67%	7.3	3	39	4.9	1.7
Bweengwa	36	13	12	47%	6	5	26	-0.5	0.6
Total	154	10.9	9	61%	6.7	3	43	4.9	1.8
Years of Experience (Years)									
Mwanza West	38	4	2	139%	5.9	1	30	108	3
Choongo East	44	6.5	6.5	61%	3.9	1	15	-0.6	0.6
Haatontola	36	10	6	103%	10	1	48	5	2
	36	13	9	95%	12.6	2	60	4.4	1.9
Total	154	8	5	113%	9	1	60	9	2.7

Total Number of Cattle Owned/ household									
Mwanza West	38	61	36	130%	79	7	441	14	3.5
Choongo East	44	56	35	117%	65	8	306	6.6	2.6
Haatontola	36	55	41	104%	57	9	331	16	3.6
Bweengwa	36	59	34.5	101%	59	14	293	7	2.5
Total	154	57	35	88%	65	7	441	11	3
Total Number of Cattle Sold/household									
Mwanza West	38	1	1	119%	1.5	0	6	1.4	1.3
Choongo East	44	3	2	123%	4	0	15	2.3	1.7
Haatontola	36	4	1	217%	7.6	0	45	26	4.8
Bweengwa	36	5	3	138%	7	0	31	5	2
Total	154	3	1	175%	5.6	0	45	24	4
Total Number of Cattle Purchased/household.									
Mwanza West	38	1	0	162%	1.5	0	5	2	1.8
Choongo East	44	1.6	1	126%	2	0	8	3	1.8
Haatontola	36	2	0.5	179%	3	0	13	7.4	2.7
Bweengwa	36	2	1	147%	3	0	12	8.3	2.5
Total	154	2	1	153%	2.3	0	13	9.4	2.7

It can be noted from Table 4.4 that among the respondents, the Buyers were mainly the younger generation with an age range of 23 to 38 years. The Buyers also have the least experience in managing the farm enterprises (2 years on average) and have the least number of both cattle and other livestock. From these observations, it is likely that Buyers are mainly start-up farmers who are still building up stock on their farms and hence their interest in purchasing being more than their participation in purchasing cattle.

Table 4.4 shows descriptive statistics based on the 4 market behaviours identified in this study. That is the Trader, Seller, Buyer, and Holder. It can be noted from this table that Buyers among the respondents were mainly the younger generation with an age range of 23 to 38 years. These Buyers also have the least experience in managing farms at 3 years on average. The Buyers are also seen to have the smallest household numbers of the four types of market behaviour. The highest average age among the four types of market participation was 50 years which was among the Sellers, followed by the Holders at an average age of 44 years. Next to the Buyers, the Traders were found to have the second lowest average age at 43 years. The oldest farm manager among the Traders was however found to be 95 years of age while the Buyers had a 38 year old farm manager as the oldest. A study of Zambian smallholder cattle farmers shows that older farmers participate more in livestock markets as sellers than do younger farmers and found a statistical difference in cattle selling behaviour of farmers by their age (Lubungu, 2013). This study by Lubungu also found that the household size affected market participation as farmers with larger households were inclined to have more seller behaviour than those with smaller household sizes.

Traders are also noted as having the most experience as farm managers (9 years), followed by the Sellers and Holders who have the same years of experience (8 years). The least experienced are the Buyers with three years' experience as farm managers. This was also the case for survey as the Traders and Sellers had the largest household population as compared to the Buyers who had the least and the Holders who had the second largest. The Traders had the highest number of cattle per household followed by the Sellers and the Buyers had the least. This was not a surprise as households with higher cattle numbers sell more than those with less (Barrett et al., 2004; Lubungu et al., 2013). Cross tabulation and Pearson's chi-square was used to investigate relationship between the market behaviour and the characteristics shown in Table 4.3. The results showed that only age had a significant relationship with market behaviour of farmers while the other three characteristics

(experience of farm manager, number of cattle owned, and household population size) did not show any significant relationship. This contradicted other literature that found market behaviour was influenced by the experience of the farm manager, number of cattle owned by the farming household/ enterprise and the household population size (Lubungu, 2013; Lubungu et al., 2013). This variation however could be due to the limitations of our sample size in carrying out cross tabulation and Pearson's chi-square test. Chi-square tests are less accurate when done on small sample sizes as was the case for our survey (Healey, 2014).

Table 4.3: Descriptive Statistics grouped by Market behaviour

Characteristic	N	Mean	Median	Standard Deviation	Co-efficient of Variance	Minimum	Maximum	Kurtosis	Skewness
Age of Farm Manager (Years)									
Trader	74	43	41	14.0	33%	20	95	2.7	1.2
Seller	31	50	48	15.0	30%	22	82	-0.5	0.5
Buyer	10	31	32	5.7	43%	23	38	-2	-0.2
Holder	39	44	39	16.0	38%	23	86	0.05	0.9
Household Population									
Trader	74	12	10	7.5	63%	3	43	3.5	1.5
Seller	31	10	10	4.0	43%	4	23	1.8	1
Buyer	10	8	8	3.4	18%	4	15	1.2	0.9
Holder	39	11	9	7.0	67%	3	36	6	2
Years of Experience (Years)									
Trader	74	9	7	8.0	87%	1	34	1.7	1.5
Seller	31	8	5	9.0	113%	1	42	5	2
Buyer	10	3	2	10.0	81%	1	7	1.9	1.8
Holder	39	8	4	12.0	114%	1	60	12	3.4
Total Number of Cattle Number									
Trader	74	63	41	74.0	118%	8	441	12	3.2
Seller	31	57	31	62.0	107%	13	293	7	3
Buyer	10	36	21	50.0	139%	7	175	8	2.8
Holder	39	53	37	54.0	102%	14	267	8	3

4.3 Perceptions of Sources of Risk and Risk Management Strategies

4.3.1 Introduction

This section presents the results from the assessment of perceptions of sources of risk and risk management strategies, and risk profile questions. There are a total of five sub-sections within this section, inclusive of the introduction. The introduction is followed by a sub-section, 4.3.2 looking at perceptions of sources of risk as an opportunity and as a threat. This sub-section 4.3.2 shows the distribution of responses to perceptions of risk among all the respondents. What follows is a sub-section assessing the perceptions on risk that are in sub-section 4.3.2. Assessment of perceptions of risk is done using risk importance indices and risk choice matrices. The assessment of perception of sources of risk is done first for the entire study population and then based on study location and on market behaviour. The sub-section that follows looks at the assessment of the risk management strategies. The last sub-section looks at the risk profiles of the respondents. This last section uses responses from part C (IV) of the questionnaire to categorise the respondents' risk profiles and specific risk attitudes as shown in Table 4.9. The respondents' characteristics are then presented with respondents grouped by their risk attitudes.

4.3.2 Perceptions of sources of risk

Table 4.5 below shows the distribution of responses from all the respondents on perceptions of risk as a benefit to their farming enterprises. Table 4.6 shows the same distribution for the study population, except looking at downside risk. The most important sources of risks that the farmers identified as having potential benefit for their farms, mentioned in order of importance scoring are input price variability, changes in technology, succession, labour availability and livestock health and climate variation with the same scores. Of least importance as benefit for their farms where bank interest volatility, availability of capital, business contract changes, natural disasters and access to market for products.

From Table 4.6 we find that the most important threats for these farmers are input price variability, natural disasters, livestock thefts, availability of labour and livestock health. The least threat is seen in changes in availability of capital, input access, access to market for farm products, succession and market information with the same score and changes in technology. These farmers perceived input price variability, availability of labour and

livestock health to be important both as threats and as opportunities for their farming enterprises.

Similarities in perceived opportunities between the traditional cattle farmers in this study with the New Zealand dairy farmers in Shadbolt and Olubode-Awasola's (2013) survey can be seen in the perceived opportunity from technology changes and risk associated with labour. Variability in input prices was perceived as very important threats by both studies. However while New Zealand dairy farmers saw access to inputs to be a high threat, the traditional cattle farmers in Monze perceived this risk to be of little threat to their enterprises.

Although risk perception varies with location, we find the beef producers in Texas and Nebraska have similar perception of cattle price variation (price variation when buying cattle) and cattle disease/ health as important threats (Hall et al., 2003). While the smallholder dairy farmers in Tigray Ethiopia perceive technology as an important threat, the farmers surveyed in Monze perceive it as one of the opportunities rather than a threat (Gebreegziabher & Tadesse, 2014). The Ethiopian farmers however do have similarities with the Zambian farmers in their perceived importance of price risk as a threat.

Table 4.4: Distribution of responses on perception of risk as an opportunity

Source of risk	N	Mean	Median	Percentage response					
Risk Sources				Very low	Low	Medium	High	Very high	Total
Input price variability	154	3	3	4%	18%	27%	29%	23%	100%
Changes in technology	154	3	3	9%	22%	25%	32%	11%	100%
Succession	154	3	3	8%	23%	32%	33%	3%	100%
Labour availablity	154	3	3	3%	28%	40%	23%	7%	100%
Livestock health	154	3	3	12%	8%	50%	23%	6%	100%
Climate variation	154	3	3	2%	25%	49%	14%	11%	100%
Feed/ pasture availability	154	3	3	11%	24%	40%	15%	10%	100%
Livestock thefts	154	3	3	19%	14%	43%	10%	14%	100%
Changes in policy and government laws	154	3	2	13%	41%	23%	10%	13%	100%
Plant diseases and pests	154	3	3	8%	32%	40%	16%	5%	100%
Product price variability	154	3	2	12%	32%	35%	19%	3%	100%
Crop yield variation	154	3	3	4%	29%	47%	12%	8%	100%
Input access	154	3	3	10%	40%	31%	15%	5%	100%
Market information access	154	3	3	10%	25%	46%	15%	5%	100%
Product market access	154	3	3	10%	39%	32%	16%	3%	100%
Natural Disasters	154	3	3	13%	31%	38%	14%	4%	100%
Business contract changes	154	2	2	22%	45%	21%	7%	5%	100%
Availability of capital	154	2	3	25%	21%	42%	8%	3%	100%
Bank interest volatility	154	2	2	25%	40%	23%	6%	5%	100%

Table 4.5: Distribution of responses on perception of risk as a threat

Source of risk	N	Mean	Median	Percentage response					
				Very low	Low	Medium	High	Very high	Total
Input price variability	154	3	3	6%	15%	31%	39%	10%	100%
Natural Disasters	154	3	3	6%	19%	26%	40%	9%	100%
Livestock thefts	154	3	3	7%	26%	20%	17%	30%	100%
Labour availablity	154	3	3	8%	15%	32%	39%	6%	100%
Livestock health	154	3	3	3%	18%	42%	27%	10%	100%
Plant diseases and pests	154	3	3	2%	15%	48%	25%	10%	100%
Changes in policy and government laws	154	3	3	3%	21%	44%	16%	16%	100%
Changes in policy and government laws	154	3	3	3%	21%	44%	16%	16%	100%
Product price variability	154	3	3	5%	34%	31%	24%	6%	100%
Crop yield variation	154	3	3	6%	22%	46%	19%	6%	100%
Feed/ pasture availability	154	3	3	10%	18%	48%	14%	11%	100%
Bank interest volatility	154	3	3	14%	23%	41%	16%	6%	100%
Climate variation	154	3	3	6%	16%	56%	18%	5%	100%
Business contract changes	154	3	2	12%	41%	26%	15%	6%	100%
Changes in technology	154	3	2	10%	45%	25%	11%	9%	100%
Market information access	154	3	3	6%	28%	46%	16%	3%	100%
Succession	154	3	3	11%	36%	34%	16%	3%	100%
Product market access	154	3	3	5%	24%	56%	14%	1%	100%
Input access	154	3	3	5%	44%	38%	14%	0%	100%
Availability of capital	154	2	2	16%	44%	31%	6%	2%	100%

4.3.3 Assessment of Perceptions of Sources of Risk

Further assessment of importance of risk sources was done using risk importance index and risk choice matrix. These take into consideration the likelihood of risk to occur and the perceived impact of risk as an opportunity or threat as described in the methodology chapter.

Figure 4.5 is shows the results of the risk importance index for all the respondents while Figures 4.6 to 4.9 show the risk importance index for each of the four study sites (Bweengwa, Choongo East, Hatontola and Mwanza West). The risk importance indices for the four study sites are then followed by Figures 4.10 to 4.13 which are the indices for each of the four market behaviour types (Trader, Seller, Buyer and Holder). The risk choice matrices based on location and market behaviour then follow from Figures 4.14 to 4.22.

Based on the risk importance index, the most important threats for all the respondents were due to natural disasters, labour availability, livestock thefts, input price variability and plant diseases and pests. Of least importance are threats arising from availability of capital,

market information access, business contract changes, changes in technology and access to markets for products. Not much change has occurred in the most important threats as perceived by all the farmers in the survey after taking into account the likelihood of risk occurring as a threat. The order of importance of sources of risk has however changed as input price variability is no longer the most important threat but rather the fourth. Livestock health has completely been replaced by risks due to plant diseases and pests as one of the most important threats. With the exception of risk due to variation in input access which is now a more important threat than before, the least important sources of risk are still the same when likelihood of threat occurring is considered and when it is not.

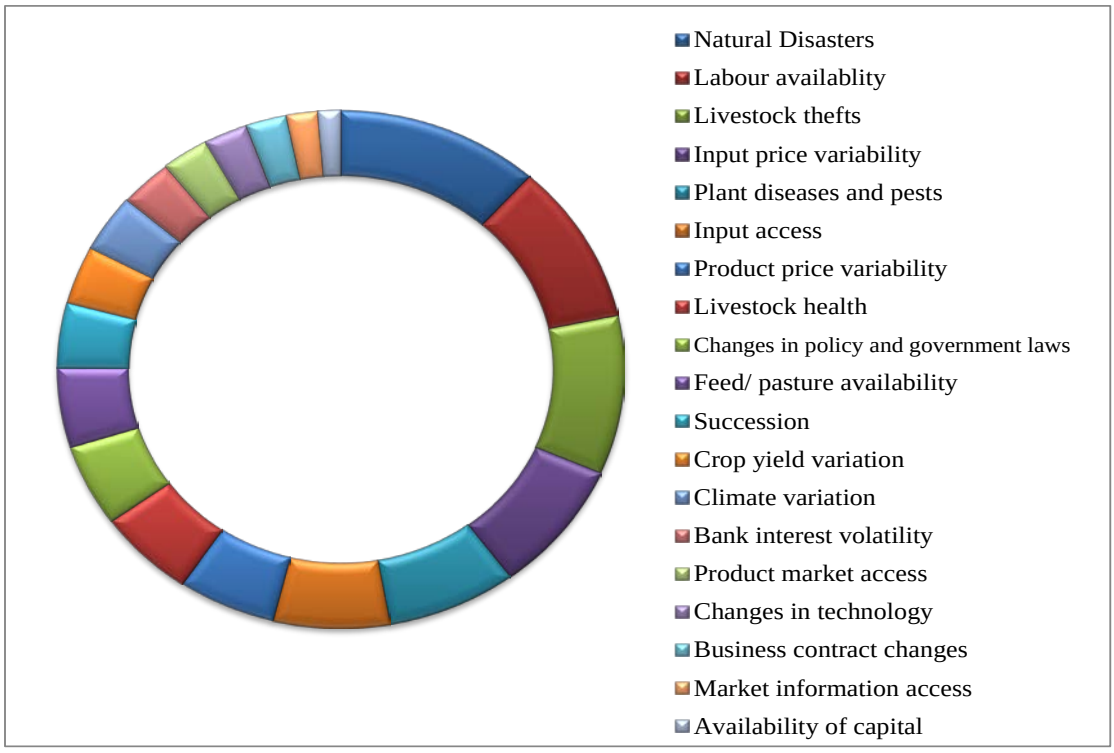

Figure 4.5: Risk Importance Indices for all respondents ranked in descending order

4.3.3.1 Risk Importance Index based on location

Figures 4.6 to 4.9 show the respondents' perceived importance of the identified sources of risk in descending order of importance as a threat. These indices are based on location. The findings of the risk importance index in Figures 4.6 to 4.9 are summarized in Table 4.6 below.

Production risk can be seen to be a concern for all the farmers, particularly livestock theft for all four study sites and natural disasters for Bweengwa, Choongo East and

Hatontola. The availability of labour is also a source of concern for all the farmers, although the degree to which it is perceived as important varies. All the respondents perceive availability of capital to be of low importance as a source of risk.

Variations can be seen in the perception of risks among respondents from different locations. Respondents from Choongo East were the only ones who perceived risk from livestock disease to be of high importance, while the respondents from Bweengwa and Hatontola saw plant diseases and pests to be more important. Respondents from Mwanza West are observed to be the most different in their perception of risk from the respondents from the other three study sites. Respondents from Mwanza West were the only ones who considered changes in policy and government laws, crop yield variation and feed/ pasture availability to be important sources of risk while the respondents from the other study sites did not. These three sources of risk could not be captured as being important by the risk importance index in Figure 4.5 (risk importance index for all the respondents) because this was an average of all the responses. This shows the importance of being more specific to the population of interest in order to capture the most accurate perceptions of risk.

Overall production risk can be seen to be the most important source of risk for the respondents from Mwanza West. Although the other three study sites also list production risk as the most important source of risk, differences can be seen in that price risk in the form of input price variability is among the first five important sources of risk for Bweengwa, Choongo East and Hatontola whereas this ranks as the tenth important source of risk for Mwanza West. Among the four study sites, respondents from Bweengwa can be noted as ranking variability in both input and product price as being important. Respondents from Bweengwa perceive variability in price risk as being more important compared to the respondents from Haatontola and Choongo East who only perceive input price variability as being relatively important and respondents from Mwanza West who perceive both input and product price variability to be of low importance.

These findings can be related to Table 4.3 which shows respondents from Mwanza West as having the least number of cattle sales and purchases, and those from Bweengwa as having the highest number of both sales and purchases. Figure 4.9 below shows that the respondents from Mwanza West are more concerned about production rather than price or market risk which can be related to their high cattle number (they have the highest number of cattle per household) and low participation in cattle markets (they have the least sales and

purchases) during the study period. The respondents from Bweengwa who are most concerned about price risk have the highest number of both sales and purchases. This could indicate a relationship between market participation and farmers' perception of risk. But it could also indicate a relationship between market participation and location, or risk perception and location. Statistical analysis is therefore required to identify whether there is a relationship among these variables mentioned.

Table 4.6: Summary of results for risk importance index based on location

All respondents	**Bweengwa**	**Choongo East**	**Hatontola**	**Mwanza West**
Most important threats in descending order of importance				
Natural disasters	Livestock thefts	Natural disasters	Natural disasters	Changes in policy and government laws
Labour availability	Natural disasters	Labour availability	Livestock thefts	Crop yield variation
Livestock thefts	Input price variability	Input price variability	Plant diseases and pests	Livestock thefts
Input price variability	Plant diseases and pests	Livestock thefts	Labour availability	Feed/ pasture availability
Plant diseases and pests	Labour availability	Livestock health	Input price variability	Labour availability
Least important threats in descending order of importance				
Market access for products	Crop yield variation	Business contract changes	Market access for products	Input access
Changes in technology	Feed/ pasture availability	Bank interest volatility	Changes in technology	Market information access
Business contract changes	Changes in technology	Input access	Market information access	Business contract changes
Market information access	Market access for products	Market information access	Availability of capital	Bank interest volatility
Availability of capital	Availability of capital	Availability of capital	Succession	Availability of capital

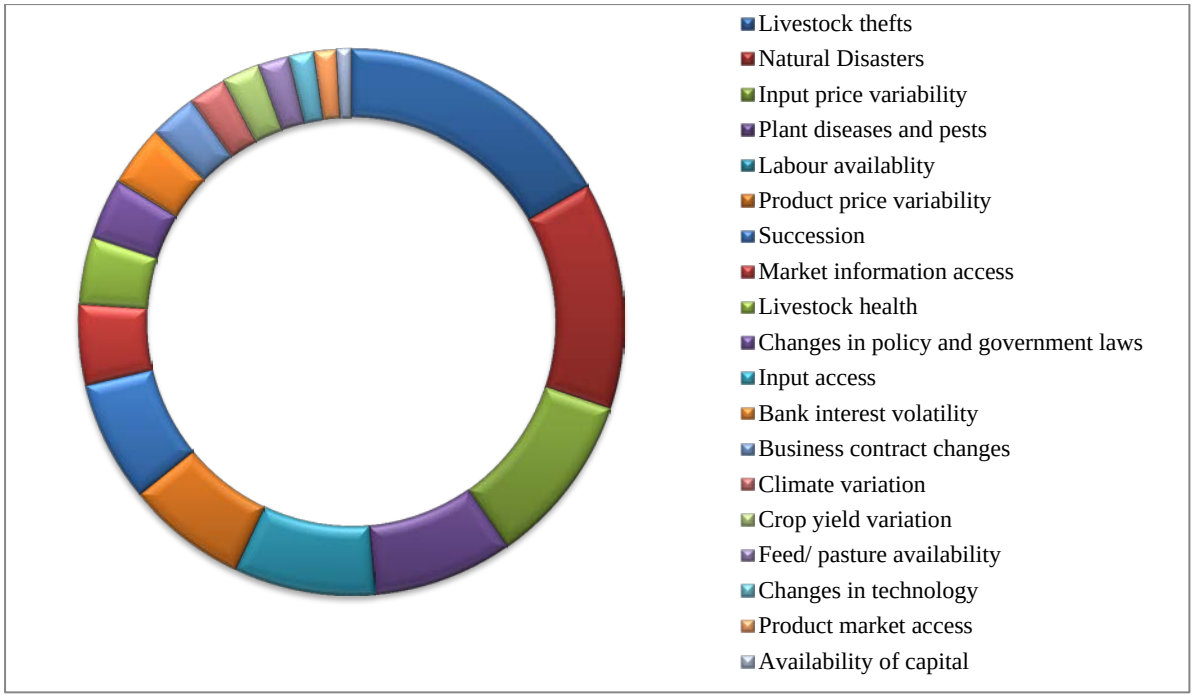

Figure 4.6: Risk Importance Indices for Bweengwa ranked in descending order

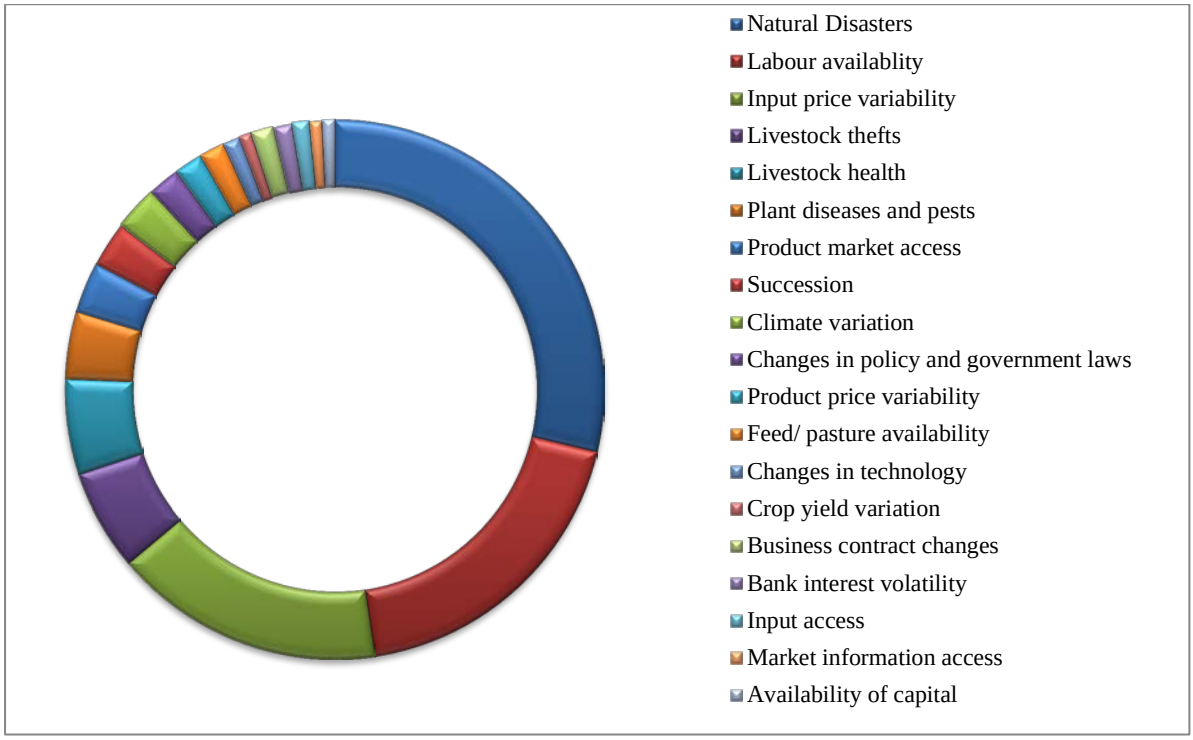

Figure 4.7: Risk Importance Indices for Choongo East ranked in descending order

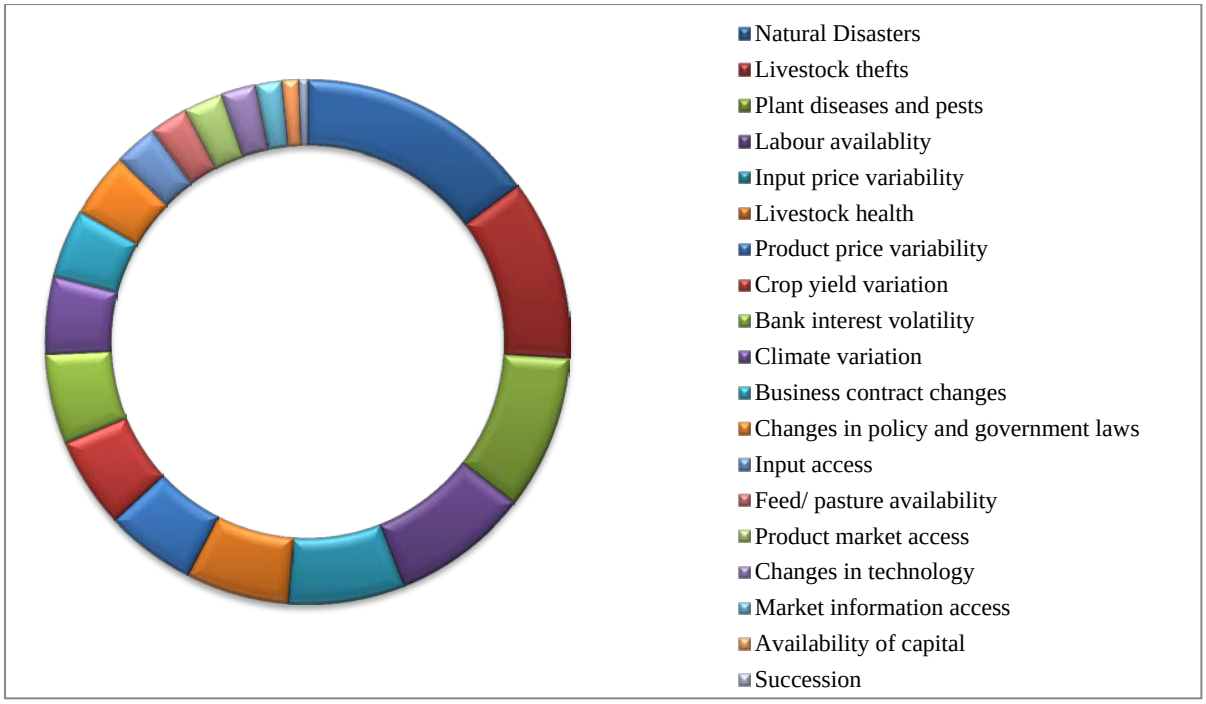

Figure 4.8: Risk Importance Indices for Haatontola ranked in descending order

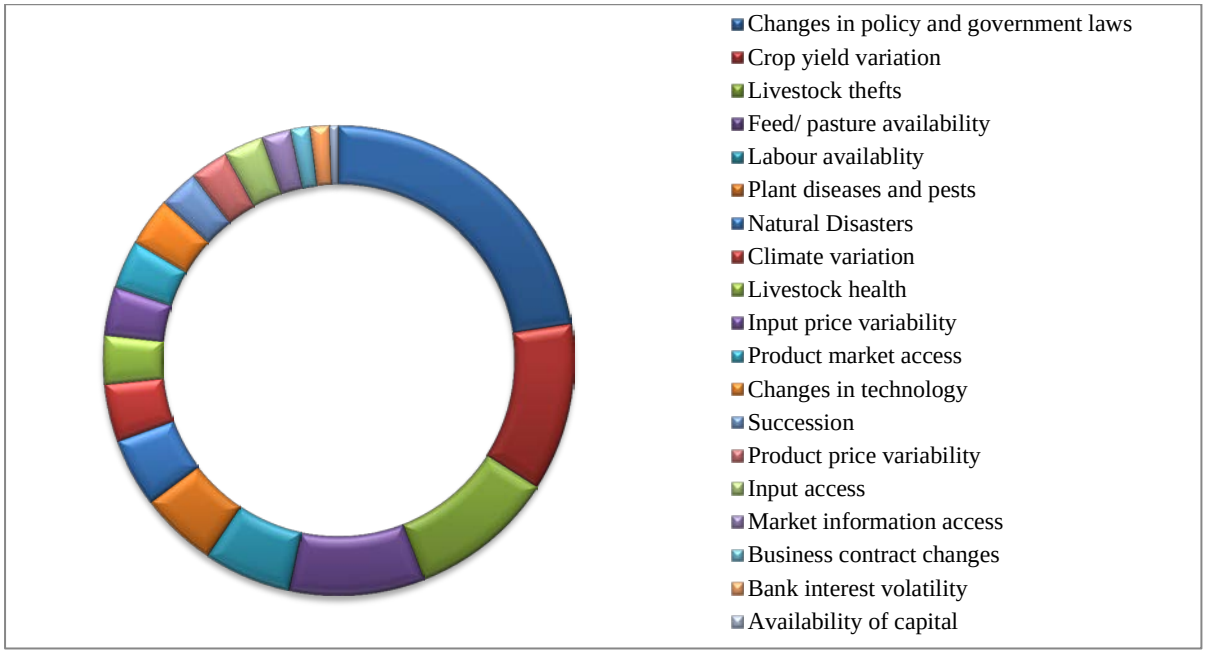

Figure 4.9: Risk Importance Indices for Mwanza West ranked in descending order

4.3.3.2 Risk Importance Index based on Market Behaviour

Below (Figure 4.10 to 4.13) are similar indices as in Figures 4.6 to 4.9, except these are grouped by market behaviour of the respondents. Figures 4.10 to 4.13 above show that perceptions of sources of risk are almost similar since all four types of market behaviour consider one or more types of production risk to be the most important source of risk, with the exception of Buyers who perceive price risk (input price variation) and availability of labour to be the most important source of risk. Similar to the risk importance indices based on location, availability of capital is perceived to be of least importance among the respondents when grouped by market behaviour.

A few differences in risk perception of farmers can be noted when the farmers are grouped by their four market behaviours. Narrowing down on price risk as was done with the indices based on location, it can be seen that the Traders consider input and product price variability to be relatively important, which is consistent with the respondents from Bweengwa whose market behaviour can be defined as that of Traders as they buy and sell cattle more than the other respondents. Respondents from Hatontola also have perceptions of risk that are similar to those of Traders and Bweengwa respondents. Considering the respondents from Hatontola had the second highest number of cattle sales per year at 4 head of cattle and same number of cattle purchases at 2 head of cattle per year. These cattle sales and purchase figures for Hatontola are almost similar to those of Bweengwa (the only difference is the average number of cattle sold per household which is higher by one for Bweengwa). Respondents from Bweengwa and Hatontola can thus be seen as exhibiting risk perception and market participation characteristics of a Trader.

Sellers are more concerned about production risk and changes in government policies and laws. It would be expected that being cautious of and monitoring market risk is a priority for Sellers rather than market risk being perceived as having low importance. However, this low perception in importance of market risk could be explained as Sellers being comfortable with market risk hence their willingness to sell cattle. Sellers are more concerned with ensuing they maintain steady production for them to continue selling and government laws that affect ability to sell particularly in Zambia where livestock movement bans have affected traditional cattle farmers' participation in cattle markets (Lubungu et al., 2013).

The Buyers can be seen in Figure 4.11 to perceive input price variability as the second most important source of risk. This is similar to the Holders who also consider input price variability to be a very important source of risk.

Table 4.7: Summary of results for risk importance index based on market behaviour

All respondents	**Traders**	**Sellers**	**Buyers**	**Holders**
Most important threats in descending order of importance				
Natural disasters	Livestock thefts	Livestock thefts	Labour availability	Natural disasters
Labour availability	Natural disasters	Natural disasters	Input price variability	Input price variability
Livestock thefts	Labour availability	Changes in policy and government laws	Changes in policy and government laws	Labour availability
Input price variability	Plant diseases and pests	Labour availability	Natural disasters	Plant diseases and pests
Plant diseases and pests	Input price variability	Succession	Succession	Livestock thefts
Least important threats in descending order of importance				
Market access for products	Business contract changes	Market access for products	Availability of capital	Changes in technology
Changes in technology	Succession	Changes in technology	Climate variation	Market access for products
Business contract changes	Input access	Input access	Crop yield variation	Market information access
Market information access	Availability of capital	Market information access	Market information access	Succession
Availability of capital	Changes in technology	Availability of capital	Bank interest volatility	Availability of capital

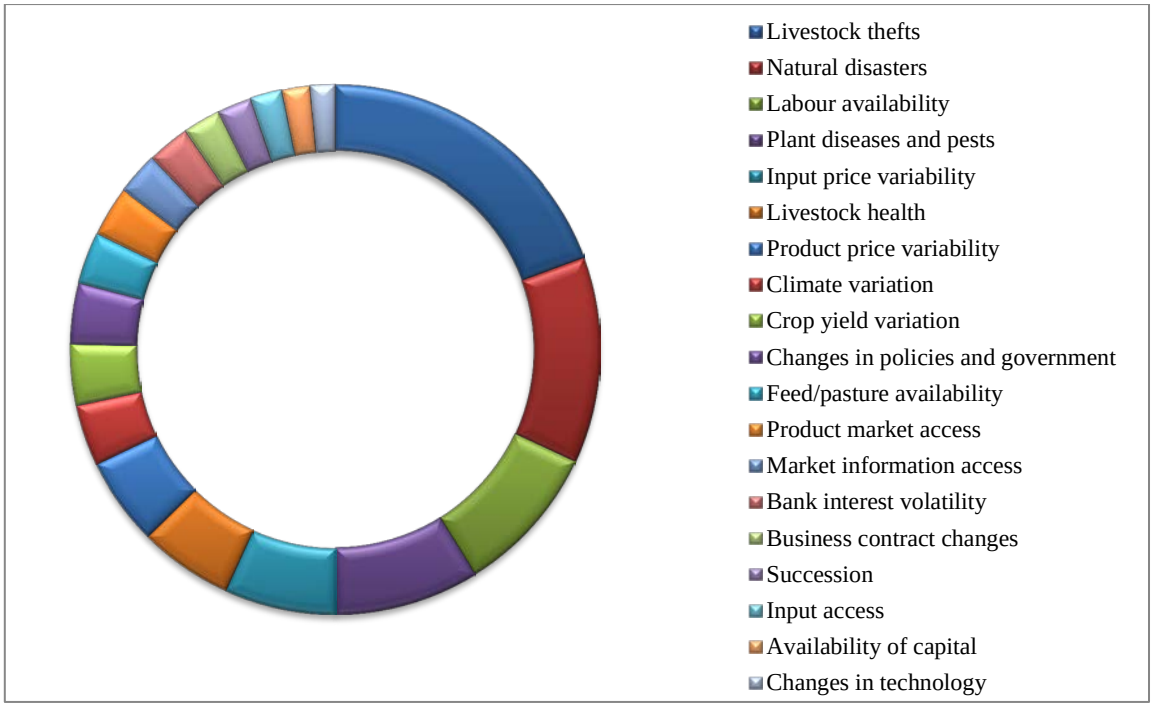

Figure 4.10: Risk Importance Indices for Traders ranked in descending order

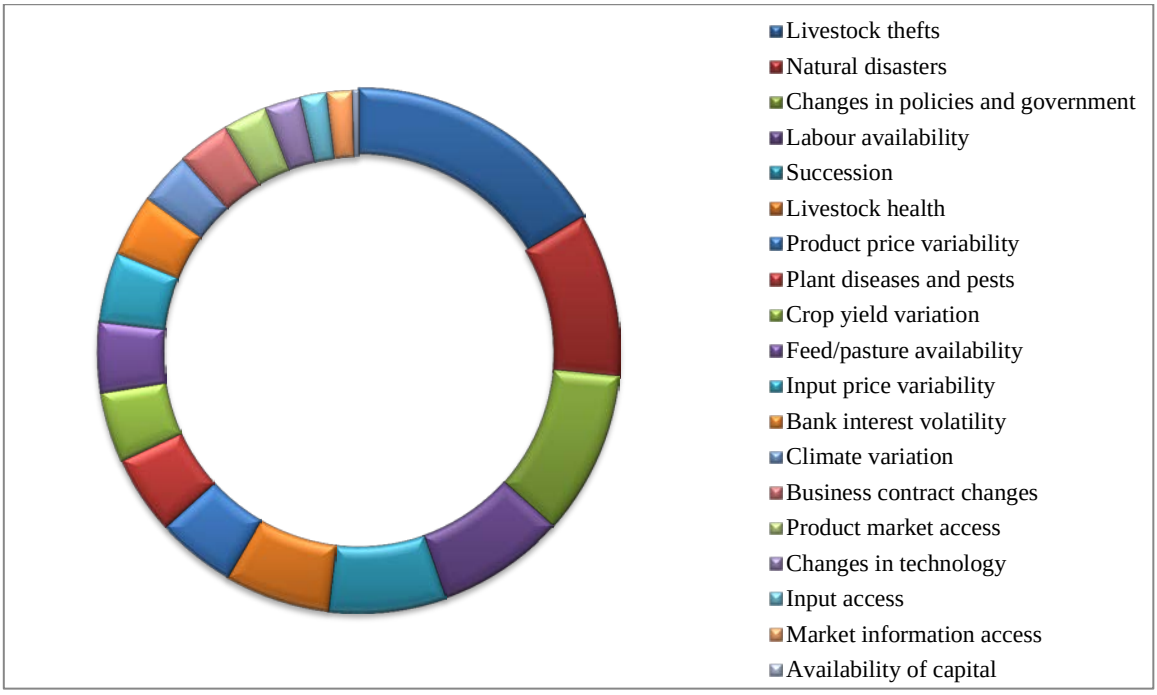

Figure 4.11: Risk Importance Indices for Sellers ranked in descending order

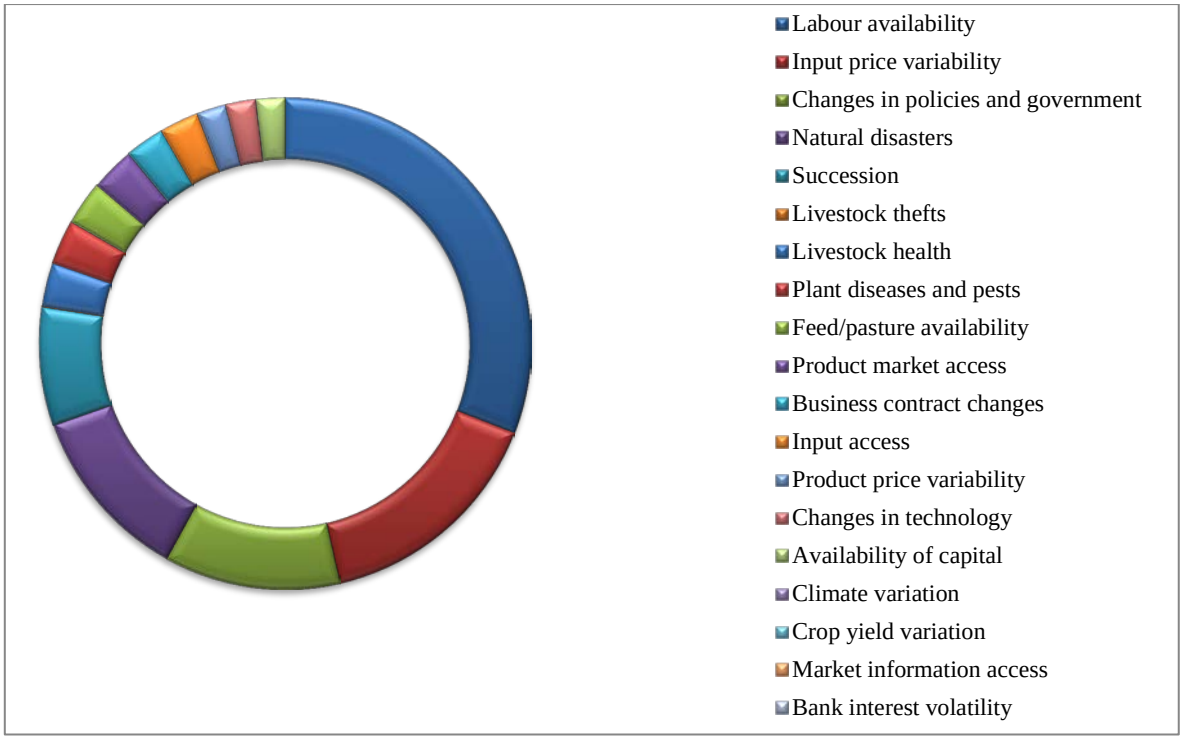

Figure 4.12: Risk Importance Indices for Buyers ranked in descending order

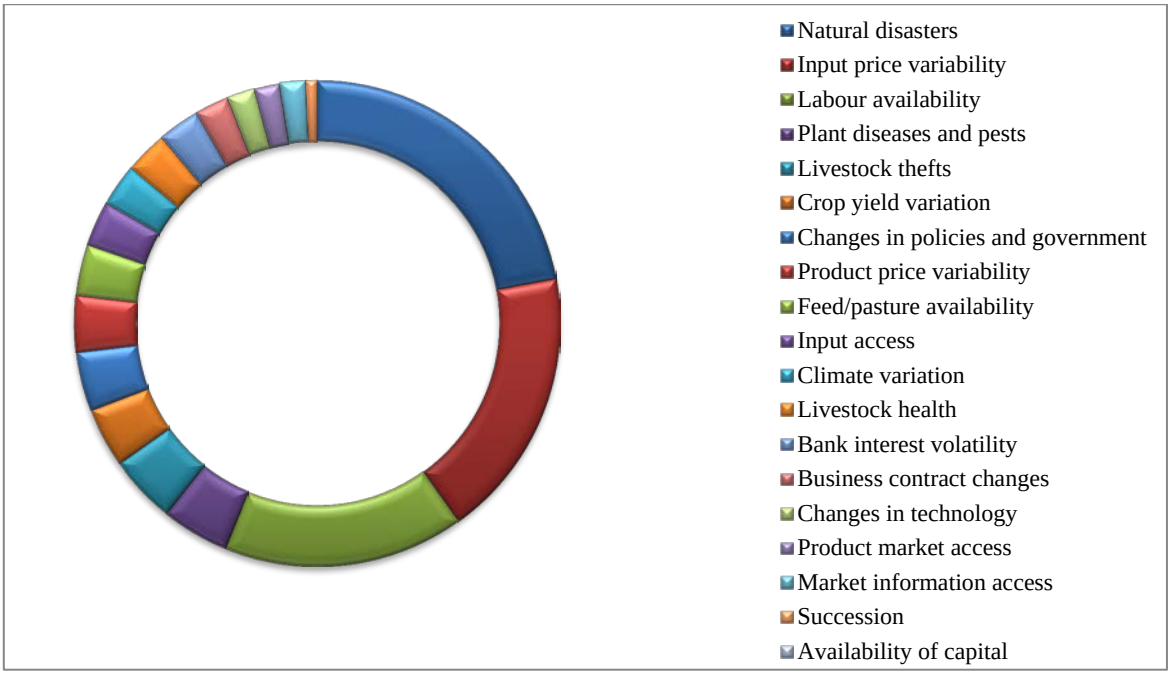

Figure 4.13: Risk Importance Indices for Holders ranked in descending order

4.3.3.3 Risk Choice Matrix based on location

Risk choice matrices were done to assess the perception of risk of respondents taking into consideration the impact of the risk and the likelihood of that risk happening for both downside and upside risk. This differs from the assessment done using the indices whose risk importance was based on calculations from the risk impact and likelihood scores for risk as a threat. While the indices above show negative perceptions of risk, the matrices show both the negative and positive perceptions of risk as can be seen in Figure 4.14 below.

Looking at the arrow of attention from the risk choice matrix based on location, it can be said that with the exception of respondents from Hatontola who appear to be risk neutral (see Figure 4.16), the respondents view risk more as a threat than an opportunity. The respondents from Hatontola perceive all sources of risk to be of minimal to moderate benefit and threat. This is the opposite of what we see with the respondents from Choongo East (Figure 4.15) who see opportunity in risk due to input price variation, and succession, and threat in risk due to natural disasters, availability of labour and input price variability. Respondents from Mwanza West consider risk to be more of a threat than an opportunity as they perceive risk from changes in policy and government laws to be the most important threat to their enterprises. This echoes the finding in Figure 4.9 where respondents from Mwanza West were the only respondents who perceived risk from changes in policy and government laws to be the most important threat. This is different from what we see with the farmers in Bweengwa who consider risk due to livestock threat, natural disasters and labour availability to be more of a threat than respondents from the other study sites.

The arrow of attention shows that the most common source of risk that the respondents view as an opportunity was risk due to variability in input prices. Despite this common element it can be seen that perceptions on sources of risk differ with location of the farmers or respondents. This is similar to what was found from the risk importance indices.

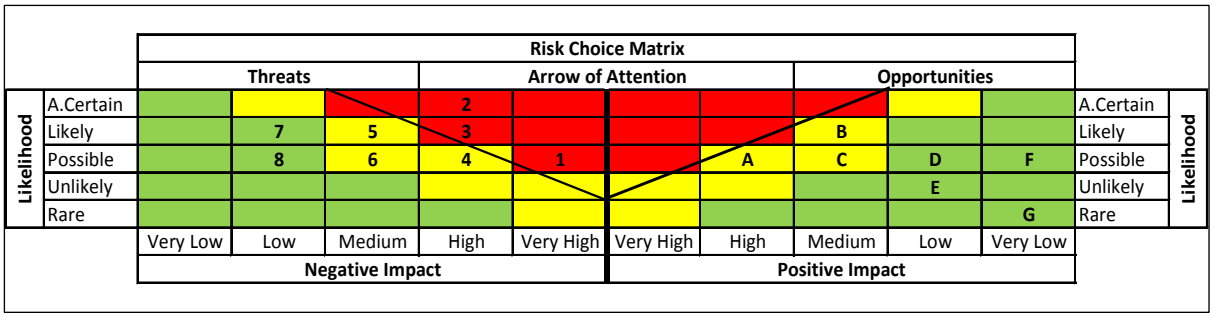

Figure 4.14: Risk Choice Matrix for Bweengwa

Opportunities to benefit from:

A-Input price variability, Changes in technology, Input access

B-Availability of capital, Natural disasters

C-Climate variation, Product price variability, Plant diseases and pests, Feed/ pasture availability, Labour availability, Product market access, Market information access, Succession

D-Crop yield variation, changes in policy and government laws, Bank interest volatility

E-Business contract changes

F-Livestock thefts

G-Livestock health

Threats to lose from:

1-Livestock thefts

2-Natural disasters

3-Labour availability

4-Input price variability

5-Product price variability, Input access

6-Business contract changes

7-Climate variation, Livestock health, Plant diseases and pests, Crop yield variation, Changes in policy and government laws, Feed/pasture availability, Product market access, Market information access, Bank interest volatility

8-Changes in technology, Succession, Availability of capital

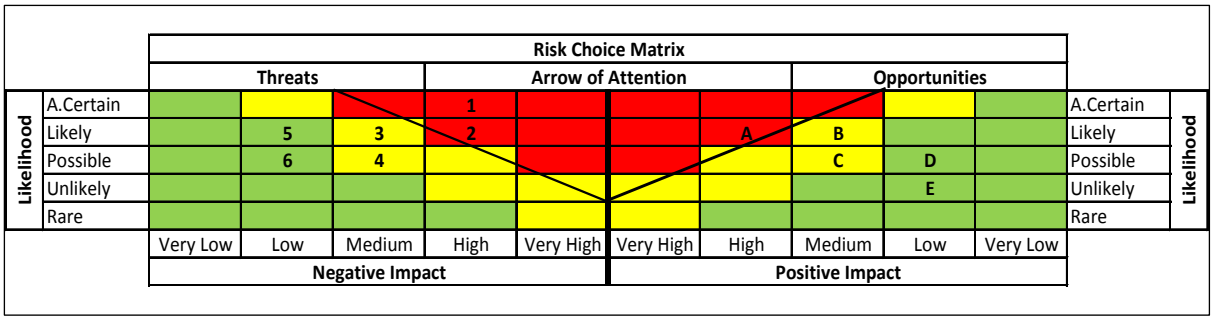

Figure 4.15: Risk Choice Matrix for Choongo East

Opportunities to benefit from:

A-Input price variability, Succession

B-Climate variation, Feed/ pasture availability, Changes in technology, Availability of capital, Natural Disasters

C-Livestock health, Plant diseases and pests, Crop yield variation, Livestock thefts, Labour availability, Market information access

D-Product price variability, Changes in policy and government laws, Input access, Product market access, Bank interest volatility

E-Business contract changes

Threats to lose from:

1-Natural Disasters

2- Input price variability, Labour availability

3- Plant diseases and pests, Product market access

4- Climate variation, Livestock health, Crop yield variation, Changes in policy and government laws, Livestock thefts, Feed/ pasture availability, Market information access, Bank interest volatility

5- Product price variability, Business contract changes, Input access, Succession

6-Changes in technology, Availability of capital

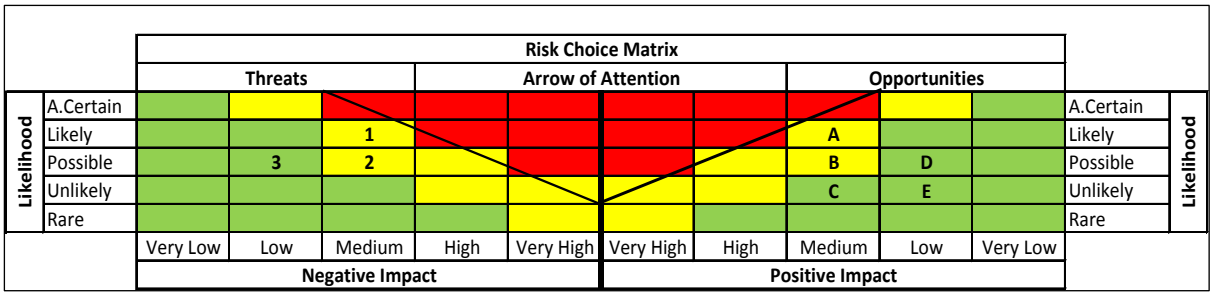

Figure 4.16: Risk Choice Matrix for Haatontola

Opportunities to benefit from:

A-Input price variability, Feed/pasture availability, Succession, Natural Disasters

B-Climate variation, Livestock health, Plants diseases and pests, Crop yield variation, Livestock thefts, Changes in technology, Labour availability, Market information access, Availability of capital

C-Product market access

D-Product price variability, Input access, Bank interest volatility

E-Changes in policy and government laws, Business contract changes

Threats to lose from:

1-Plant disease and pests, Labour availability, Natural disasters

2-Climate variation, Livestock health, Input price variability, Crop yield variability, Product price variability, Crop yield variation, Changes in policy and government laws, Livestock thefts, Feed/ pasture availability, Product market access, Bank interest volatility

3-Changes in technology, Business contract changes, Input access, Market information access, Succession, Availability of capital

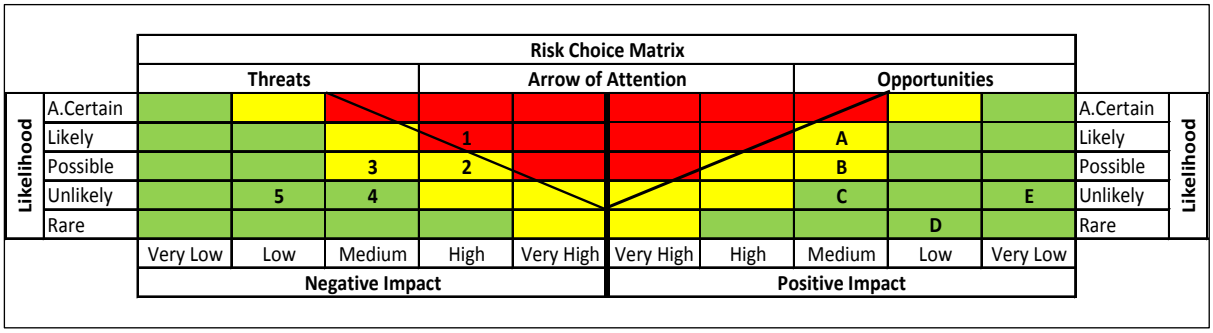

Figure 4.17: Risk Choice Matrix for Mwanza West

Opportunities to benefit from:

A-Feed/ pasture availability

B-Climate variation, Livestock health, Input price variability, Product price variability, Plant diseases and pests, Crop yield variation, Changes in policy and government laws, Livestock thefts, Changes in technology, Labour availability, Market information access, Succession

C- Business contract changes, Input access, Product market access

D-Natural Disasters

E-Bank interest volatility, Availability of capital

Threats to lose from:

1-Changes in policy and government laws

2-Crop yield variation

3-Climate variation, Livestock health, Input price variability, Product price variability, Plant diseases and pests, Livestock thefts, Feed/ pasture availability, Changes in technology, Labour availability, Input access, Product market access, Market information access, Succession, Natural Disasters

4- Business contract changes, Bank interest volatility

5- Availability of capital

4.3.3.4 Risk Choice Matrix based on market behaviour

Traders do not see much opportunity in risk but rather the arrow of attention as seen in Figure 4.19 indicates a need to pay attention to risk due to livestock thefts. They can however still take advantage of risk due to input price variation and feed/ pasture availability

which is likely to occur with medium positive impact on their farms. This could be done by making use of livestock markets as suggested in literature (Barrett et al., 2004) by selling off animals when pastures are low and purchasing or restocking when cattle prices are low.

Changes in business contracts offer the least opportunity to Traders and the least threats are expected from changes in technology, business contract changes, input access, succession and availability of capital.

Buyers see opportunity in input price variability. They can also take advantage of feed/ pasture availability, availability of capital and natural disasters. The least opportunity is expected from business contract changes, input access, and product market access.

Risk mitigation strategies for the Buyers should be prioritized towards threats due to changes in labour availability, input price variability, succession, and natural disasters. The least threat is expected from product price variability, livestock thefts, changes in technology and availability of capital. Seeing as these are individuals who are more interested in buying than purchasing, it makes sense for them to be more concerned with variation in prices of inputs than those of products, while taking advantage of these fluctuating input prices.

Sellers do not perceive risk as having opportunity to benefit their farming enterprises, although they do see a possibility of benefiting from input price variation. The least opportunity is expected from changes in business contract. Risk management is to be concentrating on preventing livestock thefts. Of least concern are risks due to changes in business contracts.

Holders find risk due to variability in input prices and changes in technology to be high, although not likely to occur. The least benefit is expected from business contract changes which are perceived to have low levels of upside risk and low likelihood of occurrence.

Risk management strategies should be prioritized towards risks due to variability of input prices, labour availability and natural disasters. Of least concern to these respondents are risks associated with changes in technology, succession and availability of capital.

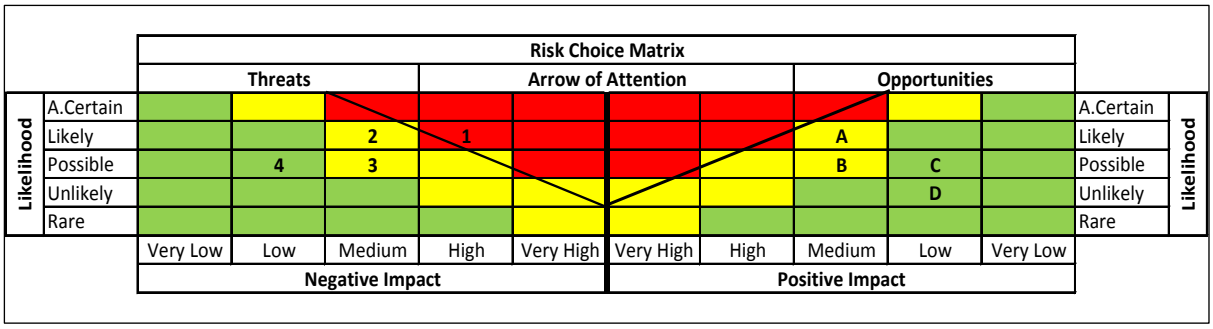

Figure 4.18: Risk Choice Matrix for Traders

Opportunities to benefit from:

A-Climate variation, Input price variability, Feed/ pasture availability, Input access, Succession

B-Livestock health, Product price variability, Plant diseases and pests, Crop yield variation, Changes in policy and government laws, Livestock thefts, Changes in technology, Labour availability, Product market access, Market information access, Availability of capital, Natural disasters

C-Bank interest volatility

D-Business contract changes

Threats to lose from:

1-Livestock thefts

2-Product price variability, Plant diseases and pests, Labour availability, Product market access, Natural disasters

3-Climate variation, Livestock health, Input price variability, Crop yield variation, Changes in policy and government laws, Feed/ pasture availability, Market information access, Bank interest volatility

4-Changes in technology, Business contract changes, Input access, Succession, Availability of capital

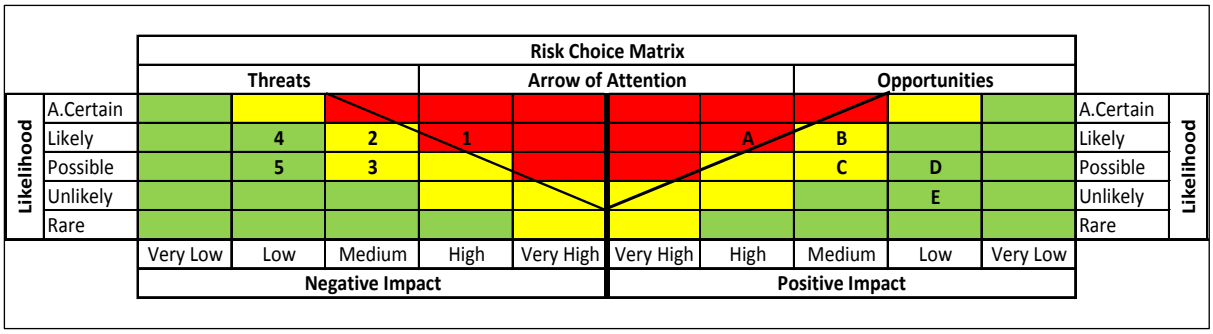

Figure 4.19: Risk Choice Matrix for Buyers

Opportunities to benefit from:

A-Input price volatility

B-Feed/ pasture availability, Availability of capital, Natural disasters

C-Climate variation, Livestock health, Crop yield variation, Livestock thefts, Changes in technology, Labour availability, Market information access, Succession

D-Product price variability, Plant diseases and pests, Changes in policy and government laws, Bank interest volatility

E-Business contract changes product, Input access, Product market access

Threats to lose from:

1- Labour availability

2-Input price variability, Succession, Natural disasters

3-Climate variation, Livestock health, Plant diseases and pests, Crop yield variation, Changes in policy and government laws, Feed/ pasture availability, Product market access, Market information access, Bank interest volatility

4-Business contract changes, Input access

5-Product price variability, Livestock thefts, Changes in technology, Availability of capital

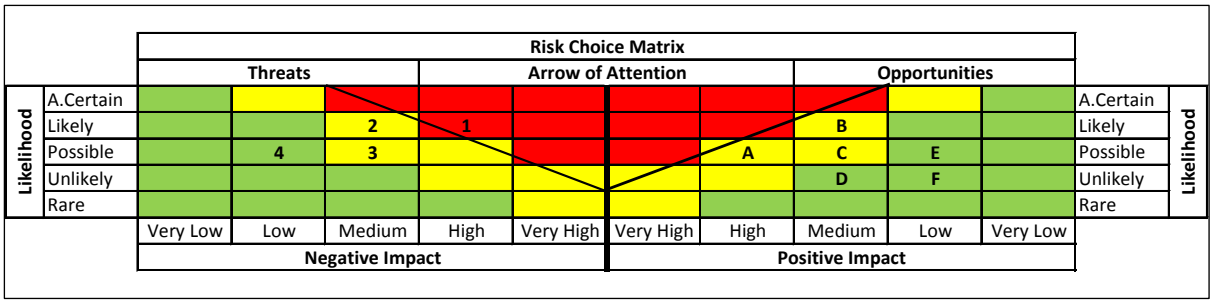

Figure 4.20: Risk Choice Matrix for Sellers

Opportunities to benefit from:

A-Input price variation

B-Feed/ pasture availability

C-Climate variation, Livestock health, Plant diseases and pests, Crop yield variation, Changes in policy and government laws, Livestock thefts, Changes in technology, Labour availability, Input access, Market information access, Succession, Natural disaster

D-Product price variability

E-Product market access

F-Business contract changes

Threats to lose from:

1-Livestock thefts

2-Changes in policy and government laws, Labour availability, Succession, Natural disasters

3-Climate variation, Livestock health, Input price variability, Product price variability, Plant diseases and pests, Crop yield variation, Feed/ pasture availability, Changes in technology, Business contract changes, Input access, Product market access, Market information access, Bank interest volatility

4-Availability of capital

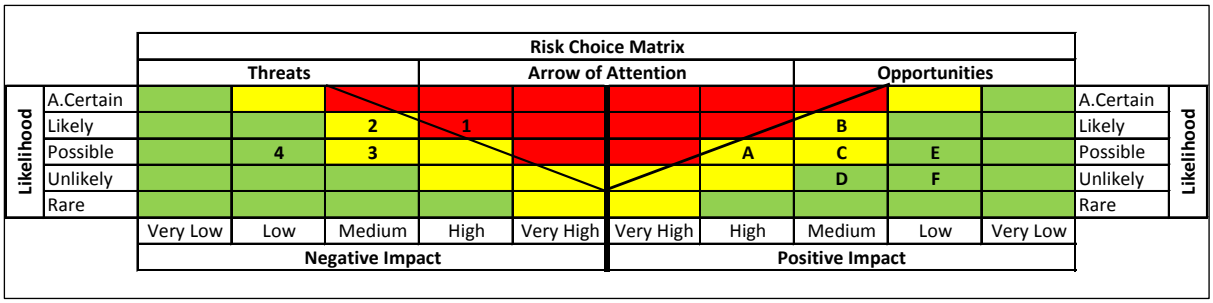

Figure 4.21: Risk Choice Matrix for Holders

Opportunities to benefit from:

A-Input price variability, Changes in technology

B-Feed/ pasture availability, Succession, Availability of capital

C-Climate variation, Livestock health, Product price variability, Plant diseases and pests, Crop yield variation, Changes in policy and government laws, Livestock thefts, Labour availability, Market information access, Natural disasters

D-Product market access

E-Bank interest volatility

F-Business contract changes

Threats to lose from:

1-Input price variability, Labour availability, Natural disasters

2-Product price variability, Plant diseases and pests, Business contract changes, Input access

3-Climate variation, Livestock health, Crop yield variation, Changes in policy and government laws, Livestock thefts, Feed/ pasture availability, Product market access, Market information access, Bank interest volatility

4-Changes in technology, Succession, Availability of capital

4.3.4 Assessment of Perceptions of Risk Management Strategies

Table 4.8 below shows the number of farmers who used various risk management strategies against those who did not. On the same table, the risk management strategies are then ranked in descending order of calculated risk importance index. The calculated risk importance index takes into consideration the rating of importance of individual risk management strategies as described in the methodology chapter. Figure 4.22 presents the results of the risk importance index also in descending order of importance.

The most used risk management strategy was dipping/ spraying of cattle, followed by diversifying livestock kept and crops grown on the farm. However, the risk importance index revealed use of drought resistant crops, diversifying types of crops produced and diversifying farm activities as the top three important risk management strategies. This shows that although a risk management strategy was used by the respondents, it did not necessarily mean it was perceived as the most important one. The risk importance index was calculated using the use of the strategy and the perceived importance ranking of that strategy.

The least used risk management strategy was using livestock insurance, using forward contracts, using futures markets and replacing human labour with machinery. The least important strategy based on risk management strategy importance index was keeping debt low, followed by using forward contracts and livestock insurance. It is interesting to note that the most used risk management strategy is not perceived to be the most important. Use of the strategy may therefore not be determined by the farmers' perceptions but rather the availability of that strategy or laws that might require that farmers use the strategy. However, the least used strategies can be seen to also be perceived as the least important. This might be due to lack of knowledge or experience with the strategy on the part of the farmers such that they do not realise the importance of some of these risk management strategies. Some risk management strategies may have low risk importance index and low usage amongst the respondents simply because they are not relevant among them.

Some notable differences and similarities can be seen in perception of risk management strategies. While the surveyed farmers in Monze found diversification of crops produced on their farms and diversification of farm activities to be one of the most important risk management strategies, as did the smallholder dairy farmers in Tigray, Ethiopia (Gebreegziabher & Tadesse, 2014), farmers from developed countries had the opposite view which could have been influenced by the fact that these are more commercialised farmers who believe specialisation is more important than diversifying farm activities (D. C. Hall et al., 2003; Shadbolt & Olubode-Awasola, 2013).

There is however a common view that financial risk management through use of futures, forward contracts and livestock insurance are not among the most important risk management strategies even in past surveys (Gebreegziabher & Tadesse, 2014; D. C. Hall et al., 2003; Shadbolt & Olubode-Awasola, 2013). For our survey in particular, risk management is focused on production risk management as production risk management

strategies are both the most used and perceived to be the most important. The risk choice matrices in Figures 4.14 to 4.21 show that market/ price risk is one of the sources of upside risk which could explain why these respondents do not prioritise price risk management.

Table 4.8: Distribution of responses on perceived importance of identified risk management strategies.

Risk Management Strategy	N	NA	User	Non-User	Mean	Median	Ver high scores (%)	Importance Index (%)	Rank
Using drought resist crops	154	2	107	45	4	4	79%	317%	1
Diversifying types of crops produced	154	2	129	23	4	4	73%	291%	2
Diversifying farm activities	154	3	105	46	4	4	66%	265%	3
Storing feed for cattle	154	2	128	24	4	4	51%	203%	4
Practicing transhumance grazing strategy	154	2	87	65	3	3	66%	199%	5
Monitoring weather patterns	154	2	65	87	3	3	62%	187%	6
Dipping/spraying cattle	154	2	145	7	5	5	35%	175%	7
Working off farm	154	2	52	100	3	3	55%	164%	8
Producing crops with low price variability	154	2	58	94	3	3	55%	164%	8
Using disease resistant cattle breeds	154	2	81	71	4	4	40%	161%	9
Using futures markets	154	2	26	126	3	3	53%	160%	10
Diversifying livestock on the farm	154	2	129	23	4	4	38%	151%	11
Vaccination of cattle	154	1	119	34	4	5	36%	145%	12
Applying crop disease and pest control strategies	154	3	102	49	4	4	35%	140%	13
Replace human labour with machinery	154	2	28	124	4	3	34%	135%	14
Spreading sales of farm products across the year	154	2	85	67	4	3	31%	125%	15
Monitoring markets	154	2	93	59	3	3	32%	97%	16
Using livestock insurance	154	2	21	131	3	3	25%	74%	17
Using forward contracts	154	2	23	129	3	2.5	17%	51%	18
Keeping debt low	154	2	53	99	3	3	16%	47%	19

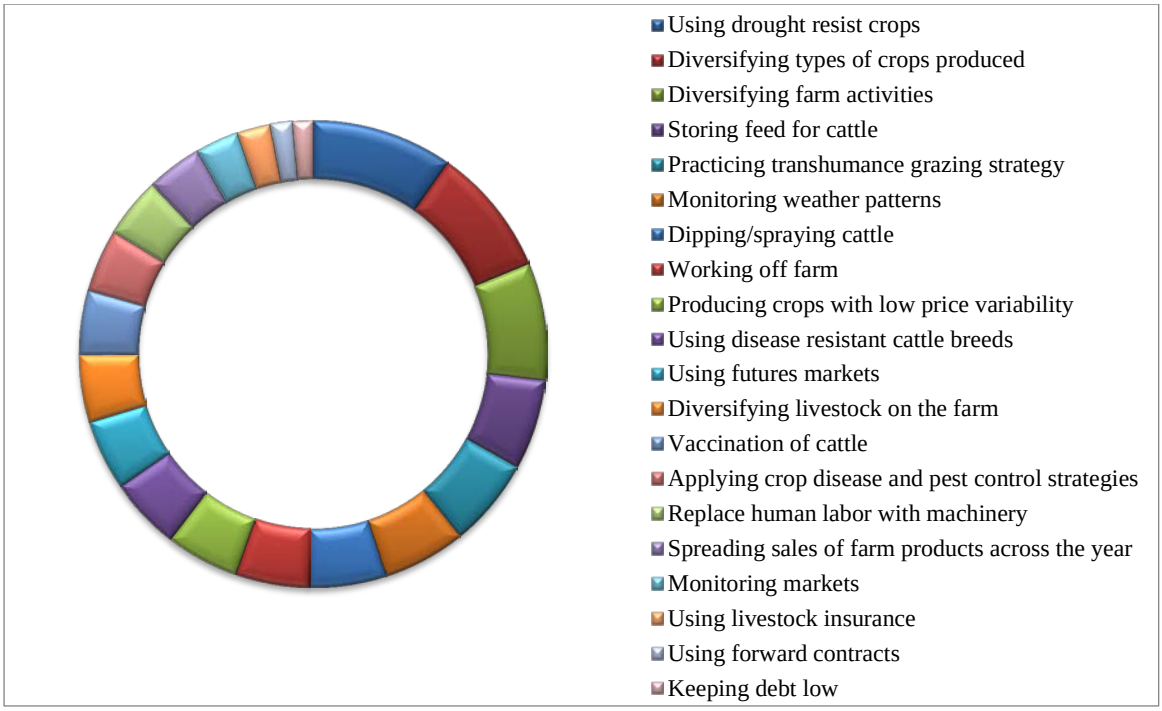

Figure 4.22: Risk Management Strategies Importance Indices arranged in descending order

4.3.5 Risk Profiles

This section looks at the risk profiles of the respondents which are presented in Tables 4.9 to 4.11. Table 4.9 shows the responses to the risk profile questions for all the respondents. Using the last question for risk profiles "when it comes to business I like to play it safe", the respondents were grouped by risk attitudes as shown in Table 4.10. This table is then followed by a presentation of the characteristics of the farmers by their risk attitudes in Table 4.11.

Table 4.9 shows 44% of respondents considered themselves able to manage most of the risk on their farming enterprises within a season, while 24% disagreed. The majority of respondents therefore considered themselves able to manage risk on their farming enterprises within a season. A closer look at each of the four study sites shows that unlike the other three sites, respondents from Mwanza West generally considered themselves unable to manage most of the risk on their farming enterprises within a season. However when we looked at long term risk, we found that the respondents from Mwanza West also considered themselves able to manage long term risk like the rest of the respondents.

These findings were not really as expected because Monze district is one of the districts with problems of famine and livestock diseases that require government intervention (Chifuwe, 2006). Market risk is another challenge that along with livestock disease risk has hindered the growth of traditional cattle farmers in Zambia (Lubungu et al., 2013). The ability of the traditional cattle farmers in Monze to manage their short term and long term risk remains uncertain as these farmers continue to face the challenges of poverty and hunger due to agricultural risk. Access to finance also remains a challenge because most lending institutions are not willing to lend to traditional farmers because of their poor risk management.

Table 4.10 shows the risk attitudes the respondents are classified into based on the responses to the last question in Table 4.9. Most of the respondents consider themselves to be risk averse (76%), while 18% were risk neutral and 6% were risk seeking. These findings are similar across study sites as the majority of respondents consider themselves risk averse for each of the individual study sites as shown in Table 4.10. Respondents from Bweengwa and Mwanza West have no respondents who considered themselves risk seeking. Looking at the findings that the Bweengwa farmers have Trader behaviour in market participation and they perceive market risk to be one of the most important risks they face, it was expected that these would have some risk seeking farmers who despite the fact that market risk is one of the biggest threats these farmers have, the farmers still sell and purchase cattle. The respondents from Mwanza West on the other hand did not perceive price risk as one of the important sources of threats on their farming enterprise. It therefore makes sense that the majority of Sellers came from Mwanza West. These findings on risk attitudes of the respondents are similar to what was found in other studies among small-scale farmers (Ayinde et al., 2008). The case was similar to what was found among New Zealand dairy farmers who were mostly risk averse (Shadbolt & Olubode-Awasola, 2013).

Table 4.11 shows that regardless of age, the majority of the respondents were risk averse. None of the respondents above 50 years of age were risk seeking, meaning the risk seeking farmers were mainly those below the age of 51 and with less than 31 years of experience as farm managers. This is expected as younger farmers are expected to be more risk seeking than older farmers. Table 4.11 also shows that the Traders and Holders have the lowest number of risk seeking farmers at 5% of the Traders and the Holders, while Sellers and Buyers had the highest number of risk seeking respondents.

Table 4.9: Risk profiles of respondents

		Risk Averse		Risk Neutral		Risk Seeking		Total (%
	N	Frequency	Percentage (%	Frequency	Percentage (%	Frequency	Percentage (%)	
Location								
Mwanza West	38	33	87%	5	13%	0	0%	100%
Choongo East	44	32	73%	9	20%	3	7%	100%
Hatontola	36	21	58%	8	22%	7	19%	100%
Bweengwa	36	31	86%	5	14%	0	0%	100%
Total	154	117		27		10		
Age								
20-30	31	22	71%	6	19%	3	10%	100%
31-40	43	32	74%	9	21%	2	5%	100%
41-50	38	26	68%	7	18%	5	13%	100%
51-60	22	21	95%	1	5%	0	0%	100%
> 60	20	16	80%	4	20%	0	0%	100%
Total	154	117		27		10		
Years of Experience								
< 10 years	108	80	74%	21	19%	7	6%	100%
10-20 years	34	28	82%	4	12%	2	6%	100%
21-30 years	7	5	71%	1	14%	1	14%	100%
31-40 years	2	2	100%	0	0%	0	0%	100%
41-50 years	2	1	50%	1	50%	0	0%	100%
> 50 years	1	1	100%	0	0%	0	0%	100%
Total	154	117		27		10		
Market Participation								
Trader	74	55	74%	15	20%	4	5%	100%
Seller	31	24	77%	4	13%	3	10%	100%
Buyer	10	7	70%	2	20%	1	10%	100%
Holder	39	31	79%	6	15%	2	5%	100%
Total	154	117		27		10		
Selling channel Choice*								
Abattoir	47	36	77%	8	17%	3	6%	100%
Butchery	8	6	75%	0	0%	2	25%	100%
Private Buyer	28	18	64%	9	32%	1	4%	100%
Private Buyer & Abattoir	19	17	89%	1	5%	1	5%	100%
Private Buyer & Butchery	3	3	100%	0	0%	0	0%	100%
Private Buyer, Abattoir & Butchery	1	0	0%	1	100%	0	0%	100%
Total	106	80		19		7		

*Some respondents used a combination of two or three channels for selling their cattle resulting in a total of six classes of channel choices represented in the table above.

Table 4.10: Risk Attitudes of Respondents

Response	Frequency	Percentage (%)	Risk Attitude Category
Strongly disagree and Disagree	10	6	Risk seeking
Neutral	27	18	Risk neutral
Agree and Strongly Agree	117	76	Risk averse

Table 4.11: Characteristics of respondents by their risk attitudes

		Risk Averse		Risk Neutral		Risk Seeking	
	N	Frequency	Percentage (%	Frequency	Percentage (%	Frequency	Percentage (%
Location							
Mwanza West	38	33	28%	5	19%	0	0%
Choongo East	44	32	27%	9	33%	3	30%
Hatontola	36	21	18%	8	30%	7	70%
Bweengwa	36	31	26%	5	19%	0	0%
Total	154	117	100%	27	100%	10	100%
Age							
20-30	31	22	19%	6	22%	3	30%
31-40	43	32	27%	9	33%	2	20%
41-50	38	26	22%	7	26%	5	50%
51-60	22	21	18%	1	4%	0	0%
> 60	20	16	14%	4	15%	0	0%
Total	154	117	100%	27	100%	10	100%
Years of Experience							
< 10 years	108	80	68%	21	78%	7	70%
10-20 years	34	28	24%	4	15%	2	20%
21-30 years	7	5	4%	1	4%	1	10%
31-40 years	2	2	2%	0	0%	0	0%
41-50 years	2	1	1%	1	4%	0	0%
> 50 years	1	1	1%	0	0%	0	0%
Total	154	117	100%	27	100%	10	100%
Market Participation							
Trader	74	55	47%	15	56%	4	40%
Seller	31	24	21%	4	15%	3	30%
Buyer	10	7	6%	2	7%	1	10%
Holder	39	31	26%	6	22%	2	20%
Total	154	117	100%	27	100%	10	100%
Selling channel Choice*							
Abattoir	47	36	45%	8	42%	3	43%
Butchery	8	6	8%	0	0%	2	29%
Private Buyer	28	18	23%	9	47%	1	14%
Private Buyer & Abattoir	19	17	21%	1	5%	1	14%
Private Buyer & Butchery	3	3	4%	0	0%	0	0%
Private Buyer, Abattoir &	1	0	0%	1	5%	0	0%
Total	106	80	100%	19	100%	7	100%

4.4 Marketing

This section looks at the market behaviour of the respondents. Figure 4.23 shows the cattle selling trends of the respondents during the study period while Figure 4.24 shows the cattle purchasing trends during the same period. The market behaviour of respondents by their location is presented in Table 4.12 and Table 4.13 presents the cattle selling channel choice of the respondents by their location. Tables 4.14 shows market behaviour of the respondents by risk attitude, while Table 4.15 shows the cattle selling channel choice of the respondents by their risk attitudes.

4.4.1 Cattle Marketing Trends

The cattle selling trends in Figure 4.23 indicate that cattle sales by the respondents were mostly done in the months of January, June and July, while sales started reducing from October through November to December which had the least sales.

The purchasing trends as shown in Figure 4.23 below indicate that the respondents mostly bought cattle in the month of May, followed by August, then June. The fewest purchases were found in March, followed by November, with December having no sales.

These trends are expected of traditional cattle farmers who sell not only as a business but also to cater for emergencies that usually include school fees for their school going children. This could account for the high sales in January. The high sales in the periods of June and July can be attributed to the poor pastures during this period which is Zambia's dry season. This is accompanied by endemic livestock diseases such as corridor disease and cowdriosis which usually appear in the cold season (Makala, Mangani, Fujisaki, & Nagasawa, 2003). These result in farmers being more willing to cull their sick cattle to reduce on feeding and treatment costs.

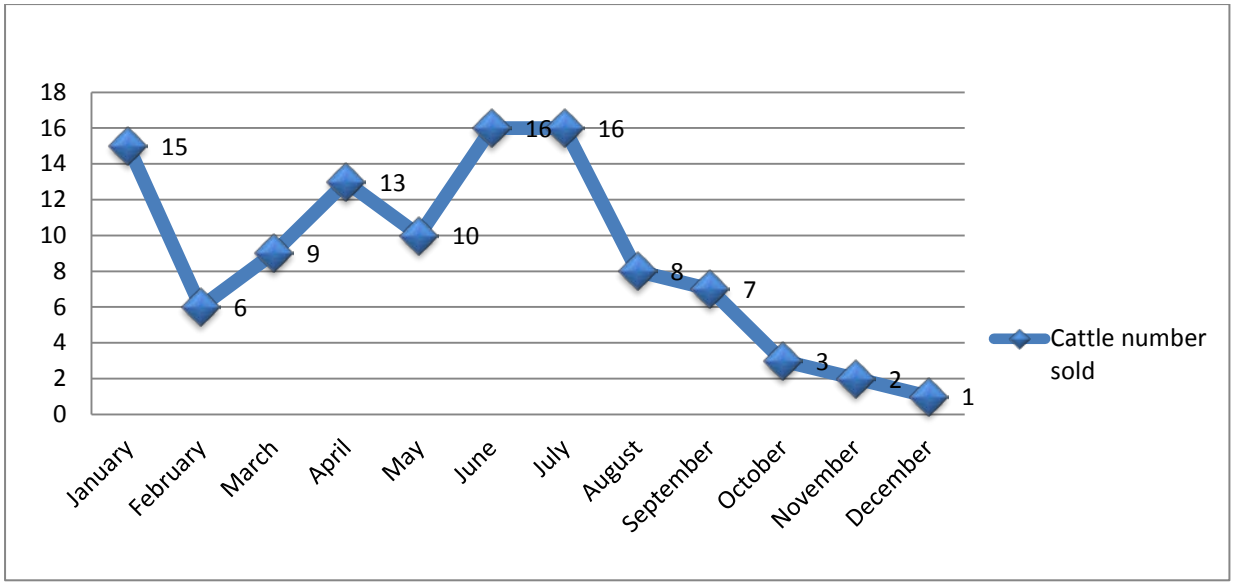

Figure 4.23: Cattle selling trends

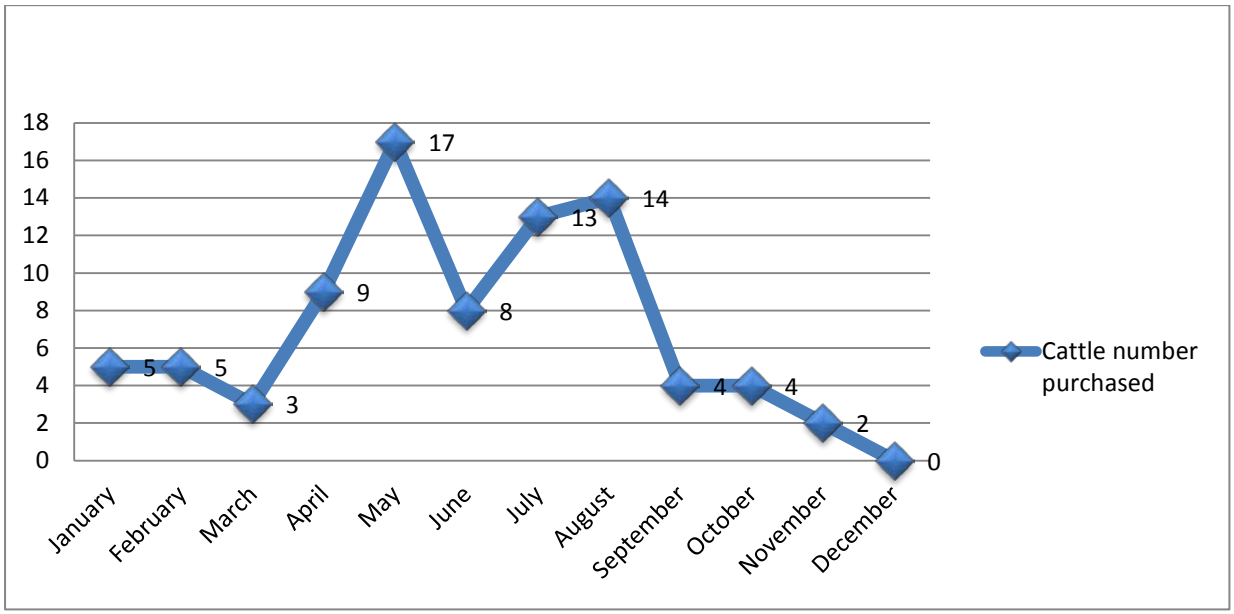

Figure 4.24: Cattle purchasing trends

4.4.2 Distribution of market characteristics of respondents by location

Tables 4.12 and 4.13 below show the market behaviour and choice of market channel of respondents by location. Table 4.12 shows the proportion of Traders, Sellers, Buyers and Holders for each of the four study sites. With the exception of Mwanza West, the most common market behaviour among the respondents is that of market Traders who make up

50% of the respondents from Hatontola and Bweengwa, and 59% of the respondents from Choongo East. Mwanza West had the same number of Traders as Holders at 31.6%. The information in Table 4.12 shows that although Bweengwa had the highest number of cattle sales per household, Choongo East had more farmers that participated in selling cattle. This verifies further that the respondents from Bweengwa had a higher off-take rate as compared to the other study sites because despite the fact that the respondents from Bweengwa had less farmers selling cattle, they still had the highest number of cattle sold on average per household, unlike the respondents from Choongo East that had more cattle selling farmers.

Table 4.13 shows that the most commonly used selling channel amongst all the respondents was the Abattoir, followed by Private buyers and the Butchery as the least used selling channel. The Butchery channel was not popular in Bweengwa as is evident in the Table 4.13 below. This could be due to the fact that compared to the other study sites like Choongo East and Hatontola which were closer to the Town of Monze, Bweengwa was the furthest to the town where the butcheries are found. It was easier and cheaper for the respondents from Bweengwa to use private buyers and abattoirs which are more common and accessible for them.

4.4.3 Distribution of market characteristics of respondents by risk attitude

Looking at the market behaviour by risk attitudes of the respondents, Table 4.13 shows that regardless of risk attitude (whether risk averse, risk neutral or risk seeking), the majority of respondents were Traders. This might indicate that risk attitude may not influence the market behaviour of the respondents, and this behaviour will not vary with different risk behaviour. A closer look within groups of market behaviour of the respondents shows that Sellers and Buyers are more of risk seekers, while Traders are risk neutral and the Holders were more risk averse.

Similarly, the choice of market channel does not show much difference, with Abattoir once again dominating as the most popular selling channel among the respondents. With the exception of risk seeking respondents that perceive the Butchery to be the second most important market channel, the Private buyers emerge as the second most used market channel among the respondents when grouped by risk attitude as was the case in the previous Table 4.12 grouped by location.

The Tables above 4.12 to 4.13 show that there isn't much of a difference in market behaviour and choice of market channel among the respondents regardless of location and risk attitude of the respondents. These are mare observations from descriptive presentation of the data. It is therefore important to now look at whether there really is no relationship or whether there is between market behaviour of the respondents and their risk attitudes and perceptions using statistical methods. This was done first using cross-tabulation and Pearson's chi-square and regression tree analysis.

Table 4.12: Market behaviour of respondents by location

		Market Behaviour								
Location	**N**	**Traders**		**Sellers**		**Buyers**		**Holders**		**Total Percentage**
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	
Mwanza West	38	12	31.6	10	26.3	4	10.5	12	32	100%
Choongo East	44	26	59.1	7	15.9	4	9.1	7	15.9	100%
Hatontola	36	18	50.0	8	22.2	0	0.0	10	27.8	100%
Bweengwa	36	18	50.0	6	16.7	2	5.6	10	27.8	100%
Total	154	74	48%	31	20%	10	6%	39	25%	100%

Table 4.13: Selling channel choice of respondents by location

Location	**N**	**Abattoir**		**Butchery**		**Private Buyer**		**Private Buyer & Abattoir**		**Private Buyer & Butchery**		**Pivate buyer, Butchery and Abattior**		**Total p**
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	
Mwanza West	22	12	55	1	5	1	5	5	23	3	14	0	0	100%
Choongo East	33	14	42	4	12	14	42	1	3	0	0	**0**	0	100%
Hatontola	26	13	50	3	12	6	23	4	14	0	0	0	0	100%
Bweengwa	24	8	33	0	0	5	21	10	42	0	0	1	4	100%
Total	105	45%		8%		25%		19%		3%		1%		100%

Table 4.14: Market behaviour of respondents by risk attitude

		Trader		Seller		Buyer		Holder		Total
Attitude	N	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequen	Percentage (%)	(%)
Risk Averse	117	55	47	24	21	7	6	31	26	100
Risk Neutral	27	15	56	4	15	2	7	6	22	100
Risk Seeking	10	4	40	3	30	1	10	2	20	100

Table 4.15: Selling channel choice of respondents by risk attitude

		Abattoir		Butchery		Private Buyer		Private Buyer & Abattoir		Private Buyer & Butchery		Private Buyer, Abattoir & Butchery		Total
Attitude	N	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequen	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	(%)
Risk Averse	80	36	45	6	8	18	23	17	21	3	4	0	0	100
Risk Neutral	19	8	42	0	0	9	47	1	5	0	0	1	5	100
Risk Seeking	7	3	43	2	29	1	14	1	14	0	0	0	0	100

4.5 Cross-tabulation and Pearson's Chi-square test

The following section has results from the Pearson's Chi-square test done to investigate possible relationships between market behaviour and other variables, and risk attitude and other variables. The results presented in the section are those that had significant results with p-value less than 0.05. The results that were non-significant are in the appendices.

The results of the Pearson's Chi-square indicate that there is a relationship between the market behaviour of the respondents and their age, their perception of risk due to changes in policies and government laws, their perception of risk due to changes in technology and perceptions of risk due to livestock thefts. This could explain the differences in market behaviour of the respondents with age as we found that younger farmers sold less and bought more cattle while the middle aged farmers participated the most in cattle markets. There was also a relationship found between risk attitude of the respondents and their location.

Table 4.15: Market behaviour by age group of respondents

	20-30	31-40	41-50	51-60	Above 60
Buyer	4	6	0	0	0
Holder	9	11	6	7	6
Seller	2	5	11	5	8
Trader	14	19	22	11	8

The Pearson's Chi-squared test statistic of 23.4 with 12 degrees of freedom was significant (p-value = 0.024)

Table 4.16: Market behaviour by perception on risk and changes in policies and government laws

	Holder	One-way	Trader
Very Low	1	10	9
Low	18	11	34
Medium	8	10	17
High	9	2	5
Very High	3	8	9

The Pearson's Chi-squared test statistic of 20.66 with 8 degrees of freedom was significant (p-value = 0.0081)

Table 4.17: Market behaviour by perception on risk due to cattle thefts

	Holder	One-way	Trader
Very Low	3	7	20
Low	7	4	10
Medium	25	19	22
High	2	3	10
Very High	2	8	12

The Pearson's Chi-squared test statistic of 18.70 with 8 degrees of freedom was significant (p-value = 0.0166)

Table 4.18: Market behaviour by perception on risk due to changes in technology

	Holder	One-way	Trader
Very Low	1	6	7
Low	5	9	20
Medium	8	12	19
High	22	8	20
Very High	3	6	8

The Pearson's Chi-squared test statistic of 16.73 with 8 degrees of freedom was significant (p-value = 0.0330)

Table 4.19: Risk attitude by location

	Study Site			
	Bweengwa	**Choongo**	**Haatontola**	**Mwanza West**
Neutral	5	9	8	5
Risk Averse	31	32	21	33
Risk Seeker	0	3	7	0

The Pearson's Chi-squared test statistic of 18.1 with 6 degrees of freedom was very significant (p-value = 0.006)

4.6 Regression Analysis

4.6.1 Introduction

This section looks at the statistical analysis done on the data using regression analysis. It also includes the PCA done prior to the regression or leading up to the regression analysis. Data imputation was first done on section C of the questionnaire to fill in the missing responses. This was then followed by reduction of the data which was done using Principal Component Analysis and finally the regression Analysis was done to investigate relationships between risk perceptions and attitudes with market behaviour. The statistical software R was used for analysis.

4.6.2 Principal Component Analysis

PCA was therefore done on the following groups of questions:

1. Potential to benefit from risk (Opportunity).
   PCA was done for each of the 5 groups of questions based on groups of risk sources as shown in the appendix, i.e. PCA on production, market, institutional, personal and financial risks as an opportunity. The components chosen and their respective variance proportions are in Table 4.20 below. Where the original question was used, this is indicated as "original" rather than the percentage variance. These will be explained further in the paragraph that follows the PCA groups.

Table 4.20: Potential to benefit from risk- Percentage of Variance for each chosen component for each group of source of risk

	Production risk	**Market risk**	**Institutional risk**	**Personal risk**	**Financial risk**
Component 1	26%	42%	Original	Original	Original
Component 2	17%				
Component 3	12%				

2. Likelihood of occurrence of risk as an opportunity.
   Similar to the above part (1), PCA was done for each of the five groups of questions based on the source of risk. Table 4.21 below shows the percentage variance for each of the chosen components. In the PCA for likelihood of occurrence of risk as an opportunity there was only one component.

Table 4.21: Likelihood of occurrence- Percentage of Variance for each chosen component for each group of source of risk

	Production risk	**Market risk**	**Institutional risk**	**Personal risk**	**Financial risk**
Component 1	35%	Original	70%	64%	79%

3. Potential to lose from risk (Threat).
   PCA was done for five groups of questions on risk as a threat as shown in Table 4.22 below. For personal risk, the original questions were used rather than principal components. While production risk had 3 components, the other 4 groups of sources of risk (institutional, market, personal and financial risks) only had one principal component.

Table 4.22: Potential to lose from risk- Percentage of Variance for each chosen component for each group of source of risk

	Production risk	Market risk	Institutional risk	Personal risk	Financial risk
Component 1	25%	41%	63%	Original	69%
Component 2	19%				
Component 3	14%				

4. Likelihood of occurrence of risk as a threat.
   PCA was done on each of the five groups of risk sources, resulting in 5 groups as indicated in Table 4.23 below. Original questions were used for institutional risk and personal risk.

Table 4.23: Likelihood of occurrence of risk as a threat- Percentage of Variance for each chosen component for each group of source of risk

	Production risk	Market risk	Institutional risk	Personal risk	Financial risk
Component 1	31%	50%	Original	Original	69%
Component 2	17%				

5. Importance of risk management strategy.
   PCA was done for questions grouped under the mitigation strategies and a separate one for those grouped under prevention strategies. Table 4.24 below shows the total of three groups for the risk management questions and the variance proportions for their chosen components.

Table 4.24: Importance of risk management strategy- Percentage of Variance for each chosen component for each group of risk management strategy

	Mitigation strategies	Prevention strategies
Component 1	57%	45%
Component 2		21%

The principal components to be retained for the regression analysis were selected using two criteria. The first criteria used variance proportions of the principal component and second one used the interpretability of the principal components retained in the first selection, using the component loadings for interpreting.

In a PCA, the first principal component accounts for the largest amount of total variance, and the one that follows it will account for the second largest and so on (O'Rourke & Hatcher, 2013). The amount of total variance accounted for by each extracted principal component decreases in order from the first principal component to the last such that only the first components account for the most variance. Selection of principal components to be retained uses this reasoning such that components are retained if they account for a specified proportion of variance. For this study, if the variance proportions for the first few components totalled up to at least 50% of the total variance of the PCA when combined, they were retained for use in the regression analysis (O'Rourke & Hatcher, 2013). An example of this is in Table 4.22 under PCA for "potential to lose from production risk" where there were nine components originally but out of the nine only the first three were retained to be used in the regression analysis because the variance proportions for the three components added up to 58% which is more than 50%, but we could not select only the first two as these added up to less than 50%. In other cases where the first component accounted for twice or more the percentage variance of the second component, the first principal component was the only one retained as this was the most representative of the variable in question, for example in Table 4.22 under PCA for Financial risk, only component 1 was selected which had a variance proportion of 69% which is more than twice the variance proportion of the second component (Kawabata, 2015).

Where there were two principal components, the one with the larger variance proportion was retained for the regression analysis. If the two principal components had almost equal or equal variance proportions, then the original variables were retained for regression analysis rather than the principal components. This was because the variance proportions of the principal components were equal or almost equal meant the two variables were not correlated and each one was as important as the other in representing the particular construct; therefore we used the original variables (Kawabata, 2015). This was the case for "potential to benefit from institutional risk", "potential to benefit from personal risk", "potential to benefit from financial risk", "likelihood of potential to benefit from market

risk", "potential to lose from personal risk", "likelihood of potential to lose from institutional risk" and "likelihood of potential to lose from personal risk". Table 4.25 below shows the variables retained for regression analysis as original variables

The principal components that were selected for the regression analysis were as indicated in Tables 4.26 to 4.27.

Table 4.25: Original Variables used in the Regression Analysis

	Variable 1	**Variable 2**	**Variable 3**	**Variable 4**
Potential to benefit from institutional risk	Changes in policies and government laws.	Changes in business contract.	-	-
Potential to benefit from personal risk	Availability of labour.	Succession.	-	-
Potential to benefit from financial risk	Volatility in bank interest.	Availability of capital.	-	-
Likelihood of potential to benefit from market risk	Variability in input prices	Variability in product prices	Access to product markets	Access to market information
Potential to lose from personal risk	Availability of labour.	Succession.	-	-
Likelihood of potential to lose from institutional risk	Changes in policies and government laws.	Business contract changes.	-	-
Likelihood of potential to lose from personal risk	Availability of labour.	Succession.	-	-

After using the variance proportions to select the principal components to be retained for the regression analysis, component loadings were now used to further select principal components for regression analysis among the retained principal components using interpretability criteria.

Each variable has component loadings on each of its principal components. The loadings equal to or greater than 0.3 were considered to be the meaningful loadings in this case. It is recommended to use a minimum of 0.3 for loadings when selecting meaningful component loadings (Westad, Hersletha, Lea, & Martens, 2003), loadings less than 0.3 are considered weak, those between 0.3 and 0.5 are acceptable while loadings greater than 0.5 are considered strong. For this analysis, 0.3 was the minimum loading used.

Tables 4.26 and 4.27 below show the principal components selected using variance proportions and the component loadings for each variable. Only variables with meaningful component loadings where included in these tables. Component loadings were considered to be meaningful if they were 0.3 or greater such that any variable with loading less than 0.3 for the selected principal components was not retained for the regression analysis. Variables with meaningful loadings on more than one principal component were considered to be complex items and were not retained for the regression analysis because they are not pure measures of any construct. This means among all the variables from the principal components that were retained after selection using variance proportion of the principal components, only the variables that had meaningful principal component loadings and had no complex items were retained for regression analysis. Principal components that were not interpretable e.g. those with complex items, were not retained for the regression analysis. This was the case for "potential to lose from production risk" which had three principal components after selection by variance proportion. After selection using interpretability, only component 2 could be retained as the other two components were complex items.

The remaining variables and their respective principal components and component loadings are as shown in Tables 4.26 and 4.27.

Table 4.26: Retained variables with component loadings ≥ 0.3

Potential to benefit from Production risk	
	Component 1
Cattle health	-0.499
Natural disaster	-0.337
Plant and pest diseases	-0.329
Variability in crop yield	-0.327
Potential to benefit from Market risk	
	Component 1
Access to product markets	-0.561
Volatile product prices	-0.552
Access to market information	-0.547
Likelihood of potential to benefit from Production risk	
	Component 1
Cattle Health	-0.507
Natural disasters	-0.487
Feed/ pasture availability	-0.357
Likelihood of potential to benefit from Institutional risk	
	Component 1
Changes in government laws and policies	-0.778
Changes in business contract	-0.629
Likelihood of potential to benefit from Personal risk	
	Component 1
Succession	0.825
Availability of labour	0.565
Likelihood of potential to benefit from Financial risk	
	Component 1
Availability of capital	0.739
Volatility of bank interest	0.674
Potential to lose from Production risk	
	Component 2
Natural disasters	-0.605
Climate variation	-0.380

Potential to lose from Market risk	
	Component 1
Variability in input prices	-0.726
Variability in product prices	-0.529
Access to market information	-0.438
Potential to lose from Institutional risk	
	Component 1
Changes in business contract	0.732
Changes in government laws and policies	0.681
Potential to lose from Financial risk	
	Component 1
Volatility of bank interest	-0.862
Availability of capital	-0.507
Likelihood of potential to lose from Production risk	
	Component 1
Plant diseases and pests	-0.404
Cattle health	-0.394
Climate variation	-0.366
Likelihood of potential to lose from Market risk	
	Component 1
Variability in product prices	-0.515
Variability in input prices	-0.557
Access to product markets	-0.454
Access to market information	-0.456
Likelihood of potential to lose from Financial risk	
	Component 1
Availability of capital	0.748
Volatility of bank interest	0.663

Table 4.27: Retained variables with component loadings ≥ 0.3- Importance of Risk Management Strategies

Preventive Risk Management Strategies	
	Component 1 (On farm production techniques)
Crop disease and pests control	-0.475
Using disease resistant cattle breeds	-0.449
Using drought resistant crops	-0.375
Mitigation Risk Management Strategies	
	Component 1 (Market techniques)
Using livestock insurance	-0.397
Using forward contracts	-0.375
Monitoring weather pattern	-0.318
Monitoring markets	-0.317
Using futures markets	-0.313

4.6.3 Logistic Regression Tree Analysis

4.6.3.1 Seller Model

The seller model was run using seller market behaviour as the dependent variable and explanatory variables as described under methodology for logistic regression trees. Seller market behaviour as a dependant variable for modelling the regression trees was defined in "R" as the respondents who did not have zero cattle sells and had zero cattle purchases (this way traders were excluded). From the seller model 1 in Figure 4.25 it was found that seller market behaviour was affected by a farmer's perception for likelihood of variability in product prices to occur as an opportunity and the number of dairy animals on that farm. A farmer was more likely to exhibit seller market behaviour if he owned at least one dairy cow and on condition that they perceive opportunity from variability in product prices to be relatively or highly likely to occur. The seller model was run a second time after removing question B 4 as indicated in the methodology section, the findings were the same as those for seller model 1.

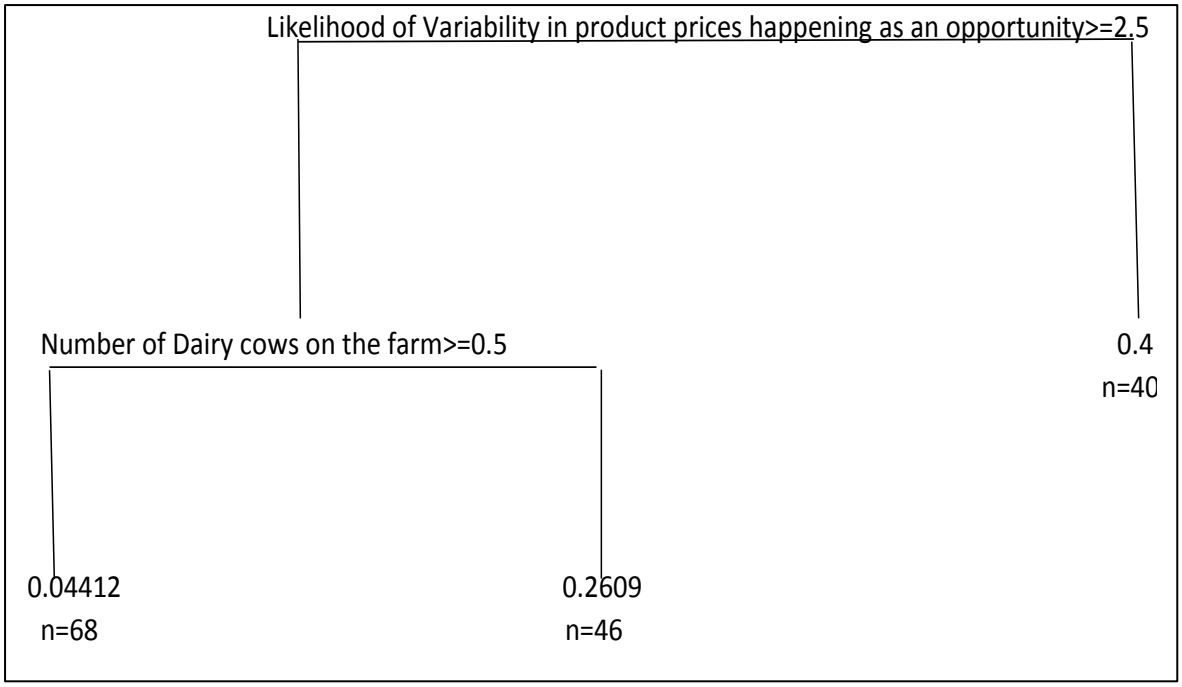

Figure 4.25: Regression tree for Seller Model 1

4.6.3.2 Holder Model

The following two figures below show the results for the holder model. Based on Figure 4.26, holder market behaviour of a farmer was strongly influenced by the farmer's engagement in beef and dairy production, beef production exclusively, dairy production exclusively, crop production, mixed farming, other livestock production and formal salaried employment. The other factor that strongly affects holder market behaviour is a farmers perceived potential to benefit from business risk, specifically business contract changes.

A farmer was more likely to be a holder if his perceived potential to benefit from business risk was relatively low (i.e. less than 2.5 on the likert scale), on condition that his main income generating activity included at least either a, b, c, f, g, h and I where a = Beef and Dairy production, b= Beef production, c = Crop production, f – Dairy production, g = Formal salaried employee, h= Mixed farming, i = Other livestock production.

In figure 4.27, holder model 2 changes in the results when question B4 was removed were observed. Figure 4.27 shows that the two most important determinants of holder behaviour were the farmer's risk perception of potential to lose due to climate risk and the perceived potential to benefit from risk due to changes in access to product market.

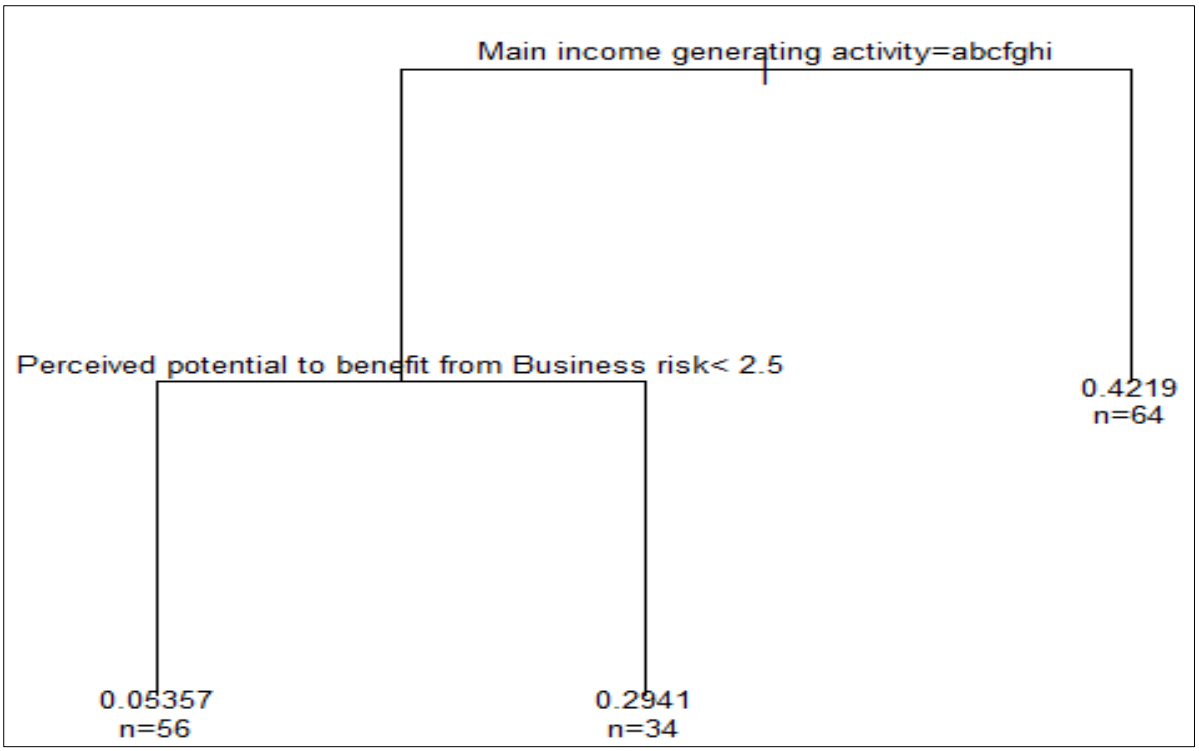

Figure 4.26: Regression tree for Holder Model 1

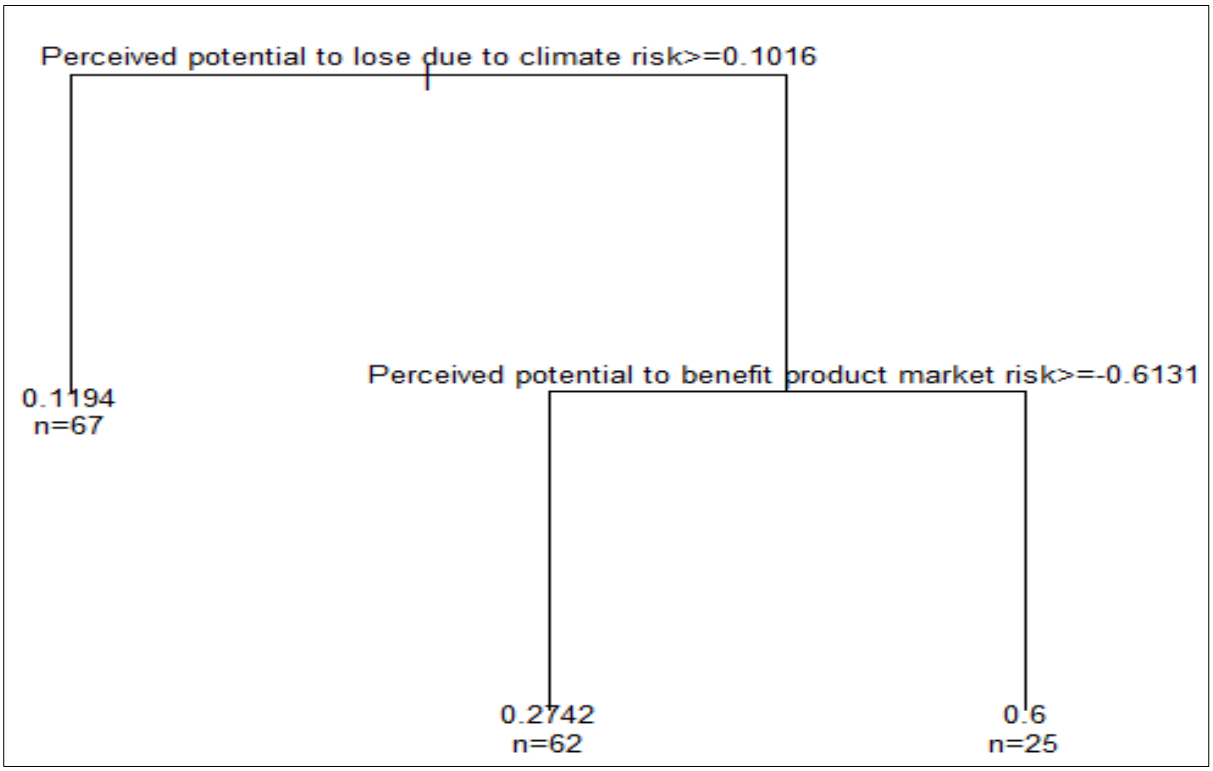

Figure 4.27: Regression tree for Holder Model 2

4.6.3.3 Buyer Model

In figure 4.28, the regression tree for buyer model1 shows that the most important determinant for buyer market behaviour is the age of the farmer. Farmers who are 38.5 years or older are least likely to exhibit buyer market behaviour. For farmers who were less than 38.5 years of age they stood a 14% chance of exhibiting buyer market behaviour. The findings were the same for both model 1 and model 2. These findings on buyer market behaviour are consistent with the Pearson's chi-square findings that indicate that the age of a farmer has an influence on market behaviour of the farmers. Similar to the findings of the buyer model regression analysis, the descriptive statistics in Table 4.3 indicate that the maximum age for buyers was 38 years.

Figure 4.28: Regression tree for Buyer Model 1

4.6.3.4 Trader Model

For the trader model 1 (see Figure 4.29 below), the most important variables in determining trader market behaviour of the respondents were the number of cattle owned by the farmer, his ability to manage risk within a season and the farmer's perceived potential to lose due to climate risk. The results for trader model 1 and trader model 2 were found to be the same.

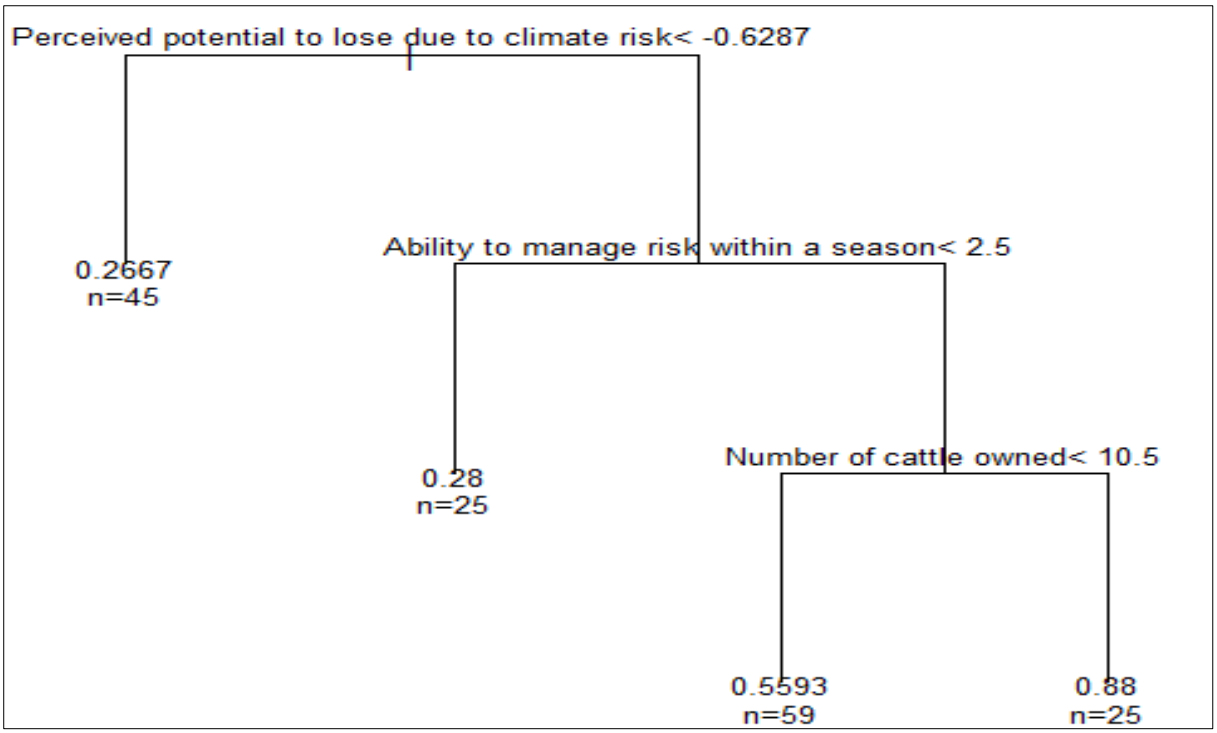

Figure 4.29: Regression tree for Trader Model 1

4.7 Results and Discussion Summary

The surveyed farmers perceived risk from natural disasters to be the most important threat for their farming enterprises. The five most important sources of risk were risk due to natural disasters, labour availability, livestock thefts, input price variation and plant diseases and pests. The least important sources of risks were access to product markets, changes in technology, business contract changes, market information access and availability of capital. However these perceptions of risk differ and were more specific with different locations. Most of the farmers were found to perceive most of the risk they are exposed to as a threat, although some saw opportunity in input price variation.

Although one of the major challenges for traditional cattle farmers in Monze are livestock diseases, we find that livestock diseases are not perceived as one of the most important sources of risk as would be expected. This could be because most farmers are able to manage this risk or are aware of ways to manage this risk. Livestock disease control through dipping or spraying to control ticks and vaccination against livestock diseases is among the most important risk management strategies as

perceived by the surveyed farmers. Natural disasters however come out to be one of the most important sources of risk amongst the surveyed farmers. This was expected of farmers in Monze as drought problems are another challenge faced by these farmers. From the risk choice matrices, we see that none of the surveyed farmers see high level of opportunity in natural disasters, climate variation, variability in feed availability or cattle health variation. This shows that these farmers do not take advantage of markets to sell their cattle during times of low pasture availability due to natural disasters of climate variation as discussed in literature. There is therefore need to show farmers how they can utilise market risk and production risk in the form of availability of pasture and feed or variability in climate to their benefit.

These farmers already see opportunity in market risk, particularly the traders, which shows that they may already be using market risk to their benefit. However, in their management of risk, these farmers do not use insurance nor do they perceive it to be one of the most important risk management strategies. According to the President for Zambia National Farmers Union (ZNFU), Dr Evelyn Nguleka, insurance is one of the risk management strategies available for traditional farmers in Zambia. There may however be need to investigate further why most of the farmers are not using it and do not perceive it as being an important risk management strategy. This will help in understanding whether the farmers need to understand use of insurance further or do not know of its availability. With insurance, it would be easier for traditional farmers to access loans from banks.

Other than use of livestock insurance, the other risk management strategies perceived to be of least importance were keeping debt low, using forward contracts, monitoring markets and spreading sales of farm products across the year. Considering these farmers consider market risk to be one of the most important sources of risk, it may be important to educate them further on available strategies for market risk management and how these may be used for the farmers. It was found that amongst these farmers, the most important risk management strategies for the surveyed farmers were using drought resistant crops, diversifying types of crops grown and farm activities, storing feed for cattle and practicing transhumance grazing strategy.

The buyers and sellers were mostly found to be risk seeking while the traders were mostly risk neutral and the holders were risk averse. The age of a farmer was

found to have an effect on the farmer's market participation. This was observed in the results were younger farmers bought more cattle than they sold while the older farmers or middle aged farmers sold more. These younger farmers were found to be more risk seeking than the older farmers (above 50 years of age) who were more risk averse. These younger farmers who were mostly risk seeking could be among the majority of buyers who are mostly risk seeking.

From the results it was observed that market behaviour of farmers can be affected by specific risk perceptions depending on the individual farmer. Using Pearson's Chi-square it was found that market behaviour can be affected by perception of risks due to changes in policies and government laws, cattle thefts and changes in technology. We also found a relationship between risk attitude and location of an individual.

Using regression tree analysis, we confirmed that market behaviour of farmers can be affected by a number of attributes. Determination of seller behaviour in farmers can be affected by the farmer's perceived opportunity due to risk arising from variability in product prices and the number of dairy cows the farmer owned.

Holder behaviour in farmers can be affected by the farmer's perception of climate risk and perception of risk due to access to product markets. Holder market behaviour can also be affected by perception of business risk and the main income generating activity of a farmer. Buyer behaviour was affected by the farmer's age. Trader behaviour among the farmers can be determined by their perception of climate risk, their ability to manage risk within a season and the number of cattle they own.

Although the Pearson's chi-square showed no relationship between market behaviour and the number of cattle owned, regression analysis shows that the number of cattle a farmer owns can determine their decision to buy and sell cattle within a season. However, this is only true if other conditions are fulfilled which are a farmers ability to manage risk within a season and their perceived potential to lose due to climate risk.

We therefore see that a farmer's market behaviour is influenced by the number of cattle they own, their ability to manage risk within a season and their perception of climate risk and market risk management strategies. It can therefore be seen that the

climate risk farmers in Monze face has an influence on their decisions to either sell or buy cattle. However, these farmers do not see opportunity in climate risk. Whether they sell more or less when exposed to climate risk is not clear. What is clear is that their market behaviour is affected by perception to risk and risk management strategies.

CHAPTER FIVE

5 CONCLUSION AND RECOMMENDATIONS

5.1 Policy Recommendations

There is need to educate traditional farmers on risk management and how the farmers can benefit from some of the risks they are exposed to by making use of upside risk. Because risk attitudes and perceptions are farmers specific and differ with location, government intervention in risk management should be more specialised in order to cater for the specific needs of individual farmers.

Production risk and market risks are the most important sources of risks among traditional farmers and hence their management should be a priority if traditional cattle farmers are to improve in their productivity and hence their participation in cattle markets since number of cattle owned has an effect on the likelihood of a farmer to be involved in cattle markets as a buyer and seller.

Looking at how younger farmers are more risk seeking and risk seekers participate more in markets, government will do well to invest in younger farmers if they are to improve the cattle industry in Zambia. This investment should be in promoting increased productivity among the younger pastoralists who sell less due to their low cattle numbers compared to the older farmers.

5.2 Future Research Recommendations

Future research should look further at the relationship of risk and market participation, particularly with a larger sample size that will allow for more statistical analysis. The results from the regression tree analysis show that some sources of risk have an influence on determination of the market behaviour of farmers. However, specific relationships could not be inferred due to sample size hence the need for further research.

A country wide survey would be helpful for policy makers to be able to document sources of risk that are of most importance in different parts of the country and the risk management strategies that are most useful in these areas. This information will help

government know where to prioritize what resources in risk management to avoid wasting resources.

Future research should be done using longitudinal data as this would profile long term behaviour and decisions of the farmers which may be different from what they do in one season e.g. a farmer may not sell in the year of study but after his animals grow and reach market weight he may sell them in the coming years.

The risk importance and risk management strategy importance indices, and the risk choice matrices are tools that can be used by individual farmers in their farm decision making for them to see what risks they should be mitigating and which ones they can optimize as opportunities for their farming enterprises.

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7 APPENDICES

7.1 Appendix 1: Ethics Approval letter

FILE

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

7 May 2014

Belindah Chilala
[redacted]
PALMERSTON NORTH 4410

Dear Belindah

Re: Understanding Risk Exposure and Risk Management along the Beef Value Chain for Small-Scale Farmers with Beef Enterprises in Monze, Southern Zambia

Thank you for your Low Risk Notification which was received on 30 April 2014.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

You are reminded that staff researchers and supervisors are fully responsible for ensuring that the information in the low risk notification has met the requirements and guidelines for submission of a low risk notification.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

cc Prof Nicola Shadbolt
Institute of Agriculture and Environment
PN433

Dr Liz Dooley
Institute of Agriculture and Environment
PN433

Assoc Prof Blessing Maumbe
Institute of Agriculture and Environment
PN433

Prof Peter Kemp, HoI
Institute of Agriculture and Environment
PN433

7.2 Appendix 2: Survey Letter

Dear Farmer,

This serves as an invitation to take part in a research survey.

My name is Belindah Chilala, currently doing my Masters in Agricommerce at Massey University, Palmerston North New Zealand. I am currently in Mazabuka to do a survey for my thesis which is a requirement for me to complete my Masters programme.

My research is looking at perceptions of risk and risk management strategies among traditional cattle farmers in selected areas of Monze district and how these may or may not affect cattle market participation amongst these farmers.

Attached to this letter is a questionnaire which as a randomly selected participant, you are requested to answer. All the information in the survey is strictly confidential and under the Massey University research policy you are under no obligation to answer the questionnaire. Your assistance in furthering knowledge on agricultural risk management among traditional cattle farmers in Zambia will however be highly appreciated.

For further inquiries feel free to contact my research supervisor Professor Nicola Shadbolt on +64(06)3569099 ext. 84793.

Thanking you in advance

Belindah Chilala [redacted]

"This project has been evaluated by peer review and judged to be low. Consequently, it has not been reviewed by one of the University Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics),telephone +64 06 350 5249, email humanethics@massey.ac.nz".

7.3 Appendix 3: Survey Questionnaire

Farmer ID:

Location:

A. <u>Demographic information</u>

1. Type of farm manager.
   a. Farm Owner .b. Hired Manager .c. Spouse of Farm Owner
   .d. Child of Farm Owner .e. Other (Specify)

2. Gender.
   a. Male .b. Female

3. Age
   ……

4. Marital status.
   a. Single b. Married c. Divorced 4. Widowed
5. Educational level.
   a. None b. Primary c. Secondary d. Tertiary
6. Household Composition (please indicate numbers in the box)
   a. Adult Males ☐ b. Adult Females ☐ c. Children (below 16) ☐
7. How many years of experience do you have running the daily operations of this farm (Please specify below).

   ……

8. How long has the farm been in operation? (Please give an approximate figure below)

   ……

B. Farm Characteristics

1. What farming system is used on this farm? Please tick where applicable.
    a. Mixed Livestock Production……..
    b. Mixed Farming (including growing crops)……..
    c. Beef Production only……..
    d. Dairy Production only…….....
    e. Dairy and Beef Production…….
2. Please complete the table below by indicating the number of animals on this farm.

Type of livestock	**Number**
1. Dairy Cows	
2. Beef Cows	
3. Cows (non-specific)	
4. Bulls	
5. Oxen	
6. Calves	
7. Goats	
8. Sheep	
9. Chickens	
10. Donkeys	
11. Others (Please specify)	

3. What is the sole purpose of keeping cattle on this farm? Please circle ONE (1).
   .a. Beef .b. Dairy .c. Beef and Dairy .d. Draught Power
   .e. Other (Specify)
4. What is the main income generating activity for the farm? Please tick ONE.
    a. Crop Production …….
    b. Dairy Production …….....
    c. Beef Production….....

d. Other livestock Production……
e. Mixed Farming ……...
f. Formal Salaried employee...
g. Self-employed…….
h. Other (Specify)……

5. What cattle grazing strategy do you use on this farm? Please circle where applicable
    a. Kept within the village in kraals and grazed on nearby pastures (village resident herds).
    b. Kept at the village in the rain season from November to April and moved to the flood plains in the dry season from May to October (transhumance).
    c. Permanent residence within the flood plains but moved to higher grounds in the rain season when there are floods (interface herds).
    d. Other (Please specify)

        ……..

C. Risk

I. Opportunities from Uncertainty/ Risk

For each of the sources of risk listed below, circle a number which represents the following:

a. The potential for this farming enterprise to benefit from the risk on a scale of 1 to 5 with 1 being very low and 5 very high.

b. The likelihood of this opportunity happening within a period of 1 year.

	a. Potential to benefit from this risk					**b. Likelihood of this opportunity happening**				
Sources of Uncertainty/risk	Very low	Low	Medium	High	Very high	Very Unlikely	Unlikely	Possible	Likely	Almost Certain
1. Climate variation	1	2	3	4	5	1	2	3	4	5
2. Livestock Health	1	2	3	4	5	1	2	3	4	5
3. Variability in input prices	1	2	3	4	5	1	2	3	4	5
4. Variability in product prices	1	2	3	4	5	1	2	3	4	5
5. Plant diseases and pests	1	2	3	4	5	1	2	3	4	5
6. Variability in crop yields	1	2	3	4	5	1	2	3	4	5
7. Variability in cattle weight gain	1	2	3	4	5	1	2	3	4	5
8. Changes in policies and government laws	1	2	3	4	5	1	2	3	4	5
9. Livestock Thefts	1	2	3	4	5	1	2	3	4	5
10. Availability of feed/ pastures	1	2	3	4	5	1	2	3	4	5

11. Changes in technology	1	2	3	4	5	1	2	3	4	5
12. Availability of labour	1	2	3	4	5	1	2	3	4	5
13. Business Contract changes	1	2	3	4	5	1	2	3	4	5
14. Access to inputs	1	2	3	4	5	1	2	3	4	5
15. Access to product markets	1	2	3	4	5	1	2	3	4	5
16. Access to Market Information	1	2	3	4	5	1	2	3	4	5
17. Succession	1	2	3	4	5	1	2	3	4	5
18. Volatility in Bank Interest	1	2	3	4	5	1	2	3	4	5
19. Availability of Capital	1	2	3	4	5	1	2	3	4	5
20. Natural Disasters	1	2	3	4	5	1	2	3	4	5
21. Other (Specify)	1	2	3	4	5	1	2	3	4	5

II. Threats from Uncertainty/ Risk

For each of the sources of risk listed below, circle a number which represents the following:

a. The potential for this farming enterprise to lose or be disadvantaged from the risk on a scale of 1 to 5 with 1 being very low and 5 very high.

b. The likelihood of this threat happening within a period of 1 year.

	a. Potential to lose from this risk					**b. Likelihood of this threat happening**				
Sources of Uncertainty/risk	Very low	Low	Medium	High	Very high	Very Unlikely	Unlikely	Possible	Likely	Almost Certain
1. Climate variation	1	2	3	4	5	1	2	3	4	5
2. Livestock Health	1	2	3	4	5	1	2	3	4	5
3. Variability in input prices	1	2	3	4	5	1	2	3	4	5
4. Variability in product prices	1	2	3	4	5	1	2	3	4	5
5. Plant diseases and pests	1	2	3	4	5	1	2	3	4	5
6. Variability in crop yields	1	2	3	4	5	1	2	3	4	5
7. Variability in cattle weight gain	1	2	3	4	5	1	2	3	4	5
8. Changes in policies and government laws	1	2	3	4	5	1	2	3	4	5
9. Livestock Thefts	1	2	3	4	5	1	2	3	4	5

10. Availability of feed/ pastures	1	2	3	4	5	1	2	3	4	5
11. Changes in technology	1	2	3	4	5	1	2	3	4	5
12. Availability of labour	1	2	3	4	5	1	2	3	4	5
13. Business Contract changes	1	2	3	4	5	1	2	3	4	5
14. Access to inputs	1	2	3	4	5	1	2	3	4	5
15. Access to product markets	1	2	3	4	5	1	2	3	4	5
16. Access to Market Information	1	2	3	4	5	1	2	3	4	5
17. Succession	1	2	3	4	5	1	2	3	4	5
18. Volatility in Bank Interest	1	2	3	4	5	1	2	3	4	5
19. Availability of Capital	1	2	3	4	5	1	2	3	4	5
20. Natural Disasters	1	2	3	4	5	1	2	3	4	5
21. Other (Specify)	1	2	3	4	5	1	2	3	4	5

III. Risk Management Strategies

Below is a list of risk management strategies, please circle a number for each strategy to indicate:

a. On a scale of 1 to 5 how important you believe the strategy is in managing risk **on this farm**, with 1 being of very low importance and 5 very high importance.
b. Indicate whether you use the strategy on this farm or not by putting Y for Yes, N for No and NA for non-applicable.

Risk Management Strategy	a. Importance of Strategy					b. Use of Strategy		
	Very low	Low	Medium	High	Very high			
Replace human labour with machinery	1	2	3	4	5	Y	N	N/A
Storing feed for cattle	1	2	3	4	5	Y	N	N/A
Practicing transhumance grazing strategy	1	2	3	4	5	Y	N	N/A
Vaccination of cattle	1	2	3	4	5	Y	N	N/A
Dipping/ spraying cattle	1	2	3	4	5	Y	N	N/A
Applying crop disease and pest control exercise	1	2	3	4	5	Y	N	N/A
Diversifying farm activities	1	2	3	4	5	Y	N	N/A
Diversifying types of crops produced	1	2	3	4	5	Y	N	N/A
Diversifying livestock on the farm	1	2	3	4	5	Y	N	N/A

Monitoring weather patterns	1	2	3	4	5	Y	N	N/A
Spreading sales of farm products over several times of the year.	1	2	3	4	5	Y	N	N/A
Monitoring markets	1	2	3	4	5	Y	N	N/A
Using futures markets	1	2	3	4	5	Y	N	N/A
Using forward contracts	1	2	3	4	5	Y	N	N/A
Keeping debt low	1	2	3	4	5	Y	N	N/A
Using livestock insurance	1	2	3	4	5	Y	N	N/A
Producing crops with low price variability	1	2	3	4	5	Y	N	N/A
Using drought resistant crops	1	2	3	4	5	Y	N	N/A
Using disease resistant cattle breeds	1	2	3	4	5	Y	N	N/A
Working off farm	1	2	3	4	5	Y	N	N/A
Others (Please Specify)	1	2	3	4	5	Y	N	N/A
	1	2	3	4	5	Y	N	N/A

IV. Risk Profiles

Please read the statement below and for **each** circle **one (1)** which best reflects your views.

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Within a season I am able to manage most of the uncertainty that occurs on this farming enterprise	1	2	3	4	5
Over the long term (two or more seasons)I am able to manage most of the uncertainty that occurs on this farming enterprise	1	2	3	4	5
I find planning difficult because the future is uncertain	1	2	3	4	5
When there are a number of solutions to a problem, I find it difficult to make a choice	1	2	3	4	5
When it comes to business, I like to play it safe	1	2	3	4	5

D. Marketing

I. Cattle sales: Fill in the table below for the past 12 months.

NOTE: -Question D5, more than one reason can be given as purpose for selling cattle.

-Include cattle that are traded through exchanges, e.g. cattle as payment for veterinary services.

D1. Animal type. (code a)	D2. How many animals sold?	D3. Average price (ZMW)	D4. Selling month? (Code b)	D5. Purpose of selling (Code c)	D6. Marketing channel (Code d)[2]	D7. Frequency of using the market channel (Code e)

[2] Please indicate next to the market channel key if you have a contractual agreement with the buyer, and/or if they are a regular customer you usually sell to.

a) Animal type	b) Selling Month	c) Purpose of selling	d) Marketing channel	e) Frequency of using market channel
1= Bulls (>3 years) 2=Castrated adult males (oxen>3 years) 3= Immature males (< 3 years) 4= Cows (calved at least once) 5= Heifers(female ≥1yr,have not calved) 6=Female calves (between 8 weeks &<1yr) 7=Male calves (between 8 weeks &<1yr) 8= Pre weaning males (<8 weeks) 9= Pre weaning females (<8 weeks)	1=January 2=February 3=March 4=April 5=May 6=June 7=July 8=August 9=September 10=October 11=November 12=December	1= Livestock trading as a business/ source of income. 2 = To meet emergency household expenses. 3= To supplement crop income. 4= Culling because not productive. 5= Culling because sick. 6 = Other: (Specify)	1=Butchery 2=Abattoir 3= Feedlots 4= Individual private buyers e.g. farmer or for home consumption 5= Supermarkets/ retailer 6= Cattle traders 7= Other channels (Specify)	1=Always 2=Often 3=Sometimes 4=Rarely

II. Cattle purchases: Fill in the table below for the past 12 months.

D8. Animal type (code a)	D9. How many animals bought?	D10.Average price (ZMW)	D11. Purchase month? (Code b)	D12. Purpose of purchasing (Code c)	D13. Source (Code d)[3]	D14. Frequency of using source (Code e)

[3] Please indicate next to the source whether you have a contractual agreement to purchase from the indicated source and/or whether you usually source from them.

a) Animal type	**b) Purchase Month**	**c) Purpose of purchasing**	**d) Source**	e) Frequency of using Source
1= Bulls (>3 years) **2**=Castrated adult males (oxen>3 years) **3**= Immature males (< 3 years) **4**= Cows (calved at least once) **5**= Heifers(female ≥1yr,have not calved) **6**=Female calves (between 8 weeks &<1yr) **7**=Male calves (between 8 weeks &<1yr) **8**= Pre weaning males (<8 weeks) **9**= Pre weaning females (<8 weeks)	1=January 2=February 3=March 4=April 5=May 6=June 7=July 8=August 9=September 10=October 11= November 12= December	1= For fattening purpose 2= To replace old, sold or lost stock. 3= Buying female cow for reproduction. 4= Buying bull for reproduction 5= Slaughter 6= To improve your breed 7= Other: (specify)	1= Other traditional farmer 2= Breeding centre 3= Commercial farmer 4= Cattle traders 5= Others (Specify)	1=Always 2=Often 3=Sometimes 4=Rarely

Additional Questions on Marketing

1. How difficult is it to find the following buyers? Tick the value that is applicable.
   a. Butchery;

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

   b. Abattoir;

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

   c. Feedlot;

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

   d. Private buyer;

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

   e. Supermarket/ retailer;

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

   f. Cattle traders;

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

   a. Others (Please specify);

      Easy ☐ Fair ☐ Difficult ☐ Non applicable ☐

2. Is the produce from this farm graded before trading?

Yes ☐ No ☐

3. If yes to question (2) above, which buyer(s) and stock types(s) does this apply to?

.....

.....

4. Do you have problems meeting the grades?

Yes ☐ No ☐

5. If yes to question 4 above, please explain

……

……

6. Do you receive market information prior to sales?

Yes ☐ No ☐

7. If yes in question 6 above, what type of information do you receive?

……

……

8. What type of market information do you use?

……

……..…..

9. What are your sources of information?

……..……...……

……...…….

10. Do you perform price surveys before selecting a market channel?

Yes ☐ No ☐

11. How is price set during sales? Please circle what is applicable to this enterprise.

a. I set the price .b.We negotiate .c. It is market driven

.d. It is dictated by buyers e. Other (Specify)

7.4 Appendix 4: Classification of Sources of Risk and Risk Management Strategies for PCA

Table 7.4.1: Classification of Identified Sources of Risk

Sources of Uncertainty/risk	**Type of Uncertainty/ Risk Source**
1. Climate variation	Production Risk
2. Livestock Health	Production Risk
3. Variability in input prices	Market Risk
4. Variability in product prices	Market Risk
5. Plant diseases and pests	Production Risk
6. Variability in crop yields	Production Risk
7. Changes in policies and government laws	Institutional Risk
8. Livestock Thefts	Production Risk
9. Availability of feed/ pastures	Production Risk
10. Changes in technology	Production Risk
11. Availability of labour	Human/ personal Risk
12. Business Contract changes	Institutional Risk
13. Access to inputs	Production Risk
14. Access to product markets	Market Risk
15. Access to Market Information	Market Risk
16. Succession	Human/ personal Risk
17. Volatility in Bank Interest	Financial Risk
18. Availability of Capital	Financial Risk
19. Natural Disasters	Production Risk

Table 7.4.2: Classification of Identified Risk Management Strategies

	Risk Management Strategy	Classification of Strategy
1.	Replace human labour with machinery	Prevention Strategy
2.	Storing feed for cattle	Mitigation Strategy
3.	Practicing transhumance grazing strategy	Mitigation Strategy
4.	Vaccination of cattle	Prevention Strategy
5.	Dipping/ spraying cattle	Prevention Strategy
6.	Applying crop disease and pest control exercise	Prevention Strategy
7.	Diversifying farm activities	Mitigation Strategy
8.	Diversifying types of crops produced	Mitigation Strategy
9.	Diversifying livestock on the farm	Mitigation Strategy
10.	Monitoring weather patterns	Mitigation Strategy
11.	Spreading sales of farm products over several times of the year.	Mitigation Strategy
12.	Monitoring markets	Mitigation Strategy
13.	Using futures markets	Mitigation Strategy
14.	Using forward contracts	Mitigation Strategy
15.	Keeping debt low	Mitigation Strategy
16.	Using livestock insurance	Mitigation Strategy
17.	Producing crops with low price variability	Prevention Strategy
18.	Using drought resistant crops	Prevention Strategy
19.	Using disease resistant cattle breeds	Prevention Strategy
20.	Working off farm	Mitigation Strategy

7.5 Appendix 5: Assessment of Sources of Risk and Risk Management Strategies

Table 7.5.1

BWEENGWA								
Assessment of Risk Sources that Create Opportunity within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance	rank
Input price variability	36	4	4	14	50	700	1	
Changes in technology	36	4	3	12	39	467	2	
Feed/ pasture availability	36	3	3	9	28	250	3	
Livestock health	36	3	3	8	33	250	4	
Input access	36	3	3	9	17	150	5	
Product market access	36	3	3	9	17	150	5	
Crop yield variation	36	3	3	8	19	146	6	
Livestock thefts	36	3	3	8	19	146	6	
Availability of capital	36	3	3	9	14	125	7	
Succession	36	3	3	9	14	125	7	
Product price variability	36	3	3	9	14	125	7	
Climate variation	36	3	3	9	14	125	7	
Plant diseases and pests	36	3	3	9	11	100	8	
Labour availablity	36	3	3	9	8	75	9	
Market information access	36	3	3	9	6	50	10	
Bank interest volatility	36	2	3	6	8	50	10	
Natural Disasters	36	3	3	9	6	50	10	
Changes in policy and government laws	36	2	3	6	6	33	11	
Business contract changes	36	2	3	5	0	0	12	

Table 7.5.2:

CHOONGO EAST								
Assessment of Risk Sources that Create Opportunity within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance	rank
Succession	45	4	4	16	60	960	1	
Input price variability	45	4	4	16	53	853	2	
Natural Disasters	45	3	4	12	47	560	3	
Feed/ pasture availability	45	3	4	12	42	507	4	
Changes in technology	45	3	4	12	36	427	5	
Climate variation	45	3	4	12	36	427	5	
Livestock health	45	3	3	9	36	320	6	
Labour availablity	45	3	3	9	20	180	7	
Plant diseases and pests	45	3	3	9	18	160	8	
Availability of capital	45	3	4	12	13	160	8	
Livestock thefts	45	3	3	9	12	108	9	
Product market access	45	2	3	6	18	107	10	
Market information access	45	3	3	9	9	80	11	
Product price variability	45	2	3	6	11	67	12	
Crop yield variation	45	3	3	9	7	60	13	
Business contract changes	45	2	2	4	11	44	14	
Changes in policy and government laws	45	2	3	6	7	40	15	
Bank interest volatility	45	2	3	6	7	40	15	
Input access	45	2	3	6	2	13	16	

Table 7.5.3:

HATONTOLA								
Assessment of Risk Sources that Create Opportunity within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance rank	
Feed/ pasture availability	35	3	4	12	40	480	1	
Input price variability	35	3	4	12	40	480	1	
Natural Disasters	35	3	4	12	37	446	2	
Livestock health	35	3	3	9	43	386	3	
Succession	35	3	4	12	31	377	4	
Changes in technology	35	3	3	9	37	334	5	
Livestock thefts	35	3	3	9	34	309	6	
Labour availablity	35	3	3	9	34	309	6	
Climate variation	35	3	3	9	17	154	7	
Plant diseases and pests	35	3	3	9	14	129	8	
Market information access	35	3	3	9	14	129	9	
Availability of capital	35	3	3	9	11	103	10	
Changes in policy and government laws	35	2	2	4	26	103	10	
Input access	35	2	3	6	14	86	11	
Crop yield variation	35	3	3	9	9	77	12	
Bank interest volatility	35	2	3	6	11	69	13	
Product market access	35	3	2	6	9	51	14	
Business contract changes	35	2	2	4	11	46	15	
Product price variability	35	2	3	6	6	34	16	

Table 7.5.4

MWANZA WEST								
Assessment of Risk Sources that Create Opportunity within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance rank	
Changes in policy and government laws	38	3	3	9	34.21	308	1	
Feed/ pasture availability	38	3	3.5	11	28.95	304	2	
Labour availablity	38	3	3	9	23.68	213	3	
Livestock thefts	38	3	3	9	21.05	189	4	
Crop yield variation	38	3	3	9	15.79	142	5	
Livestock health	38	3	3	9	13.16	118	6	
Input price variability	38	3	3	9	13.16	118	6	
Succession	38	3	3	9	13.16	118	6	
Climate variation	38	3	3	9	10.53	95	7	
Changes in technology	38	3	3	9	10.53	95	7	
Product price variability	38	3	3	9	7.89	71	8	
Market information access	38	3	3	9	7.89	71	8	
Input access	38	3	2	6	10.53	63	9	
Plant diseases and pests	38	3	3	9	5.26	47	10	
Product market access	38	3	2	6	7.89	47	10	
Business contract changes	38	3	2	6	5.26	32	11	
Natural Disasters	38	2	2	4	2.63	11	12	
Bank interest volatility	38	1	1	1	2.63	3	13	
Availability of capital	38	1	11	11	0.00	0	14	

Table 7.5.4

BWEENGWA								
Assessment of Risk Sources that Create Threat within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance rank	
Livestock thefts	36	4	4	16	58	933	1	
Natural Disasters	36	4	4	16	47	756	2	
Input price variabilit	36	4	3	12	47	567	3	
Plant diseases and p	36	4	4	14	33	467	4	
Labour availablity	36	3	4	12	39	467	4	
Product price variabi	36	3	4	12	33	400	5	
Succession	36	3	4	12	33	400	5	
Market information	36	3	4	12	22	267	6	
Livestock health	36	3	3	9	25	225	7	
Changes in policy an	36	3	3	9	22	200	8	
Input access	36	3	4	12	17	200	8	
Bank interest volatil	36	3	3	9	22	200	8	
Business contract ch	36	2	4	8	19	156	9	
Climate variation	36	3	3	9	14	125	10	
Crop yield variation	36	3	3	9	14	125	10	
Feed/ pasture availa	36	3	3	9	11	100	11	
Changes in technolo	36	3	3	8	11	83	12	
Product market acce	36	3	3	9	8	75	13	
Availability of capita	36	3	3	9	6	50	14	

Table 7.5.5:

CHOONGO EAST								
Assessment of Risk Sources that Create Threat within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance rank	
Natural Disasters	45	4	5	20	76	1511	1	
Labour availablity	45	4	4	16	62	996	2	
Input price variabilit	45	4	4	16	53	853	3	
Livestock thefts	45	3	3	9	36	320	4	
Livestock health	45	3	3	9	33	300	5	
Plant diseases and p	45	3	4	12	18	213	6	
Product market acce	45	3	4	12	13	160	7	
Succession	45	2	4	8	18	142	8	
Climate variation	45	3	3	9	16	140	9	
Changes in policy an	45	3	3	9	11	100	10	
Product price variabi	45	2	4	8	11	89	11	
Feed/ pasture availa	45	3	3	9	9	80	12	
Changes in technolo	45	2	3	6	9	53	15	
Crop yield variation	45	3	3	9	4	40	16	
Business contract ch	45	2	4	8	9	71	13	
Bank interest volatil	45	3	3	9	7	60	14	
Input access	45	2	4	8	7	53	15	
Market information	45	3	3	9	4	40	16	
Availability of capita	45	2	3	6	7	40	16	

Table 7.5.6

HATONTOLA								
Assessment of Risk Sources that Create Threat within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance rank	
Natural Disasters	35	3	4	12	40	480	1	
Livestock thefts	35	3	3	9	40	360	2	
Plant diseases and p	35	3	4	12	26	309	3	
Labour availablity	35	3	4	12	23	274	4	
Input price variabilit	35	3	3	9	26	231	5	
Livestock health	35	3	3	9	23	206	6	
Product price variabi	35	3	3	9	20	180	7	
Crop yield variation	35	3	3	9	20	180	7	
Bank interest volatil	35	3	3	9	20	180	7	
Climate variation	35	3	3	9	17	154	8	
Business contract ch	35	2	3	6	23	137	9	
Changes in policy an	35	3	3	9	14	129	10	
Input access	35	2	3	6	14	86	11	
Feed/ pasture availa	35	3	3	9	9	77	12	
Product market acce	35	3	3	9	9	77	12	
Changes in technolo	35	2	3	6	11	69	13	
Market information	35	2	3	6	9	51	14	
Availability of capita	35	2	3	6	6	34	15	
Succession	35	2	3	6	3	17	16	

Table 7.5.7

MWANZA WEST								
Assessment of Risk Sources that Create Threats within a Season								
Risk Sources	N	Risk poter	Likelihooc	Risk score	Proportio	Importanc	Impotance rank	
Changes in policy an	38	4	4	16	50.00	800	1	
Crop yield variation	38	4	3	12	34.21	411	2	
Livestock thefts	38	3	3	9	39.47	355	3	
Feed/ pasture availa	38	3	3	9	36.84	332	4	
Labour availablity	38	3	3	9	23.68	213	5	
Plant diseases and p	38	3	3	9	21.05	189	6	
Natural Disasters	38	3	3	9	18.42	166	7	
Climate variation	38	3	3	9	15.79	142	8	
Livestock health	38	3	3	9	13.16	118	9	
Input price variabilit	38	3	3	9	13.16	118	9	
Product market acce	38	3	3	9	13.16	118	9	
Changes in technolo	38	3	3	9	13.15789	118	9	
Succession	38	3	3	9	10.53	95	10	
Product price variabi	38	3	3	9	10.53	95	10	
Input access	38	3	3	9	10.53	95	10	
Market information	38	3	3	9	7.89	71	11	
Business contract ch	38	3	2	6	7.89	47	12	
Bank interest volatil	38	3	2	6	7.89	47	12	
Availability of capita	38	2	2	4	5.26	21	13	

Table 7.5.8

TRADER						
Assessment of Risk Sources that Create Opportunity within a Season						
Risk Sources	N	Risk potential sc	Likelihood score	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Input price variability	74	3	4	12	42	503
Feed/pasture availability	74	3	4	12	27	324
Succession	74	3	4	12	30	357
Climate variation	74	3	4	12	26	308
Livestock health	74	3	3	9	28	255
Livestock thefts	74	3	3	9	27	243
Changes in technology	74	3	3	9	27	243
Labour availability	74	3	3	9	27	243
Natural disasters	74	3	3	9	19	170
Plant diseases and pests	74	3	3	9	14	122
Product market access	74	3	3	9	14	122
Changes in policies and government	74	2	3	6	18	105
Product price variability	74	3	3	9	9	85
Input access	74	3	3	9	8	73
Availability of capital	74	3	3	9	7	61
Market information access	74	3	3	9	5	49
Bank interest volatility	74	2	3	6	7	41
Crop yield variation	74	3	3	9	4	36
Business contract changes	74	2	2	4	7	27

Table 7.5.9

SELLER						
Assessment of Risk Sources that Create Opportunity within a Season						
Risk Sources	N	Risk potential sc	Likelihood score	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Input price variability	31	4	3	12	32	387
Feed/pasture availability	31	3	4	12	29	348
Livestock thefts	31	3	3	9	35	319
Natural disasters	31	3	3	9	26	232
Changes in technology	31	3	3	9	23	203
Succession	31	3	3	9	23	203
Climate variation	31	3	3	9	19	174
Crop yield variation	31	3	3	9	19	174
Changes in policies and government	31	3	3	9	19	174
Labour availability	31	3	3	9	19	174
Input access	31	3	3	9	19	174
Market information access	31	3	3	9	19	174
Livestock health	31	3	3	9	16	145
Plant diseases and pests	31	3	3	9	13	116
Product market access	31	2	3	6	16	97
Bank interest volatility	31	2	3	6	16	97
Product price variability	31	3	2	6	6	39
Business contract changes	31	2	2	4	6	26
Availability of capital	31	2	3	6	3	19

Table 7.5.10

BUYER						
Assessment of Risk Sources that Create Opportunity within a Season						
Risk Sources	N	Risk potential sc	Likelihood score	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Input price variability	9	4	4	16	44	711
Feed/pasture availability	9	3	4	12	56	667
Natural disasters	9	3	4	12	22	267
Climate variation	9	3	3	9	22	200
Livestock health	9	3	3	9	22	200
Succession	9	3	3	9	33	300
Crop yield variation	9	3	3	9	22	200
Changes in policies and government	9	2	3	6	33	200
Livestock thefts	9	3	3	9	22	200
Changes in technology	9	3	3	9	22	200
Availability of capital	9	3	4	12	11	133
Labour availability	9	3	3	9	11	100
Market information access	9	3	3	9	11	100
Product price variability	9	2	3	6	11	67
Plant diseases and pests	9	2	3	6	11	67
Business contract changes	9	2	2	4	11	44
Product market access	9	2	2	4	11	44
Input access	9	2	2	4	0	0
Bank interest volatility	9	2	3	6	0	0

Table 7.5.11

HOLDER						
Assessment of Risk Sources that Create Opportunity within a Season						
Risk Sources	N	Risk potential sc	Likelihood score	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Feed/pasture availability	40	3	4	12	50	600
Changes in technology	40	4	3	12	45	540
Succession	40	3	4	12	42.5	510
Livestock health	40	3	3	9	52.5	473
Input price variability	40	4	3	12	37.5	450
Natural disasters	40	3	3	9	35	315
Availability of capital	40	3	4	12	20	240
Crop yield variation	40	3	3	9	20	180
Product price variability	40	3	3	9	15	135
Changes in policies and government	40	3	3	9	15	135
Labour availability	40	3	3	9	15	135
Livestock thefts	40	3	3	9	12.5	113
Plant diseases and pests	40	3	3	9	10	90
Climate variation	40	3	3	9	7.5	68
Market information access	40	3	3	9	7.5	68
Product market access	40	3	2	6	7.5	45
Input access	40	2	2	4	10	40
Business contract changes	40	2	2	4	7.5	30
Bank interest volatility	40	2	3	6	5	30

Table 7.5.12

TRADER						
Assessment of Risk Sources that Create Threat within a Season						
Risk Sources	N	Risk potential sc	Likelihood sc	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Livestock thefts	74	4	4	16	51	822
Natural disasters	74	3	4	12	45	535
Labour availability	74	3	4	12	32	389
Plant diseases and pests	74	3	4	12	31	373
Input price variability	74	3	3	9	32	292
Livestock health	74	3	3	9	27	243
Product price variability	74	3	4	12	19	227
Climate variation	74	3	3	9	18	158
Crop yield variation	74	3	3	9	18	158
Changes in policies and government	74	3	3	9	18	158
Feed/pasture availability	74	3	3	9	15	134
Product market access	74	3	4	12	11	130
Market information access	74	3	3	9	12	109
Bank interest volatility	74	3	3	9	12	109
Business contract changes	74	2	3	6	16	97
Succession	74	2	3	6	15	89
Input access	74	2	3	6	14	81
Availability of capital	74	2	3	6	12	73
Changes in technology	74	2	3	6	11	65

Table 7.5.13

SELLER						
Assessment of Risk Sources that Create Threat within a Season						
Risk Sources	N	Risk potential sc	Likelihood sc	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Livestock thefts	31	4	4	16	55	877
Natural disasters	31	3	4	12	45	542
Changes in policies and government	31	3	4	12	45	542
Labour availability	31	3	4	12	35	426
Succession	31	3	4	12	32	387
Livestock health	31	3	3	9	39	348
Product price variability	31	3	3	9	29	261
Plant diseases and pests	31	3	3	9	29	261
Crop yield variation	31	3	3	9	26	232
Feed/pasture availability	31	3	3	9	26	232
Input price variability	31	3	3	9	26	232
Bank interest volatility	31	3	3	9	23	203
Climate variation	31	3	3	9	19	174
Business contract changes	31	3	3	9	19	174
Product market access	31	3	3	9	16	145
Changes in technology	31	3	3	9	13	116
Input access	31	3	3	9	10	87
Market information access	31	3	3	9	10	87
Availability of capital	31	2	3	6	3	19

Table 7.5. 14

BUYER						
Assessment of Risk Sources that Create Threat within a Season						
Risk Sources	N	Risk potential sc	Likelihood sc	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Labour availability	9	4	4	16	67	1067
Input price variability	9	3	4	12	44	533
Changes in policies and government	9	3	3	9	44	400
Natural disasters	9	3	4	12	33	400
Succession	9	3	4	12	22	267
Livestock thefts	9	2	3	6	33	200
Livestock health	9	3	3	9	11	100
Plant diseases and pests	9	3	3	9	11	100
Feed/pasture availability	9	3	3	9	11	100
Product market access	9	3	3	9	11	100
Business contract changes	9	2	4	8	11	89
Input access	9	2	4	8	11	89
Product price variability	9	2	3	6	11	67
Changes in technology	9	2	3	6	11	67
Availability of capital	9	2	3	6	11	67
Climate variation	9	3	3	9	0	0
Crop yield variation	9	3	3	9	0	0
Market information access	9	3	3	9	0	0
Bank interest volatility	9	3	3	9	0	0

Table 7.5.15

HOLDER						
Assessment of Risk Sources that Create Threat within a Season						
Risk Sources	N	Risk potential sc	Likelihood sc	Risk score	Proportion of respondents <14 R.Score(%)	Importance index
Natural disasters	40	4	4	16	55	880
Input price variability	40	4	4	16	45	720
Labour availability	40	4	4	16	40	640
Plant diseases and pests	40	3	4	12	15	180
Livestock thefts	40	3	3	9	20	180
Crop yield variation	40	3	3	9	17.5	158
Changes in policies and government	40	3	3	9	17.5	158
Product price variability	40	3	4	12	12.5	150
Feed/pasture availability	40	3	3	9	15	135
Input access	40	3	4	12	10	120
Climate variation	40	3	3	9	12.5	113
Livestock health	40	3	3	9	12.5	113
Bank interest volatility	40	3	3	9	12.5	113
Business contract changes	40	3	4	12	7.5	90
Changes in technology	40	2	3	6	12.5	75
Product market access	40	3	3	9	7.5	68
Market information access	40	3	3	9	7.5	68
Succession	40	2	3	6	5	30
Availability of capital	40	2	3	6	0	0

Table 7.5. 16

Distribution of responses on perceived importance of risk management strategies for Bweengwa															
Risk Management Strategy	**N**	**User**	**Non-User**	**NA**	**Mean**	**Median**	**Very high**	**Importance**	**Rank**	**Percentage response**					
							scores (%)	**index (%)**		**Very low**	**Low**	**Medium**	**High**	**Very high**	**Total**
Using drought resist crops	36	30	6	0	4	4	89%	356%	1	6%	3%	17%	44%	44%	100%
Practicing transhumance grazing strategy	36	31	5	0	4	4	78%	311%	2	3%	3%	33%	39%	39%	100%
Diversifying farm activities	36	34	2	0	4	4	78%	311%	2	0%	0%	36%	39%	39%	100%
Using disease resistant cattle breeds	36	29	7	0	4	4	72%	289%	3	8%	3%	14%	36%	36%	100%
Diversifying types of crops produced	36	34	2	0	4	3.5	61%	244%	4	0%	0%	50%	31%	31%	100%
Storing feed for cattle	36	28	8	0	4	4	56%	222%	5	11%	3%	14%	28%	28%	100%
Diversifying livestock on the farm	36	36	0	0	4	4	50%	200%	6	0%	0%	31%	25%	25%	100%
Replace human labor with machinery	36	6	30	0	4	5	44%	178%	7	0%	8%	14%	22%	22%	100%
Monitoring markets	36	30	6	0	4	3	44%	178%	7	3%	3%	50%	22%	22%	100%
Monitoring weather patterns	36	23	13	0	3	3	56%	167%	8	6%	17%	33%	28%	28%	100%
Applying crop disease and pest control strategies	36	20	16	0	4	4	39%	156%	9	8%	19%	19%	19%	19%	100%
Dipping/spraying cattle	36	36	0	0	5	5	28%	139%	10	0%	0%	6%	14%	14%	100%
Spreading sales of farm products across the year	36	19	17	0	3	3	44%	133%	11	0%	31%	25%	22%	22%	100%
Using futures markets	36	16	20	0	3	3	44%	133%	11	8%	25%	25%	22%	22%	100%
Vaccination of cattle	36	35	1	0	5	5	22%	111%	12	0%	0%	11%	11%	11%	100%
Using livestock insurance	36	5	31	0	3	3	33%	100%	13	22%	17%	17%	17%	17%	100%
Keeping debt low	36	10	26	0	3	3	28%	83%	14	14%	19%	42%	14%	14%	100%
Working off farm	36	17	19	0	3	3	28%	83%	14	14%	22%	36%	14%	14%	100%
Producing crops with low price variability	36	13	23	0	2	3	39%	78%	15	28%	17%	36%	19%	19%	100%
Using forward contracts	36	9	27	0	3	2	17%	50%	16	25%	33%	19%	8%	8%	100%

Table 7.5.17

Distribution of responses on perceived importance of risk management strategies for Choongo East															
Risk Management Strategy	N	User	Non-User	NA	Mean	Median	Very high	Importance	Rank	Percentage response					
							scores (%)	index (%)		Very low	Low	Medium	High	Very high	Total
Dipping/spraying cattle	45	44	0	0	5	5	89%	444%	1	2%	0%	9%	20%	69%	100%
Vaccination of cattle	45	43	1	0	4	5	78%	311%	2	2%	2%	18%	22%	56%	100%
Replace human labor with machinery	45	12	32	0	4	5	76%	302%	3	9%	9%	7%	24%	51%	100%
Storing feed for cattle	45	44	0	0	4	3	47%	187%	4	2%	0%	51%	27%	20%	100%
Using disease resistant cattle breeds	45	32	12	0	4	3	44%	178%	5	4%	4%	47%	9%	36%	100%
Using drought resist crops	45	37	7	0	3	3	42%	127%	6	9%	4%	44%	18%	24%	100%
Monitoring weather patterns	45	19	25	0	3	3	38%	113%	7	40%	7%	16%	20%	18%	100%
Applying crop disease and pest control strategies	45	25	19	0	3	3	33%	100%	8	4%	33%	29%	20%	13%	100%
Diversifying farm activities	45	38	6	0	3	3	33%	100%	8	2%	9%	56%	27%	7%	100%
Diversifying types of crops produced	45	40	4	0	3	3	33%	100%	8	2%	4%	60%	20%	13%	100%
Monitoring markets	45	36	8	0	3	3	31%	93%	9	4%	44%	20%	22%	9%	100%
Using livestock insurance	45	9	35	0	3	2	31%	93%	9	36%	20%	13%	11%	20%	100%
Diversifying livestock on the farm	45	38	6	0	3	3	29%	87%	10	4%	2%	64%	18%	11%	100%
Practicing transhumance grazing strategy	45	37	7	0	3	3	27%	80%	11	4%	7%	62%	16%	11%	100%
Spreading sales of farm products across the year	45	33	11	0	3	3	18%	53%	12	2%	18%	62%	16%	2%	100%
Producing crops with low price variability	45	12	32	0	2	2	27%	53%	12	36%	18%	20%	16%	11%	100%
Using futures markets	45	4	40	0	2	2	18%	36%	13	47%	20%	16%	9%	9%	100%
Working off farm	45	18	26	0	2	2	16%	31%	14	49%	16%	20%	11%	4%	100%
Using forward contracts	45	7	37	0	2	1	7%	13%	15	51%	20%	22%	4%	2%	100%
Keeping debt low	45	23	21	0	2	3	4%	9%	16	20%	20%	56%	0%	4%	100%

Table 7.5. 18

Distribution of responses on perceived importance of risk management strategies for Haatontola															
Risk Management Strategy	N	User	Non-User	NA	Mean	Median	Very high	Importance	Rank	Percentage response					
							scores (%)	index (%)		Very low	Low	Medium	High	Very high	Total
Dipping/spraying cattle	35	34	0	2	4	5	83%	331%	1	0%	3%	14%	20%	63%	100%
Vaccination of cattle	35	30	5	1	4	4	66%	263%	2	9%	0%	26%	26%	40%	100%
Storing feed for cattle	35	30	4	2	4	4	57%	229%	3	6%	3%	34%	34%	23%	100%
Replace human labor with machinery	35	8	26	2	3	3	46%	137%	4	29%	3%	23%	14%	31%	100%
Applying crop disease and pest control strategies	35	27	7	2	3	3	40%	120%	5	0%	17%	43%	20%	20%	100%
Diversifying farm activities	35	29	5	2	3	3	40%	120%	5	9%	6%	46%	26%	14%	100%
Diversifying types of crops produced	35	29	6	1	3	3	40%	120%	5	3%	6%	51%	26%	14%	100%
Diversifying livestock on the farm	35	27	8	1	3	3	40%	120%	5	0%	11%	49%	26%	14%	100%
Spreading sales of farm products across the year	35	24	11	1	3	3	37%	111%	6	11%	11%	40%	17%	20%	100%
Using drought resist crops	35	23	12	1	3	3	37%	111%	6	20%	6%	37%	26%	11%	100%
Using disease resistant cattle breeds	35	16	19	1	3	3	34%	103%	7	14%	17%	34%	17%	17%	100%
Producing crops with low price variability	35	15	20	1	3	3	29%	86%	8	26%	23%	23%	9%	20%	100%
Practicing transhumance grazing strategy	35	12	22	2	3	3	23%	69%	9	17%	20%	40%	11%	11%	100%
Monitoring weather patterns	35	15	20	1	3	3	20%	60%	10	29%	20%	31%	9%	11%	100%
Monitoring markets	35	24	11	1	3	2	20%	60%	10	11%	40%	29%	11%	9%	100%
Using livestock insurance	35	7	28	1	2	2	20%	40%	11	34%	20%	26%	9%	11%	100%
Working off farm	35	11	24	1	2	3	20%	40%	11	40%	9%	31%	11%	9%	100%
Keeping debt low	35	19	16	1	3	3	11%	34%	12	29%	9%	51%	6%	6%	100%
Using futures markets	35	3	32	1	2	2	9%	17%	13	29%	29%	34%	6%	3%	100%
Using forward contracts	35	5	30	1	2	2	6%	11%	14	40%	23%	31%	6%	0%	100%

Table 7.5.19

Distribution of responses on perceived importance of risk management strategies for Mwanza West															
Risk Management Strategy	N	User	Non-User	NA	Mean	Median	Very high	Importance	Rank	Percentage response					
							scores (%)	index (%)		Very low	Low	Medium	High	Very high	Total
Using disease resistant cattle breeds	38	4	33	1	5	5	97%	487%	1	0%	0%	3%	21%	76%	100%
Vaccination of cattle	38	11	27	1	5	5	95%	474%	2	0%	5%	0%	13%	82%	100%
Dipping/spraying cattle	38	30	7	1	5	5	95%	474%	2	0%	3%	3%	16%	79%	100%
Replace human labor with machinery	38	2	36	0	5	5	92%	461%	3	3%	5%	0%	5%	87%	100%
Using livestock insurance	38	0	37	1	5	5	92%	461%	3	3%	5%	0%	13%	79%	100%
Applying crop disease and pest control strategies	38	30	7	1	5	5	92%	461%	3	3%	0%	5%	11%	82%	100%
Storing feed for cattle	38	26	12	0	5	5	89%	447%	4	5%	3%	3%	13%	76%	100%
Diversifying livestock on the farm	38	28	9	1	5	5	89%	447%	4	8%	0%	3%	8%	82%	100%
Monitoring markets	38	3	34	1	5	5	89%	447%	4	0%	8%	3%	8%	82%	100%
Keeping debt low	38	1	36	1	5	5	89%	447%	4	0%	8%	3%	13%	76%	100%
Spreading sales of farm products across the year	38	9	28	1	5	5	87%	434%	5	5%	0%	8%	8%	79%	100%
Using forward contracts	38	2	35	1	5	5	87%	434%	5	0%	5%	8%	16%	71%	100%
Using drought resist crops	38	17	20	1	4	4	95%	379%	6	0%	0%	5%	74%	21%	100%
Producing crops with low price variability	38	18	19	1	4	4	92%	368%	7	3%	3%	3%	66%	26%	100%
Diversifying farm activities	38	4	33	1	4	4	89%	358%	8	3%	3%	5%	42%	47%	100%
Practicing transhumance grazing strategy	38	7	31	0	4	4	89%	358%	8	3%	8%	0%	68%	21%	100%
Diversifying types of crops produced	38	26	11	1	4	4	87%	347%	9	5%	0%	8%	71%	16%	100%
Monitoring weather patterns	38	8	29	1	4	4	87%	347%	9	3%	5%	5%	68%	18%	100%
Using futures markets	38	3	34	1	4	4	87%	347%	9	3%	5%	5%	71%	16%	100%
Working off farm	38	5	31	0	4	4	87%	347%	9	3%	0%	11%	74%	13%	100%

Table 7.5.20

Distribution of responses on perceived importance of risk management strategies for Traders															
Risk Management Strategy										Percentage response					
	N	User	Non-User	NA	Mean	Median	Very High	Importand	Rank	Very low	Low	Medium	High	Very high	Total
Dipping/spraying cattle	74	72	1	1	5	5	88	440	1	1%	1%	9%	20%	68%	100%
Vaccination of cattle	74	65	9	0	4	5	82	328	2	3%	3%	12%	22%	61%	100%
Replace human labor with machinery	74	23	50	1	4	4	65	260	3	11%	9%	15%	16%	49%	100%
Storing feed for cattle	74	62	11	1	4	4	62	248	4	7%	3%	28%	31%	31%	100%
Using drought resist crops	74	62	11	1	4	4	62	248	4	5%	1%	31%	36%	26%	100%
Using disease resistant cattle breeds	74	46	27	1	4	4	59	236	5	8%	7%	26%	16%	43%	100%
Diversifying farm activities	74	57	15	2	4	4	57	228	6	4%	5%	34%	34%	23%	100%
Applying crop disease and pest control strategies	74	47	25	2	4	4	53	212	7	7%	15%	26%	19%	34%	100%
Diversifying livestock on the farm	74	65	8	1	4	4	53	212	7	7%	3%	38%	23%	30%	100%
Diversifying types of crops produced	74	65	8	1	4	4	51	204	8	4%	4%	41%	30%	22%	100%
Spreading sales of farm products across the year	74	47	26	1	4	3	46	184	9	5%	12%	36%	19%	27%	100%
Monitoring weather patterns	74	41	32	1	3	3	46	138	10	18%	16%	20%	28%	18%	100%
Practicing transhumance grazing strategy	74	45	24	1	3	3	42	126	11	11%	14%	34%	28%	14%	100%
Using livestock insurance	74	11	62	1	3	3	42	126	11	24%	18%	16%	16%	26%	100%
Monitoring markets	74	49	24	1	3	3	38	114	12	7%	28%	27%	16%	22%	100%
Producing crops with low price variability	74	32	41	1	3	3	38	114	12	26%	16%	20%	23%	15%	100%
Using futures markets	74	19	54	1	3	3	32	96	13	18%	26%	24%	20%	12%	100%
Working off farm	74	28	45	1	3	3	32	96	13	31%	15%	22%	22%	11%	100%
Using forward contracts	74	14	59	1	3	2	23	69	14	27%	26%	24%	7%	16%	100%
Keeping debt low	74	23	50	1	3	3	22	66	15	20%	22%	36%	3%	19%	100%

Table 7.5.21

Distribution of responses on perceived importance of risk management strategies for Sellers															
Risk Management Strategy										**Percentage response**					
	N	**User**	**Non-User**	**NA**	**Mean**	**Median**	**Very High**	**Importanc**	**Rank**	**Very low**	**Low**	**Medium**	**High**	**Very high**	**Total**
Dipping/spraying cattle	31	30	1	0	5	5	90%	417%	1	0%	0%	10%	19%	71%	100%
Replace human labor with machinery	31	3	28	0	4	5	77.42%	317%	2	13%	6%	3%	13%	65%	100%
Vaccination of cattle	31	21	10	0	4	5	74%	311%	3	6%	0%	19%	16%	58%	100%
Using drought resist crops	31	18	13	0	4	4	74%	278%	4	13%	3%	10%	45%	29%	100%
Storing feed for cattle	31	24	7	0	4	4	68%	271%	5	6%	3%	23%	19%	48%	100%
Using disease resistant cattle breeds	31	13	18	0	4	5	68%	269%	6	6%	10%	16%	16%	52%	100%
Diversifying livestock on the farm	31	25	6	0	4	5	61%	247%	7	0%	10%	29%	10%	52%	100%
Applying crop disease and pest control strategies	31	23	8	0	4	4	61%	239%	8	3%	10%	26%	16%	45%	100%
Monitoring markets	31	18	13	0	4	4	61%	235%	9	3%	13%	23%	19%	42%	100%
Diversifying types of crops produced	31	25	6	0	4	4	58%	210%	10	3%	0%	39%	48%	10%	100%
Diversifying farm activities	31	17	14	0	4	4	55%	202%	11	3%	10%	32%	26%	29%	100%
Practicing transhumance grazing strategy	31	17	14	0	3	4	55%	186%	12	6%	10%	29%	48%	6%	100%
Monitoring weather patterns	31	11	20	0	3	4	55%	182%	13	16%	6%	23%	39%	16%	100%
Using livestock insurance	31	6	25	0	3	4	52%	178%	14	16%	19%	13%	6%	45%	100%
Spreading sales of farm products across the year	31	13	18	0	4	3	48%	173%	15	6%	19%	26%	6%	42%	100%
Keeping debt low	31	10	21	0	3	3	45%	153%	16	16%	6%	32%	13%	32%	100%
Producing crops with low price variability	31	11	20	0	3	3	45%	137%	17	16%	23%	16%	32%	13%	100%
Using forward contracts	31	8	23	0	3	3	42%	137%	17	13%	23%	23%	10%	32%	100%
Working off farm	31	6	25	0	3	3	45%	137%	17	23%	10%	23%	32%	13%	100%
Using futures markets	31	4	27	0	3	3	45%	135%	18	19%	16%	19%	35%	10%	100%

Table 7.5.22

Distribution of responses on perceived importance of risk management strategies for Buyers															
Risk Management Strategy										**Percentage response**					
	N	**User**	**Non-User**	**NA**	**Mean**	**Median**	**Very High**	**Importanc**	**Rank**	**Very low**	**Low**	**Medium**	**High**	**Very high**	**Total**
Dipping/spraying cattle	9	8	1	0	5	5	100%	489%	1	0%	0%	0%	11%	89%	100%
Storing feed for cattle	9	8	1	0	5	5	89%	415%	2	0%	0%	11%	11%	78%	100%
Replace human labor with machinery	9	0	9	0	4	5	89%	395%	3	0%	0%	11%	33%	56%	100%
Using disease resistant cattle breeds	9	6	3	0	4	5	78%	337%	4	0%	0%	22%	22%	56%	100%
Vaccination of cattle	9	5	4	0	4	5	78%	328%	5	0%	11%	11%	22%	56%	100%
Using livestock insurance	9	1	8	0	4	5	78%	328%	5	0%	22%	0%	11%	67%	100%
Applying crop disease and pest control strategies	9	8	1	0	4	4	67%	259%	6	0%	11%	22%	33%	33%	100%
Practicing transhumance grazing strategy	9	4	5	0	4	4	67%	252%	7	0%	0%	33%	56%	11%	100%
Diversifying types of crops produced	9	8	1	0	4	4	67%	237%	8	0%	11%	22%	67%	0%	100%
Using drought resist crops	9	4	5	0	3	4	67%	230%	9	11%	11%	11%	56%	11%	100%
Diversifying livestock on the farm	9	7	2	0	4	4	56%	210%	10	0%	0%	44%	33%	22%	100%
Monitoring markets	9	5	4	0	4	4	56%	210%	10	0%	11%	33%	22%	33%	100%
Monitoring weather patterns	9	4	5	0	3	4	56%	191%	11	0%	22%	22%	44%	11%	100%
Spreading sales of farm products across the year	9	4	5	0	4	3	44%	158%	12	0%	11%	44%	22%	22%	100%
Producing crops with low price variability	9	3	6	0	4	3	44%	158%	12	0%	11%	44%	22%	22%	100%
Using futures markets	9	1	8	0	3	2	44%	123%	13	33%	22%	0%	22%	22%	100%
Keeping debt low	9	4	5	0	4	3	33%	119%	14	0%	11%	56%	0%	33%	100%
Diversifying farm activities	9	5	4	0	3	3	33%	115%	15	0%	0%	67%	22%	11%	100%
Working off farm	9	3	6	0	3	3	33%	104%	16	0%	22%	44%	33%	0%	100%
Using forward contracts	9	0	9	0	2	2	22%	54%	17	33%	22%	22%	11%	11%	100%

Table 7.5.23

Distribution of responses on perceived importance of risk management strategies for Holders															
Risk Management Strategy										**Percentage response**					
	N	**User**	**Non-User**	**NA**	**Mean**	**Median**	**Very High**	**Importanc**	**Rank**	**Very low**	**Low**	**Medium**	**High**	**Very high**	**Total**
Dipping/spraying cattle	40	34	5	1	5	5	93%	435%	1	0%	3%	5%	13%	80%	100%
Vaccination of cattle	40	28	11	1	5	5	88%	405%	2	0%	0%	13%	13%	75%	100%
Replace human labor with machinery	40	2	37	1	4	5	83%	355%	3	8%	3%	8%	18%	65%	100%
Storing feed for cattle	40	34	5	1	4	4	65%	258%	4	5%	0%	30%	23%	43%	100%
Diversifying livestock on the farm	40	32	7	1	4	4	58%	230%	5	0%	0%	43%	15%	43%	100%
Using disease resistant cattle breeds	40	16	23	1	4	4	60%	227%	6	5%	3%	33%	30%	30%	100%
Diversifying farm activities	40	26	13	1	4	4	60%	225%	7	3%	0%	38%	40%	20%	100%
Practicing transhumance grazing strategy	40	21	18	1	4	4	55%	210%	8	0%	3%	43%	25%	30%	100%
Using drought resist crops	40	23	16	1	3	4	50%	169%	9	10%	5%	35%	38%	13%	100%
Applying crop disease and pest control strategies	40	24	15	1	4	3	48%	166%	10	0%	33%	20%	13%	35%	100%
Monitoring markets	40	21	18	1	3	3	48%	165%	11	3%	30%	20%	13%	35%	100%
Diversifying types of crops produced	40	31	8	1	4	3	45%	161%	12	0%	0%	55%	33%	13%	100%
Spreading sales of farm products across the year	40	21	18	1	3	3	43%	148%	13	3%	18%	38%	15%	28%	100%
Keeping debt low	40	16	23	1	3	3	40%	135%	14	10%	8%	43%	15%	25%	100%
Using livestock insurance	40	3	36	1	3	3	45%	136%	15	35%	8%	13%	10%	35%	100%
Producing crops with low price variability	40	12	27	1	3	3	45%	131%	16	30%	8%	18%	33%	13%	100%
Monitoring weather patterns	40	9	30	1	3	3	43%	122%	17	33%	5%	20%	28%	15%	100%
Using futures markets	40	2	37	1	3	3	43%	118%	18	33%	10%	15%	33%	10%	100%
Working off farm	40	15	24	1	3	3	40%	113%	19	30%	5%	25%	33%	8%	100%
Using forward contracts	40	1	38	1	3	2	35%	90%	20	48%	8%	10%	10%	25%	100%

7.6 Appendix 6: Cross tabulation and Pearson's Chi-square results

Market behaviour by Experience of farm Manager

	Farm Manager's Years of Experience						
	0-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**Above 30**
Buyer	9	1	0	0	0	0	0
Holder	22	11	2	2	0	0	2
Seller	17	8	3	0	0	2	1
Trader	30	20	14	3	2	3	2

The Pearson's Chi-squared test statistic of 19.3 with 18 degrees of freedom was **not** significant (p-value = 0.376)

Market behaviour by total number cattle owned

	Total Cattle Owned			
	0-50	**51-100**	**101-150**	**Above 150**
Buyer	9	0	0	1
Holder	27	8	2	2
Seller	20	6	3	2
Trader	44	19	6	5

The Pearson's Chi-squared test statistic of 5.88 with 9 degrees of freedom was **not** significant (p-value = 0.751)

Market behaviour by Household Size

	Total in Household				
	0-5	**6-10**	**11-15**	**16-20**	**Above 20**
Buyer	3	6	1	0	0
Holder	9	16	7	4	3
Seller	3	16	9	2	1
Trader	13	26	16	10	9

The Pearson's Chi-squared test statistic of 11.79 with 12 degrees of freedom was **not** significant (p-value = 0.463)

Perception on Climate Risk

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	1	1	1
Low	13	12	13
Medium	19	20	36
High	4	5	12
Very high	2	3	12

The Pearson's Chi-squared test statistic of 7.61 with 8 degrees of freedom was **not** significant (p-value = 0.4726)

Perception of Livestock Health Risk

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	0	6	13
Low	2	5	6
Medium	23	21	33
High	9	9	17
Very High	5	0	5

The Pearson's Chi-squared test statistic of 13.99 with 8 degrees of freedom was not significant (p-value = 0.082)

Perception of Input Price Variation Risk

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	1	2	3
Low	5	7	15
Medium	8	11	23
High	17	12	15
Very High	8	9	18

The Pearson's Chi-squared test statistic of 7.20 with 8 degrees of freedom was not significant (p-value = 0.5155)

Perception of Product Price Variation Risk

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	0	8	10
Low	12	10	27
Medium	15	15	24
High	10	8	11
Very High	2	0	2

The Pearson's Chi-squared test statistic of 12.07 with 8 degrees of freedom was not significant (p-value = 0.1482)

Perception on risk from Plant diseases and pests

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	0	5	7
Low	17	10	22
Medium	16	15	30
High	5	9	11
Very High	1	2	4

The Pearson's Chi-squared test statistic of 8.62 with 8 degrees of freedom was not significant (p-value = 0.3751)

Perception on Risk from Variability in Crop Yield

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	0	3	3
Low	8	14	23
Medium	19	13	40
High	7	6	6
Very High	5	5	2

The Pearson's Chi-squared test statistic of 14.05 with 8 degrees of freedom was not significant (p-value = 0.0806)

Perception on Risk due to Variability in Availability of Feed/ Pastures

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	3	6	8
Low	5	9	23
Medium	22	14	26
High	5	6	12
Very High	4	6	5

The Pearson's Chi-squared test statistic of 9.81 with 8 degrees of freedom was not significant (p-value = 0.2786)

Perception on Risk from Variation in Availability of Labour

	Market Participation		
	Holder	**One-way**	**Trader**
Very Low	1	6	7
Low	5	9	20
Medium	8	12	19
High	22	8	20
Very High	3	6	8

The Pearson's Chi-squared test statistic of 7.94 with 8 degrees of freedom was not significant (p-value = 0.4396)

Risk behaviour by Age group of Respondents

	Respondent's Age Group				
	20-30	**31-40**	**41-50**	**51-60**	**Above 60**
Neutral	6	8	8	1	4
Risk Averse	20	32	25	22	18
Risk Seeker	3	1	6	0	0

The Pearson's Chi-squared test statistic of 14.3 with 8 degrees of freedom was not significant (p-value = 0.074)

Risk behaviour by Experience of farm Manager

	Farm Manager's Years of Experience						
	0-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**Above 30**
Neutral	12	9	4	0	0	1	1
Risk Averse	59	30	14	5	2	3	4
Risk Seeker	7	1	1	0	0	1	0

The Pearson's Chi-squared test statistic of 6.84 with 12 degrees of freedom was **not** significant (p-value = 0.8677)

Risk behaviour by total number cattle owned

	Total Cattle Owned			
	0-50	**51-100**	**101-150**	**Above 150**
Neutral	18	5	1	3
Risk Averse	76	26	10	5
Risk Seeker	6	2	0	2

The Pearson's Chi-squared test statistic of 6.27 with 6 degrees of freedom was **not** significant (p-value = 0.3938)

Risk behaviour by Household Size

	Total in Household				
	0-5	**6-10**	**11-15**	**16-20**	**Above 20**
Neutral	2	10	7	4	4
Risk Averse	22	51	25	10	9
Risk Seeker	4	3	1	2	0

The Pearson's Chi-squared test statistic of 9.80 with 8 degrees of freedom was **not** significant (p-value = 0.279)

Risk behaviour by Market Behaviour

	Market behaviour			
	Buyer	**Holder**	**Seller**	**Trader**
Neutral	2	6	4	15
Risk Averse	7	31	24	55
Risk Seeker	1	2	3	4

The Pearson's Chi-squared test statistic of 1.90 with 6 degrees of freedom was **not** significant (p-value = 0.9288)

Risk behaviour by Market Behaviour

	Market behaviour		
	Holder	**One-way**	**Trader**
Neutral	6	6	15
Risk Averse	31	31	55
Risk Seeker	2	4	4

The Pearson's Chi-squared test statistic of 1.63 with 4 degrees of freedom was **not** significant (p-value = 0.804)

Cattle sold by location

	Study Site			
	Bweengwa	**Choongo**	**Hatontola**	**Mwanza West**
0-5	13	24	21	21
6-10	6	5	3	1
Above 10	5	4	2	0

The Pearson's Chi-squared test statistic of 11.33 with 6 degrees of freedom was not significant (p-value = 0.0787)